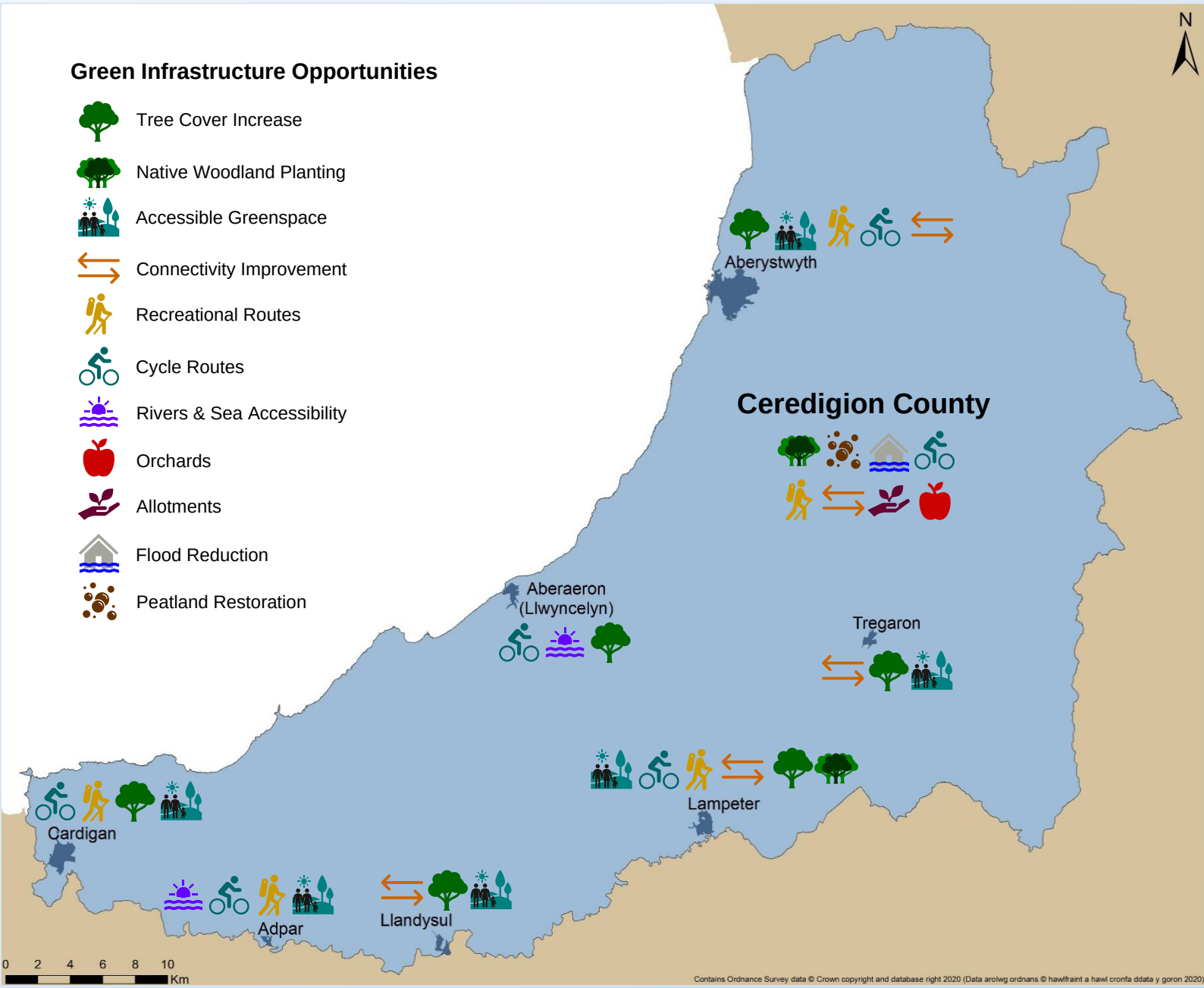
Ceredigion County Council

GREEN INFRASTRUCTURE ASSESSMENT



GI ASSESSMENT FINAL
NOVEMBER 2020

PUBLIC

Ceredigion County Council

GREEN INFRASTRUCTURE ASSESSMENT

PUBLIC

PROJECT NO. 70065900

OUR REF. NO. GI ASSESSMENT FINAL

DATE: NOVEMBER 2020

Please note that a Welsh translation of this report is also available.

WSP

Mountbatten House
Basing View
Basingstoke, Hampshire
RG21 4HJ

Phone: +44 1256 318 800

Fax: +44 1256 318 700

WSP.com

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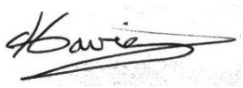
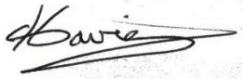
Prepared by	Helen Davies and Laura Homfray	Helen Davies, Laura Homfray and Richard Jones	Helen Davies, Laura Homfray and Richard Jones	Helen Davies, Oliver Hölzinger, Laura Homfray, Richard Jones and Sam Willis
Signature				
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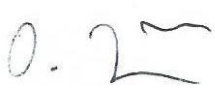
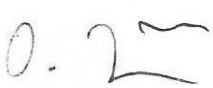
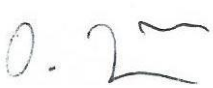
Signature				
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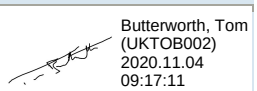
Signature				 Butterworth, Tom (UKTOB002) 2020.11.04 09:17:11
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CONTENTS

APPENDICES

0 EXECUTIVE SUMMARY

0.1.1. Green infrastructure describes the network of green and blue spaces in both rural and urban areas. These include parks, playing fields, allotments, street trees, woodlands, nature reserves and other biodiversity rich areas, footpaths, cycleways, watercourses, lakes, peat bogs and other wetlands and beaches. Green infrastructure provides multiple benefits to society known as 'ecosystem services', for example enhanced health and wellbeing, improved productivity, better air quality, reduced risk of flooding, cooling/shading during heatwaves, and a reduction in atmospheric carbon. Protecting and enhancing Ceredigion's green infrastructure – and making it accessible to all where appropriate e.g. safe, sustainable and where ecosystem and biodiversity resilience are not compromised – is therefore essential for helping the County and its residents become future-ready and resilient to environmental, social and economic challenges such as climate change and species extinction.

0.1.2. The Well-being of Future Generations Act 2015, Planning (Wales) Act 2015 and the Environment (Wales) Act 2016 provide the legislative context for delivering green infrastructure across Wales. Green infrastructure is also a key thread that runs through Planning Policy Wales 10 and the draft National Development Framework. The Welsh Government is preparing guidance on green infrastructure and its delivery within the planning system, expected to be published later in 2020.

0.1.3. WSP was commissioned by Ceredigion County Council to:

- prepare a Green Infrastructure Assessment to guide and shape the planning and delivery of Ceredigion's green infrastructure;
- make recommendations for changes necessary to the Local Development Plan development management policies; and
- undertake a detailed Green Infrastructure Audit of key urban environments in Ceredigion.
- This Green Infrastructure Assessment report comprises the following chapters, the findings of which are summarised below:
- Asset and Connectivity Mapping;
- Need for and Provision of Ecosystem Services;
- Stakeholder Consultation;
- Potential Opportunities for Ceredigion's Green Infrastructure;
- Delivering Green Infrastructure in Practice; and
- Local Development Plan Recommendations.

0.2 ASSET AND CONNECTIVITY MAPPING

0.2.1. This chapter contains maps and associated commentary of existing urban green infrastructure assets and habitats for Ceredigion's six main towns plus Adpar, the urban extension of Newcastle Emlyn on the Ceredigion/Carmarthenshire border. Maps and commentary on the land-based designations for the County as a whole are also provided. The extent of connectivity for wildlife

between existing core habitats, and for people between existing green infrastructure assets and between urban and rural areas is also identified.

0.2.2. What many people would describe as the ‘jewel in the crown’ of Ceredigion is the extensive coastline which also represents by far the largest designated area within the County. The Special Areas of Conservation (SACs) designations were awarded because of their international importance for wildlife but it is undoubtedly also a major focal point for people to connect with nature and landscape which is evidenced by the four stretches of heritage coast. This especially benefits populations and visitors in the coastal settlements north of Aberystwyth, to the north of Aberaeron, between New Quay and Tresaith, and north of Cardigan. All other major towns are located alongside the river Teifi which is also designated an SAC and provides valuable opportunities for people to connect with nature. Most terrestrial designated areas are located in the north and east of the County and are therefore geographically somewhat disconnected from the major population centres.

0.2.3. In terms of physical green infrastructure assets in Ceredigion, there appears to be fairly limited provision for all towns except for Aberystwyth, the County’s largest town. Aberystwyth appears to have good coverage of active travel routes, cycle routes, accessible green space, and urban tree cover throughout the town, further benefitting from local nature reserves and bathing areas in close proximity.

0.2.4. Opportunities for green infrastructure creation may therefore need to focus on Ceredigion’s other towns. For example, Aberaeron has good provision of coastal paths and Public Rights Of Way (PROW), and relatively good provision of accessible green space, but the lowest provision of cycle routes and urban tree cover within a 2km buffer. Cardigan also benefits from coastal paths and active travel routes, but lacks much other green infrastructure – especially accessible green space. Lampeter benefits from the river and lake, but with poor provision of linear recreational routes would benefit greatly from the opening up of further sections of its disused railway. As the smallest of Ceredigion’s main towns, green infrastructure provision in Adpar is particularly low, though there is relatively good provision of cycle routes and urban forest cover. Llandysul and Tregaron similarly benefit from the presence of a main river, but overall provision of green infrastructure is poor in these towns – especially in terms of accessible green space and urban tree cover.

0.2.5. Looking at connectivity for people, Aberystwyth, Aberaeron and Tregaron benefit the most from PROW and other linear features linking green infrastructure assets with each other; and with the surrounding countryside. In Cardigan, Adpar, Llandysul and Lampeter, the network of green infrastructure assets is far more fragmented and there is little connection with surrounding areas. This suggests a need for the creation of accessible green infrastructure networks in the latter towns.

0.2.6. In terms of broad/Phase 1 habitat classifications, buildings make up the majority of the towns, whilst improved grassland makes up the vast majority of the land area within the 2 km buffer zones around each town. The next largest area of habitat for the towns (located primarily within the buffer zones) is broadleaved semi natural woodland – particularly surrounding Llandysul, Adpar, Aberystwyth and Cardigan and Aberaeron – though this is generally fragmented. Several of the towns also benefit from coastal habitats (Aberaeron, Cardigan and Aberystwyth) and all benefit from river habitats to an extent (particularly Cardigan). Tregaron has a substantial area of bog and marsh approximately 1 km to the north. Opportunities for enhancement include increasing the diversity of habitats within the settlement boundaries, linking up woodland habitat, and enhancing some of the surrounding improved grassland to more biodiverse semi-improved or unimproved grassland.

0.2.7. Finally, due to fairly extensive provision of core ecological assets, linear corridors and stepping stones in the vicinity of each of the towns, sites appear to be connected moderately well for wildlife. Connectivity across the urbanised areas is less apparent, however, with wildlife in the towns of Aberaeron, Adpar, Cardigan, Llandysul and Tregaron likely to benefit from additional linear corridors (e.g. tree planting).

0.3 NEED FOR AND PROVISION OF ECOSYSTEM SERVICES

0.3.1. Ecosystem services are the benefits people obtain from nature. In this chapter, the likely functional benefits (i.e. cultural, regulating and provisioning services) of existing green infrastructure assets and habitats to people are identified for Ceredigion's seven towns, along with the relative need for five ecosystem services (air quality, flood reduction, recreation, health and wellbeing, and aesthetics). Anecdotal evidence of benefits provided by key green infrastructure sites in Ceredigion is also provided.

0.3.2. Based on the identification of green infrastructure assets within each of the 2 km buffers, and the ecosystem services likely to be provided by these assets, it would appear that Aberystwyth has, proportionally, the greatest ecosystem service provision of Ceredigion's towns. This is due to the good provision of linear recreation routes which also provide access to the coastline which provide significant cultural benefits, accessible green spaces, play spaces, urban tree cover and local nature reserves in and surrounding the town, which are all important for the provision of regulating and cultural ecosystem services to its residents.

0.3.3. In contrast, there is a lack of significant ecosystem service provision in the other towns due to the comparative lack of green infrastructure assets in these areas compared to Aberystwyth. Aberaeron's coastal paths, PROW, and accessible green spaces provide recreational benefits, but other cultural and regulating services are far less well addressed although the proximity and accessibility of the coastline may have a mitigating effect on the lack of cultural services within the town itself. Cardigan also benefits from coastal paths connecting dwellers to the coast and active travel routes as well as cycle paths along the river, but overall provides limited ecosystem services to its inhabitants. Lampeter, Adpar, Llandysul and Tregaron benefit from regulating and aesthetic ecosystem services associated with the main rivers which run through or adjacent to them, but little else. Tree planting and creation of local nature reserves and additional accessible green spaces in these towns is therefore recommended to improve the extent and variety of ecosystem services in these towns, which ultimately benefits the health and wellbeing of their inhabitants and may also have positive economic effects.

0.3.4. Based on the identification of broad habitats within each of the 2km buffers, and the ecosystem services likely to be provided by these habitats, it would appear that the towns which benefit the most from higher levels of habitat-based ecosystem service provision are Aberystwyth, Aberaeron and Cardigan. This could be in part because these are coastal towns which benefit from the cultural and regulating services that Ceredigion's coast and its habitats provide. Tregaron has notable ecosystem service provision to the north, where the blanket bog habitat of Cors Caron is located. Unfortunately, this area is poorly connected to the main town settlement. It would be beneficial to link these areas up with new paths or cycleways as long as wildlife disturbance is appropriately considered and managed.

0.3.5. In terms of ecosystem service needs, Cardigan, Adpar, and the more densely developed western and southern parts of Aberystwyth would benefit from the creation of green infrastructure (e.g. planting of trees and hedges) to reduce the higher background levels of particulate air pollutants in these locations. Sustainable flood management measures, such as installation of sustainable drainage systems, tree planting, or creation of large-scale green space (where feasible) aligned with natural flood management approaches, may be beneficial in Lampeter and in the east of Tregaron where the risk of surface water flooding is highest. In terms of meeting recreational needs of Ceredigion's urban residents, Adpar, Aberaeron and the eastern part of Aberystwyth would benefit from increased provision of accessible green infrastructure. Cardigan and the southern part of Aberystwyth would benefit from more accessible and/or attractive green infrastructure in order to address issues of poor physical and mental health. Finally, the level of tree cover could be improved in Aberaeron, Cardigan, Adpar, Tregaron, and the northern, western and central parts of Aberystwyth to improve aesthetics and potentially encourage inward investment by businesses.

0.3.6. At a County-wide scale, increased provision of woodland and expansion/restoration of peat bogs would help to remove carbon dioxide from the atmosphere (as well as reducing flooding downstream and providing cooling benefits). This would contribute towards the Council's commitment to become a net zero carbon local authority by 2030, and support the Council in addressing the recently declared global climate emergency.

0.4 STAKEHOLDER CONSULTATION

0.4.1. This chapter provides the outputs of two public stakeholder events and an online survey, held in order to ascertain the views of Ceredigion's residents, town/community councillors, and environmental/social groups on opportunities for enhancements to the County's green infrastructure.

0.4.2. The events provided local stakeholders with an opportunity to have their say on specific, local enhancements they would like to see made to Ceredigion's green infrastructure. These typically centred around suggestions for the creation of new green infrastructure (tree planting as well as new walking and cycling routes) in specific locations, as well as suggestions to improve the maintenance of existing green infrastructure. This information will be used to help inform the development of specific, prioritised green infrastructure opportunities.

0.4.3. The stakeholder events also resulted in many more general (non-spatially specific) suggestions being made. Of those suggestions relating to the County as a whole, tree planting was the most commonly mentioned. Attendees were also asked to list their top five priorities for Ceredigion's green infrastructure. The most common suggestions were to make physical improvements to natural resources/habitats/green space, to accessibility, and to reducing flood risk in the County.

0.4.4. The stakeholder events, attended by 41 people, were accompanied by an online survey to capture more opinions. Completed by 246 people, the survey was a valuable additional tool for providing suggestions on enhancing Ceredigion's green infrastructure. Improvements to the accessibility of local green infrastructure in the towns was the most common suggestion made by survey respondents, followed by physical improvements to green infrastructure (especially through tree planting), and better maintenance of existing green spaces and play areas. In terms of broader suggestions for the County as a whole, improving habitats for wildlife was a popular suggestion.

0.4.5. The online survey was also particularly useful for capturing feedback on the use and importance of existing green infrastructure in the County's seven main towns. Overall, a wide range of green infrastructure types are used by respondents to the survey, typically for recreation, relaxation, fitness and spotting wildlife. Aesthetic benefits of green spaces were also well recognised.

0.4.6. These more general suggestions will also be used to help inform the prioritisation of green infrastructure opportunities.

0.5 POTENTIAL OPPORTUNITIES FOR CEREDIGION'S GREEN INFRASTRUCTURE

0.5.1. This chapter draws together opportunities for creating and enhancing green infrastructure based on the results of the preceding chapters (i.e. the mapping of assets and connectivity, the ecosystem services assessment, and the stakeholder consultation). To this it adds additional opportunities set out in the published Place Plans for each of the towns, as well as those suggested by the Council's project steering group.

0.5.2. A brief summary of these opportunities for the seven towns follows:

- Aberystwyth has good coverage of green infrastructure relative to the other towns but would benefit from tree planting for enhanced air quality, climate resilience and aesthetic value. Better provision of accessible green space and connectivity of linear recreational routes are also identified to benefit well-being and tourism.
- Aberaeron would benefit from expanding its network of cycle routes to improve the town's connectivity for people. As the town's focal point, improving the accessibility and visual amenity of the harbour area through green infrastructure provision is also recognised as an important opportunity.
- Improved connectivity via active travel and recreation routes is an important opportunity for Cardigan. Increasing tree cover and accessible green space will promote equitable physical and mental wellbeing across the town.
- Lampeter would benefit from a more accessible green infrastructure network, strengthened through a greater provision of recreational routes. Increasing the urban tree cover would benefit the town itself, whilst a higher proportion of native woodland in the surrounding area would enhance biodiversity and climate resilience.
- Adpar would benefit from greater access to the River Teifi and neighbouring Newcastle Emlyn via recreational routes. The provision of more accessible green space through development is also an important opportunity.
- The recreational value of the Llandysul's existing green infrastructure would be increased by better connectivity, as would physical and mental wellbeing. Increasing urban tree cover and provision of accessible green space would also benefit residents.
- Strengthening Tregaron's already substantial network of linear features and connectivity to the surrounding landscape will support its aim of becoming a destination for outdoor recreation. Increasing the provision of green infrastructure such as tree cover and accessible green space will further benefit residents.

0.5.3. Some of the opportunities are small scale and could potentially be provided on Council land or through minor development proposals whilst others would require integration into larger scale regeneration or strategic allocations (the latter requiring a greater focus on connectivity). Other opportunities may require engagement with private landowners such as farmers, particularly for improving connectivity between urban and rural areas via new PROW, cycle routes and tree planting.

0.5.4. The Council will prioritise the recommended opportunities, using these to help guide the future development of Ceredigion – particularly in urban areas. Priority will be given to creating new green infrastructure that addresses identified deficiencies in green infrastructure and ecosystem services provision, and extends and connects the existing network. Other prioritised opportunities will relate more to enhancing the quality, accessibility and awareness of existing green infrastructure.

0.6 DELIVERING GREEN INFRASTRUCTURE IN PRACTICE

0.6.1. This Chapter sets out general principles and practical requirements of creating green infrastructure and delivering long term maintenance and management; both in relation to public and private land.

0.6.2. Possible approaches for delivering green infrastructure across the County of Ceredigion include:

- Setting out a strategic 'green infrastructure framework' with input from multiple Council departments, focusing on connectivity and addressing key local community needs.
- Working collaboratively so that prioritised green infrastructure initiatives deliver wider Council policy and emerging Welsh Government green infrastructure principles (Multifunctional, Biodiverse, Adapted for Climate Change, Healthy, and Smart & Sustainable), and support delivery of Place Plans.
- Embedding green infrastructure throughout future planning policy – especially policies relating to climate change, health and wellbeing, highways and urban regeneration schemes.
- For land to be developed (whether publicly or privately owned), set requirements within local planning documents (e.g. the Allocated Site Specifications Supplementary Planning Guidance) for masterplanners and developers to show how (multifunctional) green infrastructure is included in the design, and how long-term management and maintenance will be secured, before planning permission is granted.
- Include within the Allocated Site Specifications Supplementary Planning Guidance a requirement for developer contributions to be made available to Community Councils for enhancement of identified community green space assets.
- Utilising and extending existing monitoring data (whether council or third sector-generated) to provide evidence on the delivery of benefits from green infrastructure and therefore justify further investment.
- For council-owned green spaces, engage with potential public/third sector partners, communities and developers to attract additional funding or maintenance support in order to enhance the quality of these sites for people and/or wildlife.

- Mixing short-term wins with long-term goals, ideally supported by a green infrastructure 'champion' within the Council's senior management, to maintain focus and achieve the best outcomes.

0.7 LOCAL DEVELOPMENT PLAN RECOMMENDATIONS

0.7.1. This Chapter includes an assessment of the green infrastructure content of existing Local Development Plan development management policies. Suggestions for their enhancement are made based on Welsh legislative and policy requirements for green infrastructure, green infrastructure standards and 'good practice' Local Development Plan policies in operation across the UK.

0.7.2. Planning Policy Wales 10 requires local authorities to take a strategic and proactive approach to green infrastructure; protecting, enhancing, and improving the use and multifunctionality of existing assets. Meanwhile, Natural Resources Wales encourages local authorities to create new green infrastructure (of the right kind, in the right places) and to manage existing green infrastructure to the best possible standard in order to keep their citizens healthy. Meeting Accessible Natural Greenspace Standards and Green Flag Award criteria will help with this process.

0.7.3. With the adopted Ceredigion Local Development Plan pre-dating legislation, policy and guidance on green infrastructure in Wales, it is not surprising that the concepts of 'green infrastructure' and 'multi-functionality' are absent from the adopted development management policies. As such, there are a number of opportunities for the emerging Local Development Plan, particularly regarding policies on design (DM06), landscaping (DM10), climate change (DM11), sustainable drainage systems (DM13) and coastal management (DM23) which would benefit from explicit references to enhancing green infrastructure and ecosystem service provision. Policies which do seek to protect and enhance biodiversity and ecosystem services (DM14, DM15 and DM20) would benefit from stronger phrasing that requires overall improvement, as well as a requirement to connect to green infrastructure, habitats and public access networks located outside of the development site boundary.

0.7.4. Based on this review and the identified best practice policies from across the UK, it is recommended that emerging Local Development Plan policies commit landowners and developers to protect and enhance green infrastructure on their sites wherever possible, and to link this with surrounding green infrastructure in order to improve wider connectivity for both people and wildlife. The Environment (Wales) Act 2016 and Planning Policy Wales 10 both give significant weight to biodiversity and green infrastructure. The emerging Local Development Plan will need to reflect this prominence. In addition, the emerging Local Development Plan should consider the Welsh Government's forthcoming guidance on green infrastructure, expected to be published later in 2020.

0.7.5. More specific recommendations for inclusion in development management policies in the emerging Local Development Plan include requiring developers to:

- Discuss with the Council at the pre-application stage what type of green infrastructure and functions (ecosystem services) may be appropriate for the site;
- Set out through a green infrastructure proforma submitted with their planning application how green infrastructure (and ecosystem services) is taken into account in the scheme's design, and how it will be maintained and funded into the future;

- Protect existing on-site green infrastructure wherever possible;
- Improve the multi-functionality of any required sustainable drainage features (focusing in particular on biodiversity, aesthetic, and connection with nature benefits);
- Enhance on-site biodiversity, and where possible link with core ecological areas, linear corridors or stepping stones beyond the site boundary;
- Ensure that on-site recreation routes link in with the wider PROW network and any active travel routes;
- Meet specific standards for the quality and quantity of on-site green infrastructure provision, e.g. relating to permeability (using the Green Space Factor); or wellbeing, water and wildlife (using Building with Nature); and
- Fund green infrastructure creation/enhancement projects elsewhere if they are unable to do so on-site.

0.7.6. Inclusion of a specific green infrastructure policy is also recommended for Ceredigion's emerging Local Development Plan. As well as referring to the development-related points above, this should set out good practice principles for the planning of green infrastructure more generally (drawing on any green infrastructure framework that may be produced by the Council). For example, a Ceredigion green infrastructure policy could include points on:

- Promoting green infrastructure through collaborative and participatory processes (both within the Council, and externally with private, civic and community stakeholders);
- Enhancing connectivity within and across urban and rural areas for both people and wildlife;
- Developing green infrastructure standards which can be monitored and evaluated against measurable indicators;
- Enhancing both the variety and multi-functionality of green infrastructure, to improve the delivery of a suite of ecosystem services;
- Improving the quantity, quality, accessibility and awareness of green infrastructure assets; and
- Monitoring, quantifying and potentially monetising the benefits of green infrastructure assets to help justify future investment and for inclusion in possible natural capital assessments and accounts.

Contact name: Helen Davies

Contact details: 01256 318530 | helen.davies2@wsp.com

1 INTRODUCTION

1.1 GREEN INFRASTRUCTURE IN WALES

1.1.1. Green infrastructure (hereafter referred to as GI) describes the network of green and blue spaces in both rural and urban areas. These include (but are not limited to) parks, community gardens, street trees, woodlands, sports fields, allotments, green roofs, nature reserves, rivers and ordinary watercourses, lakes and beaches. GI provides multiple benefits to people, known as 'ecosystem services', for example:

- Soaking up rainwater and reducing the risk of flooding;
- Protection from coastal erosion and flooding;
- Keeping towns and cities cool during heat waves;
- Filtering pollution from the air;
- Storing carbon to help mitigating climate change;
- Dampening noise pollution;
- Reducing stress and promoting mental well-being;
- Providing attractive places to keep fit and therefore improving physical health;
- Creating a sense of place and thus encouraging business investment;
- Stimulating children to do better at school and employees to be more productive; and
- Supporting wildlife including bees and other pollinators.

1.1.2. Even in a largely green and rural land like Wales, green spaces in towns and cities are often the only way for many people to experience the health and well-being benefits of the outdoors. Lack of time, money or transport may prevent people from travelling far from where they live or work to enjoy the outdoors. This is particularly relevant for people who are vulnerable to socio-economic pressures (those with poor health, limited mobility, low income, and/or living in more deprived areas). This means that the provision of quality, accessible, local green space is critical for improving the nation's health equitably (in line with Sections 1-3 of the Equality Act 2010), and for reducing transport-related CO_2 emissions.

1.1.3. The Well-being of Future Generations Act 2015, Planning (Wales) Act 2015 and the Environment (Wales) Act 2016 provide the legislative context for delivering GI across Wales. GI is also a key thread that runs through Planning Policy Wales 10 and the draft National Development Framework. The Welsh Government is preparing guidance on GI and its delivery within the planning system, expected to be published later in 2020.

1.2 BACKGROUND TO THE ASSESSMENT

1.2.1. WSP was commissioned by Ceredigion County Council (hereafter referred to as CCC) to:

- prepare a GI Assessment to guide and shape the planning and delivery of Ceredigion's GI;
- undertake a detailed GI Audit of key urban environments in Ceredigion; and

- make recommendations for changes necessary to Local Development Plan (LDP) development management policies.

1.2.2. The objectives of the project are as follows:

- To identify broad principles for GI improvement;
- To identify general principles of natural resource management within and outside urban areas to be taken into account by intending developers;
- To guide the way that Ceredigion's towns evolve in the future, drawing on local distinctiveness and setting out principles to incorporate into place planning, with the aim of improving the relationship between new developments and their local GI context;
- To provide a spatial analysis to support landowners and communities (including Place Planning organisations), developers and public bodies in prioritising GI improvements;
- To identify mechanisms to maintain and where possible enhance natural and semi-natural features and promote the resilience of ecosystems; and
- To identify opportunities to create and improve GI connectivity to maximise benefits to people, places and nature.

To deliver the objectives, WSP (working alongside CCC, internal and external stakeholders, and local communities) has undertaken a GI Assessment involving the four key inter-linked tasks set out below.

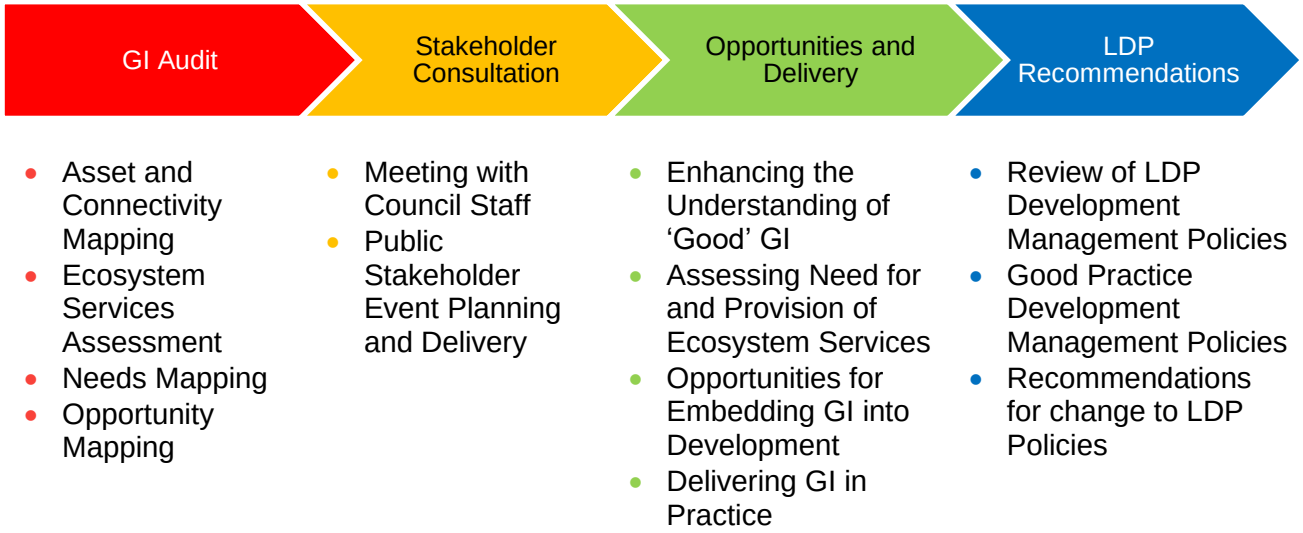


Figure 1.1: Key tasks supporting the Green Infrastructure Assessment

1.3 PURPOSE OF REPORT

1.3.1. This GI Assessment for CCC contains outputs relating to tasks 1-4 of the project, specifically:

- **Asset and Connectivity Mapping** – This contains maps and associated commentary of existing urban GI assets and habitats for Ceredigion's six main towns plus Adpar, the urban extension of Newcastle Emlyn on the Ceredigion/Carmarthenshire border. Maps and commentary are also

provided for the land-based designations for the County as a whole. The connectivity for wildlife between existing core habitats, and for people between existing GI assets and between urban and rural areas is also identified.

- **Need for and Provision of Ecosystem Services** – The likely functional benefits (i.e. cultural, regulating and provisioning services) of existing GI assets and habitats to people are identified for Ceredigion's seven towns, along with the relative *need* for five ecosystem services (air quality, flood reduction, recreation, health and wellbeing, and aesthetics). Anecdotal evidence of benefits provided by key GI sites in Ceredigion is also provided. This information on GI functionality is often missing from GI assessments and strategies, but provides an important link to broader issues of importance to decision-makers, thus making GI more salient.
- **Stakeholder Consultation** – This provides the outputs of two public stakeholder events and an online survey, held in order to ascertain the views of Ceredigion's residents, town/parish councillors, and environmental/social groups on enhancements to the County's GI.
- **Potential Opportunities for Ceredigion's GI** – This draws out opportunities for creating and enhancing GI based on the mapping of assets and connectivity, the ecosystem services assessment, the stakeholder consultation, Place Plans for each of the towns, and opportunities suggested by the CCC project steering group.
- **Delivering GI in Practice** – General principles and practical requirements of creating GI and delivering long term GI maintenance and management are set out, both in relation to public and private land.
- **LDP Recommendations** – An assessment of the GI content of existing LDP development management policies is carried out. Suggestions for their enhancement are made based on Welsh legislative and policy requirements for GI, and GI standards and 'good practice' LDP policies in operation across the UK.

2 ASSET AND CONNECTIVITY MAPPING

2.1 APPROACH

2.1.1. From data provided by CCC, and publicly available through Natural Resources Wales's (NRW) Lle Geo-Portal[1], existing urban and rural GI assets in Ceredigion have been mapped. For each of the seven towns, this includes a map of physical assets (similar to standard GI typologies such as play spaces, linear recreation routes, and urban tree cover) and an ecosystem-based map containing Phase 1 habitats.[2] Each town is depicted with a 2 km buffer surrounding it, to show assets and habitats within the adjacent countryside. At the County-level, landscape and nature conservation designations have been mapped.

2.1.2. Existing connectivity and connectivity gaps between GI assets for people are also discussed for each town, focusing in particular on urban-rural connectivity within the 2 km buffer using linear features such as Public Rights Of Way (PROW). Connectivity for wildlife is also relevant, and includes both linear features (such as hedgerows) and stepping stone habitats (such as urban green spaces).

2.2 DESIGNATIONS

2.2.1. The main landscape and nature conservation designations present in Ceredigion are defined as follows:

- Local Nature Reserves (LNRs): These are sites which contain natural features that are of special interest to the local area. Often located near urban areas, LNRs are managed by local authorities and can be used to protect habitats, as well as increase people's engagement with their environment.
- Sites of Special Scientific Interest (SSSIs): These are sites that are of particular interest to science due to the rare natural features that they contain. Designation can either be based on the biological or geological interest of the site. These sites are mostly in private ownership, though they can be owned and managed by conservation bodies, such as Wildlife Trusts.
- National Nature Reserves (NNRs): These protect some of the rarest and most important habitats, species and geology and are also all SSSIs. NNRs provide rich environments for education and scientific research. These sites are either owned by NRW or an approved body such as a County Wildlife Trust.

[1] Available at: http://lle.gov.wales/home
[2] Ecosystem services are assessed in Chapter 3.

- Special Areas of Conservation (SACs): These are protected under the European Commission (EC) Habitats and Species Directive[3] and aim to protect a range of habitats, as well as plant and animal species in order to conserve biodiversity.
- Special Protection Areas (SPAs): Similar to SACs, these are areas that are protected under the related EC Birds Directive.[4] They have been designated for the conservation of rare and vulnerable birds. Together with SACs, SPAs contribute to the network of protected habitats spanning the European Union known as 'Natura 2000'.
- Ramsar sites: These are internationally important wetland sites, designated under the Ramsar Convention.[5] Such sites are essential for numerous types of birds, especially waterfowl, and are vital for the survival of many other wetland plant and animal species.
- Biosphere reserves: Designated by UNESCO, these are recognised for their conservation and educational value, as well as for encouraging sustainable local economies. As such, Biosphere reserves are positive exemplars of human interaction with nature.
- Heritage coast: These are stretches of outstanding and unspoiled coastline set up to secure their conservation and management, and promote access and enjoyment. Whilst the designation carries no legal protection, planning authorities must take the status into account when making development decisions. Heritage coasts are commonly defined as a stretch between two points which is why they are not included in Table 2.1 which contains land areas.

2.2.2. For Ceredigion as a whole (which measures 178,300 ha), the number and area of landscape and nature conservation designations is shown in Table 2.1, with the map provided in Appendix A. Please note that the proportion of total land area does not include the very significant marine SACs area.

Table 2.1: Landscape and nature conservation designations

Designation	Number	Area (ha)	Proportion of total land area (%)
Local Nature Reserves (LNRs)	3	61	0.03
National Nature Reserves (NNRs)	8	2,981	1.67
Sites of Special Scientific Interest (SSSIs)	101	19,501	10.94
Special Areas of Conservation (SACs)	16 (incl. 3 marine)	50,968 (incl. 42,383 marine)	5.94 (not incl. marine)
Special Protection Areas (SPAs)	3	11,721	6.57
Ramsar sites	2	2,795	1.57
Biosphere Reserve	1	18,453	10.35

[3] Directive, H. (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. *Official Journal of the European Union*, *206*, 7-50.
[4] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. *Official Journal of the European Union 20, 7–25.*
[5] Matthews, G. V. T. (1993). The Ramsar Convention on Wetlands: its history and development. Gland: Ramsar Convention Bureau.

2.2.3. What many people would describe as the ‘jewel in the crown’ of Ceredigion is the extensive coastline which also represents the by far largest designation area of the County. The SAC designation indicates its importance for wildlife but it is undoubtedly also a major focal point for people to connect with nature which is also evidenced by the four stretches of heritage coast. These GI assets especially benefit populations and visitors in the coastal settlements north of Aberystwyth, to the north of Aberaeron, between New Quay and Tresaith and north of Cardigan. All other major towns are located alongside River Teifi which is also designated as SAC and provides valuable opportunities for people to connect with nature. The majority of terrestrial designated areas are located in the north and east of the County and therefore geographically somewhat disconnected from the major population centres which are located towards the west and south.

2.2.4. The three marine SACs within Cardigan Bay represent key sites of national and international importance for wildlife. The Cardigan Bay SAC is designated for its reef habitats, sea caves, grey seal population and Europe’s largest population of bottlenose dolphins, *Tursiops truncates*. The West Wales Marine SAC is designated for the harbour porpoise population, *Phocoena phocoena.* Whilst Pen Llyn a’r Sarnau SAC is designated for its coastal lagoons and shallow water reefs amongst other habitats. The four stretches of heritage coast (Borth - Clarach, Monks Cave - Llanrhystud, New Quay - Tresaith and Pen-peles - Gwbert) extending over 35 km also highlight the importance of the coast for people to enjoy unspoiled natural experiences.

2.2.5. Also important at the national and international level is part of the Dyfi Biosphere reserve. The core area of the Dyfi Biosphere is comprised of three main protected habitats: raised bog (Cors Fochno SAC and SSSI); ancient semi-natural broadleaved woodland (Coed Cwn Einion SAC and SSSI); and sea, coast and estuary (Pen Llŷn a’r Sarnau SAC).

2.2.6. Other areas of national/international importance include Ceredigion’s two Ramsar sites (wetland sites designated to be of international importance under the Ramsar Convention). Located near Tregaron, Cors Caron was designated as a Ramsar site due to the rarity and excellent condition of the raised bog habitat that it contains. The same site is also designated as a NNR, a SAC, and a SSSI. The Cors Fochno and Dyfi Ramsar site is located to the north of the County, near the village of Borth. As one of the few remaining examples of near natural raised bog habitats in the UK, it is a crucial aspect of the Dyfi NNR and Biosphere Reserve, as well as its SAC, SPA and SSSI designations. Coed Rheidol NNR/SAC/SSSI is designated for its old sessile oak wood habitat. Elenydd SAC/SSSI comprises the largest tract of blanket mire within the central Wales uplands; and Mynydd Mallaen SAC/SSSI contains large areas of old sessile oak woodland and European dry heath. Both these upland terrestrial sites are also designated as SPAs for their populations of merlin *Falco columbarius* and red kite *Milvus milvus*.

2.2.7. At the regional level, Ceredigion is home to three LNRs; all of which are located to the north of the County, near Aberystwyth. The woods and disused quarry of Penglais were designated due to the deciduous broadleaved woodland and abundance of bluebells in spring. The area centred around the iron age Pen Dinas fort received designation for the hay meadow, riverine, beach and shingle spit habitats it contains. The third site, the ancient semi-natural woodland of Coed Y Cwm, was designated a LNR due to the variety of woodland micro habitats it provides.

2.3 PHYSICAL ASSETS

2.3.1. There are a number of different GI typologies, each setting out different types of GI that can be present in an area. In Ceredigion, spatial information is available on the following types of linear and non-linear GI assets:

- Active travel routes: These are elements of infrastructure (approved by CCC[6]) that facilitate and encourage travel by physically active means, such as walking or cycling. The purpose of active travel routes is to provide access to specific destinations whilst improving the health of users. The importance of these routes is recognised nationally through the Active Travel (Wales) Act 2013,[7] which places a duty on local authorities to improve and promote such routes for routine journeys. CCC acts on this duty locally for the designated active travel towns of Aberystwyth, Cardigan and Lampeter via transport grants from the Welsh Government and one other way is through their Rights of Way Improvement Plan.[8] (Data source: CCC).
- Cycle routes: These are routes that are designed for the use of bicycles (Data source: Sustrans). Please note that this data includes cycle routes as well as on-road cycle routes.
- Coastal paths: These are trails along the coast and estuaries for pedestrians. (Data source: Lle Portal).
- PROW: These are routes that allow public passage through privately owned land. (Data source: CCC).
- Disused railways: These are former sections of railway track that may or may not have been converted for other uses, such as walking or cycling. In Ceredigion, these are generally not accessible to the public, except where designated as a PROW or cycle routes. (Data source: CCC).
- Main rivers: These are statutory watercourses designated by NRW as main rivers due to their size and/or the presence of features that regulate the flow of water through the river channel. Main rivers are important features for ecological connectivity and, if accessible, can have great recreational value. (Data source: Lle Portal).
- Ordinary watercourses: Ordinary watercourses can also be important features for ecological connectivity and of recreational value even if they are not designated as main rivers.
- Accessible green space: Ordnance Survey (OS) has produced a green space layer that comprises a range of urban green space types.[9] For Ceredigion's towns, only green space that is likely to be accessible to the public is included, i.e. excluding private residential gardens, the grounds of schools, businesses and institutions, and the 'soft estate' alongside transport corridors. Included green spaces are as follows:

[6] For more information, see: https://www.ceredigion.gov.uk/resident/travel-roads-parking/active-travel/
[7] Available at: http://www.legislation.gov.uk/anaw/2013/7/contents/enacted
[8] Available at: https://www.ceredigion.gov.uk/resident/coast-countryside/public-rights-of-way/rights-of-way-improvement-plan/
[9] Available at: https://www.ordnancesurvey.co.uk/business-government/products/mastermap-greenspace

- Allotments: These are areas of land used by residents for the growing of fruit and vegetables. (Data source: OS).
- Religious grounds and cemeteries: These are areas of land surrounding churches, including areas set aside for the burial of the deceased. (Data source: OS).
- Public parks or gardens: These are formal public spaces, such as Llandysul Memorial Park or Square Field in Aberaeron. (Data source: OS).
- Play spaces: These are areas that provide children and young people the opportunity for play, such as recreation grounds with play equipment. (Data source: OS and CCC). Please note that play spaces within enclosed school grounds have not been included in this assessment. This is because of a lack of relevant spatial school ground data. Hence, only play spaces that are accessible to the general public at least some time of the year are included.
- Playing fields: These are generally large areas used for casual sport and general recreation such as (dog) walking and picnicking. (Data source: OS).
- Sports grounds/facilities: These include outdoor recreational facilities such as golf courses, bowling greens and tennis courts. (Data source: OS).

- Village greens: These are areas of land within a defined settlement used for sport or recreation by local people. (Data source: CCC).
- Open access land: The Countryside and Rights of Way Act (CRoW) (2000) [10] defines open access land as open country and registered common land recorded on the official registers of the commons registration authorities. Also included in the definition is land which has been made freely accessible by its owners. (Data source: CCC).
- Forest access sites: These are forested sites designated by NRW for recreation purposes. (Data source: CCC).
- Urban tree cover: This comprises the area under tree canopy cover within the urban environment. (Data source: Lle Portal).
- Bathing waters: As defined by the EC Bathing Waters Directive (2006)[11], these are 'fresh or sea waters in which bathing is explicitly authorised'. (Data source: Lle Portal).
- Lakes: These are bodies of water, specifically reservoirs and natural lakes. (Data source: Lle Portal).
- Local Nature Reserves (LNR): As defined in section 2.2 above. (Data source: Lle Portal).
- Areas meeting criteria for Sites of Importance for Nature Conservation (SINC): SINCs are non-statutory designated sites that are of significant value for biodiversity and nature conservation. However, no sites have officially been designated as SINCs in Ceredigion. These sites therefore represent areas of land that CCC considers to meet SINC criteria, but are currently unprotected.

[10] Available at: http://www.legislation.gov.uk/ukpga/2000/37/contents
[11] Available at: https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/bathing-water-directives

It is also important to note that these sites are not necessarily managed for their biodiversity value nor are they necessarily accessible to the public. (Data source: CCC).

2.3.2. The area (ha) or length (km) of mapped GI assets for each of the towns (and the 2 km buffer zones) is shown for comparison in Table 2.2. The representative share of each of the asset types across the towns (controlling for their varying sizes) is shown in Figure 2.1. Commentary by town then follows. The maps of GI assets for each of the towns are provided in Appendix B.

Table 2.2: GI assets within each town (including 2 km buffer zone)

GI asset (units)		Aberystwyth	Aberaeron	Cardigan	Lampeter	Adpar	Llandysul	Tregaron	TOTAL
Active travel routes	km	30		9	5				**44**
Cycle routes	km	31	4	7	7	6	8	6	**69**
Coastal paths	km	8	7	10					**25**
Public rights of way (PROW)	km	53	33	32	18	11	14	27	**188**
Disused railways	km	3	2	0.8	4			3	**14**
Main rivers	km	16	6	10	15	14	13	12	**86**
Ordinary watercourses	km	56	30	70	74	22	32	49	**333**
OS greenspace: Allotments	ha	1	0.6	1	0.5				**3**
OS greenspace: Playing fields	ha	24	9	6	5	7	6	6	**64**
OS greenspace: Public parks or gardens	ha	4	1	0.9	0.3				**6**
OS greenspace: Religious grounds and cemeteries	ha	8	1	6	3	2	2	1	**22**
OS greenspace: Other sports grounds/facilities	ha	48	0.4	40	10	0.6	6	0.5	**105**
Play spaces (OS and CCC data)[12]	ha	19	2	4	8	1	5	0.1	**40**
Village greens	ha			9					**9**
Open access land	ha	13							**13**
Forest access sites	ha		5						**5**
Urban tree cover	ha	48	6	18	16	14	8		**110**
Bathing waters	ha	36							**36**
Lakes	ha	0.3			3				**3**
Local nature reserves (LNR)	ha	61							**61**
Areas meeting criteria for Sites of Importance for Nature Conservation (SINC)	ha	904	404	573	335	332	341	548	**3,436**
Total area of town (including buffer)	**ha**	**3,113**	**1,522**	**2,957**	**2,443**	**1,791**	**2,240**	**2,024**	**16,090**

[12] Excluding play spaces within enclosed school grounds which are not accessible to the public.

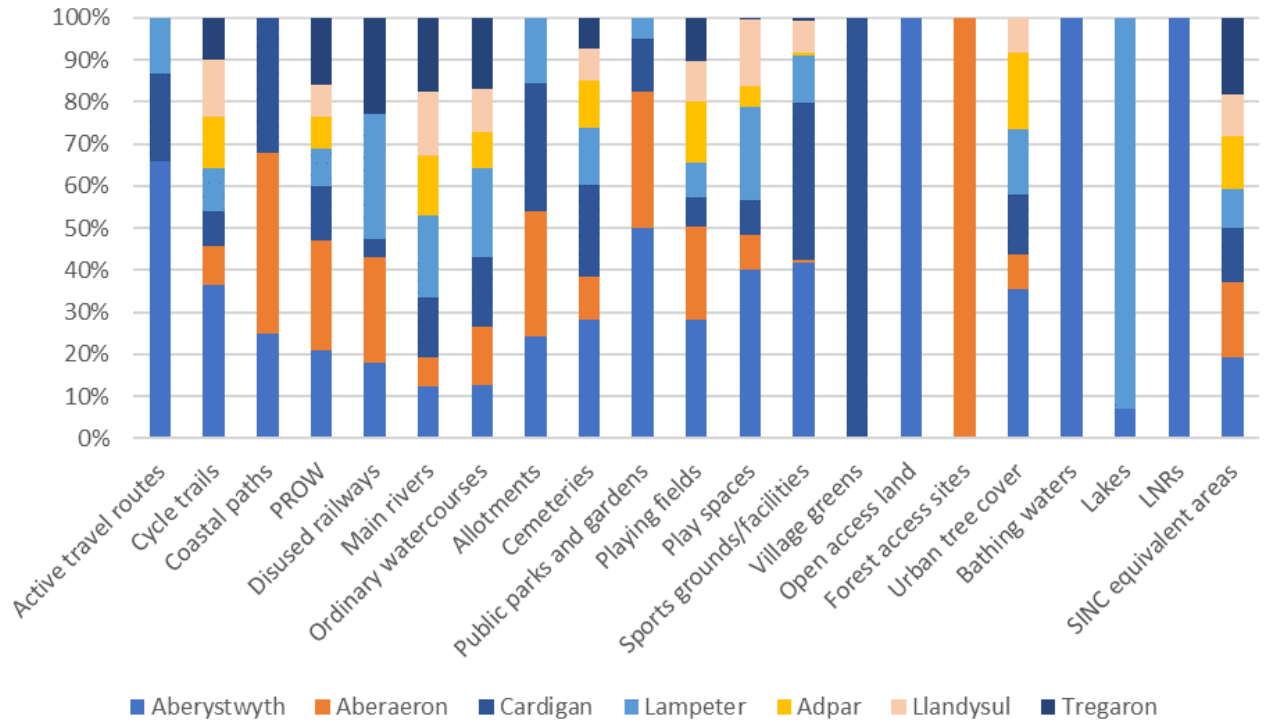


Figure 2.1: Representative share of GI assets across the seven study areas

2.3.3. Ceredigion's harbours should also be considered in this context. Whilst harbours are not usually considered a GI asset themselves (and are therefore not listed above), they often represent focal points of the County's towns and represent opportunities for residents and visitors to view and experience the nature of rivers, the coast and sea.

Aberystwyth

2.3.4. The landscape surrounding Aberystwyth comprises coastal, valley and hill environments. The coast is a particularly important feature for recreation and tourism, characterised by intimate coves and small shingle beaches. Sections of two of the County's largest rivers, the Rheidol and the Ystwyth, run through the area. Aberystwyth has the greatest diversity of GI assets identified within CCC. As the largest town, it also has the largest area of GI land cover and length of linear assets. Areas meeting SINC criteria dominate in terms of land cover with a total area of 904 ha (22.3% of the total land area for the town and its buffer). In terms of the urban GI assets, key ones are the 19 ha of play spaces, 24 ha of playing fields, 48 ha of sports grounds, and 48 ha of urban trees. Features that have been uniquely identified for Aberystwyth include: open access land, bathing waters and LNRs, which together make up 110 ha (3.5% of the study area). Important linear assets for the town include 53 km of PROW and 72 km of watercourses (main rivers and ordinary watercourses) that flow through the area. Also notable is that Aberystwyth has developed the greatest length of active travel routes, totalling 20 km.

Aberaeron

2.3.5. Situated on the coast at the mouth of the River Aeron and harbour, the landscape inland and to the south of Aberaeron is dominated by steep hillsides and cliffs with more an area of level plain to the north. The coastline is particularly important for recreation and tourism including the rocky and

shingle beaches. Away from the coast, wooded vegetation and farmland is more prominent. Within the settlement, areas meeting SINC criteria make up the majority of Aberaeron's GI assets, with a cover of 404 ha (17.6% of the study area). Other important assets for the town include 9 ha of playing fields and 6 ha of urban tree cover. It also boasts the only Forest Access Site of Ceredigion's main towns, at 5 ha. PROW make up the majority of Aberaeron's linear assets, with a total length of 33 km. Other notable features include 36 km of watercourses and 7 km of coastal paths. Running along a section of disused railway, the Aberaeron to Llanerchaeron cycle path is another notable key asset.

Cardigan

2.3.6. The landscape surrounding Cardigan is comprised of a broad river valley and the encircling undulating hills. It also benefits from its proximity to Ceredigion's coastline which is an important GI asset. For Cardigan, areas meeting SINC criteria make up the majority of the area's GI assets, with a total of 573 ha (covering 19.4% of the land area). Other important assets include 40 ha of sports grounds, 18 ha of urban tree canopy, and 6 ha of playing fields. Cardigan is also home to the County's only formally mapped village green, with a total area of 9 ha. In terms of linear assets, PROW and watercourses are the largest features, with lengths of 32 km and 80 km, respectively.

Lampeter

2.3.7. Lampeter's surrounding landscape is varied, with the main river, the Teifi, being a key feature, as well as wooded valleys and improved pasture fields. Within the settlement, areas meeting SINC criteria make up 335 ha of Lampeter's GI assets, which at 13.7% of land area is the lowest proportion of all seven towns. Also of importance are the area's urban tree cover (16 ha), sports grounds (10 ha), play spaces (8 ha) and playing fields (5 ha). Lampeter is of note as it is home to the 3 ha Falcondale Lake, which (though privately owned) is accessible by a short section of PROW. Important linear assets are the 89 km of watercourses and the 18 km of PROW.

Adpar

2.3.8. The landscape making up Adpar's surrounds consists of elevated patchwork fields crossed by minor river valleys that descend steeply to the floodplain of the Teifi. Within the settlement, Adpar's areas meeting SINC criteria make up a total of 332 ha (18.5% of the total land area). Other important assets include 14 ha of urban tree canopy and 7 ha of playing fields. Linear assets identified consist of 36 km of watercourses, 11 km of PROW and 6 km of cycle routes.

Llandysul

2.3.9. Llandysul's surrounding landscape consists of an elevated plateau interrupted by a series of watercourses of various lengths which form both steep narrow valleys and more open isolated valley corridors. Within the settlement, areas meeting SINC criteria make up a total of 341 ha of Llandysul's GI assets (15.2% of the study area). Other important assets include 8 ha of urban tree canopy, 6 ha of playing fields, 6 ha of sports grounds, and 5 ha of play spaces. The linear assets identified consist of 45 km of watercourses, 14 km of PROW and 8 km of cycle routes.

Tregaron

2.3.10. Ceredigion's adopted LDP[13] identifies the landscape surrounding Tregaron at the foot of the Cambrian Mountains as one of the most highly valued within Ceredigion. Important features include the upland moorland and grassland plateau, as well as lowland river valleys and coastal plateau. Of the seven towns, Tregaron has by far the highest proportion of land covered by areas meeting SINC criteria, at 27.1% (measuring 548 ha) (which includes the area of Cors Caron to the north of the town). Playing fields also make an important contribution, with a total area of 6 ha. Due to Tregaron's size and rural character, data were not collected for NRW's Tree Cover in Wales' Towns and Cities report[14]. As such, urban tree cover data were not available for Tregaron. In terms of linear assets, PROW and watercourses are the largest features, with lengths of 27 km and 61 km, respectively.

2.4 CONNECTIVITY FOR PEOPLE

2.4.1. As well as being physical GI assets in their own right, linear recreation routes (i.e. active travel routes, cycle routes, coastal paths and PROW) also provide important connectivity functions. These enable people to move easily (and via healthy and sustainable means) between other urban GI assets, between residential areas and urban GI assets, and from urban areas to the surrounding countryside. The Wales coastal path in particular provides great access to Ceredigion's coast which is arguably its greatest GI asset. On a larger scale, these linear recreation routes also help to integrate urban GI into Ceredigion's wider GI network. The national cycle network provides connectivity between Ceredigion's settlements, as well as linking them with some of the County's designated landscape and nature conservation sites. Other linear routes such as disused railways and rivers provide not just important connectivity for wildlife. They also represent valuable GI features for recreation where they are accessible such as through riverside paths. Commentary on the connectivity of Ceredigion's GI for people follows by town, as well as for the County as a whole.

Aberystwyth

2.4.2. Much of Aberystwyth's GI assets sit within the LDP boundary, and there is good connectivity for people across the town, e.g. via the extensive active travel routes connecting different zones. Aberystwyth also has a large number of GI assets outside of the settlement boundary, with varying levels of connectivity. Aberystwyth's coastline and bathing areas are connected to the area enclosed by the LDP boundary and beyond the buffer area by coastal paths. In addition to the coast and bathing areas, the coastal paths also connect to several areas of coastal green space. The Parc Natur Penglais LNR to the north of the town is connected via a continuous section of PROW - as is Pendinas LNR to the south west. The network of PROW and cycle routes to the south and south east are less complete and, as a result, several areas of green space (including the 13 ha of open

[13] Available at: https://www.ceredigion.gov.uk/resident/planning-building-control-and-sustainable-drainage-body-sab/planning-building-control/ceredigion-local-development-plan/
[14] Natural Resources Wales (2016). Tree Cover in Wales' Towns and Cities. Available at: https://naturalresources.wales/about-us/what-we-do/green-spaces/urban-trees/?lang=en

access land) are poorly connected to the town. Currently, there is still connectivity between most of the ecologically valuable assets. However, a loss of connectivity from north to south is a key concern as identified in the LDP.

Aberaeron

2.4.3. Outside of Aberaeron's LDP boundary, coastal paths and PROW serve as the main connection to the valuable coastline and other GI assets within the boundary area. A national cycle route[15] serves as connection from the town centre to the coast which represents a major GI asset for the town. Also of note is a section of disused railway which extends from the LDP boundary to beyond the buffer zone, which serves as an important recreational route partially connecting the town and Llanarchaeron. There are a number of village greens and common land that provide important and accessible green space within the town centre (though these assets are not identified in the spatial datasets). The only 'forest access site' identified within the seven towns is connected to the urban area of Aberaeron by PROW. The rugby/cricket pitch provides a sizable area of recreational sports ground which is connected to Aberaeron and Aberarth by footpaths.

Cardigan

2.4.4. The majority of Cardigan's GI assets sit within the LDP boundary; except for a few unconnected play spaces. Coastal paths serve as the main linear GI assets that connect Cardigan's population to its boundary area including the coastline which represents an important recreational asset as well as the adjacent site meeting SINC criteria. PROW are present within the boundary area but are often fragmented and do not form a consistent network. Also present are active travel routes, a section of which runs along the disused railway line creating an important and well used link to the Cilgerran Welsh Wildlife Centre.

Lampeter

2.4.5. The majority of Lampeter's GI assets sit inside the LDP boundary. These include a range of significant play and sports spaces as well as the river network. A notable exception is the 3 ha lake which is connected to the area within the LDP boundary via one of the town's main rivers (Nant Creuddyn), though not via any PROW. The main rivers serve as the main form of connection to the buffer area and beyond. A significant length of disused railway extends from the LDP boundary to beyond the buffer zone, though this is not currently accessible as a recreation route for people.

Adpar

2.4.6. Much of Adpar's GI assets sit outside of the LDP boundary, in the immediately adjacent town of Newcastle Emlyn; including most of the area's urban tree cover and several sizable play spaces. The exception is the residential allocation site opposite Parc y Trap[16], which includes a playing field and equipped play space (that must be maintained or enhanced with development). Many of the

[15] Please note that this includes on-road cycling.
[16] Res Allocation H0401 as identified within Ceredigion LDP Volume 2A Settlment Group Statements. Available at: http://www.ceredigion.gov.uk/resident/planning-building-control-and-sustainable-drainage-body-sab/planning-building-control/ceredigion-local-development-plan/adopted-ceredigion-local-development-plan-ldp/

assets outside of the LDP boundary are unconnected to Adpar itself, including the largest area of play space. PROW are present but are fragmented and do not form a consistent network.

Llandysul

2.4.7. Most of Llandysul's GI assets are located within its LDP boundary. This includes sports facilities, playing fields and play spaces. The exception is the sports facility just north of the LDP boundary though this appears to be connected via PROW. The main rivers (Teifi and Tyweli) are the main GI asset and accessible via the adjacent national cycle route. PROW are present and also cross the LDP boundary out of the urban area. However, due to fragmentation, the PROW do not form a consistent network of travel/recreation routes in the area.

Tregaron

2.4.8. Most GI assets identified for Tregaron are located within the LDP boundary which include playing fields, religious grounds and sports facilities. PROW serve as connection from the urban area to the buffer area and beyond, though the rivers (Brennig and Teifi) do not appear to have adjacent foot/cycle path for people to connect to the surrounding areas. The network of PROW is reasonably complete when compared to the other urban areas.

Ceredigion County

2.4.9. Ceredigion's coastal towns benefit from easy access to Ceredigion's most valuable GI asset, the coastline, via the coastal paths network. This includes access to the heritage coast sections which are particularly valuable for recreation and aesthetic values as they provide unspoiled areas for Ceredigion's citizens and visitors to connect with nature. Aberystwyth is connected to both Elenydd SAC/SPA/SSSI and Cors Caron NNR/SAC/SSSI via national cycle routes. The latter site is also connected to Tregaron via National Cycle Route 82, which continues south-west along the County boundary and Afon Teifi SAC to Lampeter, Llandysul, Adpar and Cardigan. The coastal towns of Aberystwyth additionally benefit from direct proximity (and national cycle route access) to Cardigan Bay SAC and West Wales Marine SAC, respectively. However, it should be noted that whilst access to important nature conservation sites may be beneficial for people (e.g. through the ecosystem services benefits of nature connections, reduced stress, enhanced mental wellbeing and so on), increasing public access to such sites could be detrimental to their biodiversity.[17] The qualifying features of European protected sites such as SACs and SPAs (which include areas designated nationally as SSSIs) could be severely negatively impacted by trampling, mountain bikes, noise etc, and so it will be important to ensure that people stick to permitted routes only, avoiding sensitive areas.

[17] Marzano, M & N. Dandy (2011). Disturbance of wildlife and the recreational use of forests: literature review. Forest Research, Farnham.

2.5 HABITATS

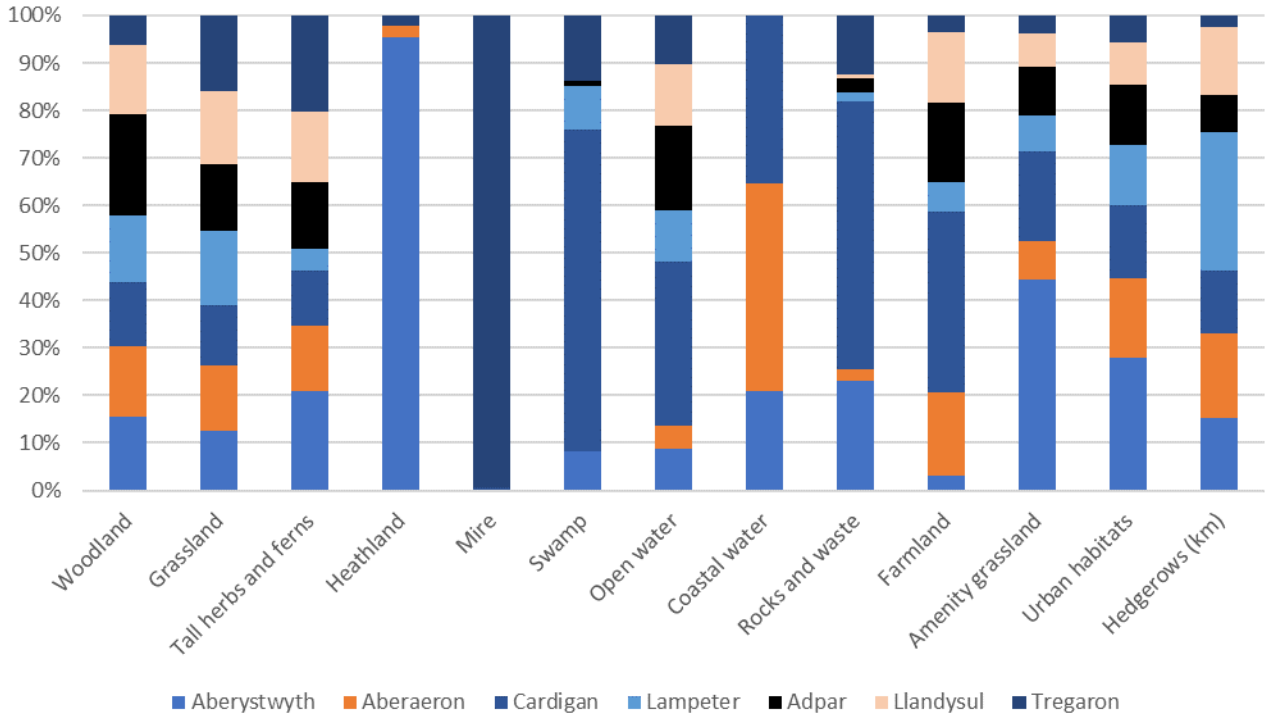
2.5.1. The main habitat types present within and surrounding Ceredigion's seven towns are as follows (with definitions obtained from the JNCC Phase 1 Handbook[18]):

- Woodland: Woodland is defined as vegetation dominated by trees more than 5m high when mature, forming a distinct, although sometimes open, canopy. Meanwhile scrub habitat is native vegetation usually less than 5m tall such as bramble or hawthorn.
- Grassland: A grassland is an area in which the vegetation is dominated by a nearly continuous cover of grasses. This category includes both areas of herbaceous vegetation dominated by grasses and certain wet communities dominated by sedge species, rush species or by other marsh herbs.
- Tall herbs and ferns: This includes bracken, and other tall vegetation such as common nettle.
- Heathland: Heathland is a well-known habitat type in the lowlands and uplands of the UK. It occurs on acidic, impoverished, dry sandy or wet peaty soils, and is characterised by the presence of a range of dwarf-shrubs including various types of heather and gorse.
- Mire: A mire is a wetland habitat type, dominated by living peat-forming plants.
- Swamp: A swamp is defined as emergent or frequently inundated vegetation, occurring over peat or mineral soils.
- Open water: Open water is defined as water lying beyond the limits of swamp or emergent vegetation, although it may contain submerged, free-floating or floating-leaved vegetation. There are two forms of open water: standing water (e.g. lakes, reservoirs, pools, flooded gravel pits, ponds, water-filled ditches, canals and brackish lagoons); and running water (e.g. rivers and streams).
- Coastal habitat: Coastal habitats are found wherever the land meets the sea. The coast is home to many habitats, such as sand, mud, rocks and shingles, saltmarsh, sand dunes, cliffs, coastal grassland and coastal heathland.
- Rocks and waste: This category includes both natural and artificial exposed rock surfaces where these are almost entirely lacking in vegetation, as well as various forms of excavations and waste tips.
- Farmland: This category includes arable cropland, horticultural land (for example nurseries, vegetable plots) and freshly-ploughed land.
- Amenity grassland: Amenity grassland is an intensively managed and regularly mown area of grass, so this category could include gardens, lawns, playing fields and urban parks.

[18] JNCC (2016). Handbook for Phase 1 habitat survey: A technique for environmental audit.

- Urban habitats: These include buildings, bare ground, caravan sites, ephemeral/short perennial grassland (i.e. short, patchy plant associations typical of derelict urban sites, quarries and railway ballast), and introduced shrub (non-native vegetation, whether planted or self-sown).
- Hedgerows: These can include species-rich hedgerows, hedges with trees, intact hedgerows and defunct hedgerows.

2.5.2. The area of these broad habitat types for each of the towns (including their 2 km buffer zones) is shown for comparison in Table 2.3, whilst the representative share of each habitat types across the towns (controlling for their varying sizes) is shown in



2.5.3. Figure 2.2.

Table 2.3: Area (ha) of broad habitat types within each town (including 2 km buffer zone)

Broad habitat type	Aberystwyth	Aberaeron	Cardigan	Lampeter	Adpar	Llandysul	Tregaron	TOTAL
Woodland	322	152	275	239	265	229	889	1,571 (10%)
Grassland	1,898	1,014	1,919	1,913	1,271	1,756	1,652	11,422 (74%)
Tall herbs and ferns	35	12	19	7	14	19	24	130 (1%)
Heathland	25	0.3	-	-	-	-	0.4	26 (<1%)
Mire	-	-	1	-	-	-	122	123 (1%)
Swamp	4	-	32	4	0.3	-	4	44 (<1%)
Open water	24	7	95	25	29	27	19	225 (1%)
Coastal habitat	76	78	127	-	-	-	-	281 (2%)
Rocks and waste	9	0.4	21	0.5	0.7	0.2	3	35 (<1%)

Broad habitat type	Aberystwyth	Aberaeron	Cardigan	Lampeter	Adpar	Llandysul	Tregaron	TOTAL
Farmland	10	26	114	15	31	34	7	237 (2%)
Amenity grassland	101	9	43	14	14	12	6	199 (1%)
Urban habitats	387	112	211	144	103	95	53	1,103 (7%)
Hedgerows (km)	88	51	75	137	28	62	9	450 (n/a)
Inaccessible for survey	10	11	11	8	7	7	0.7	21 (<1%)
TOTAL	**2,901**	**1,419**	**2,868**	**2,367**	**1,734**	**2,178**	**1,980**	**15,415**

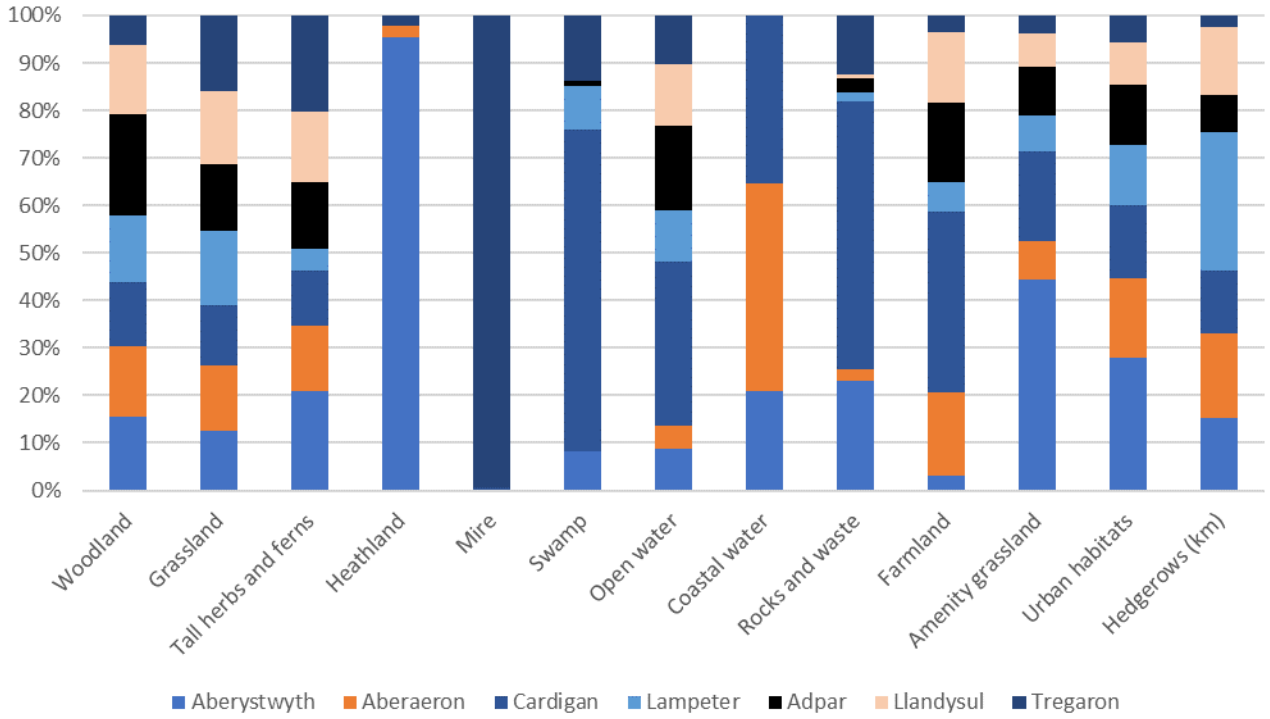


Figure 2.2: Representative share of broad habitats across the seven study areas

2.5.4. Table 2.3 shows that the majority of the land covering the towns and their hinterlands (the 2 km buffer) is comprised of grassland habitats (74% on average), ranging from two-thirds of land cover for Aberystwyth and Cardigan, to over 80% for Lampeter, Llandysul and Tregaron.

2.5.5. Woodland makes up around 10-11% of land cover for most of the study areas – the second largest habitat type in terms of area. Adpar has the most woodland, at 15%, whilst Tregaron has the least, at just 4%. Urban habitats cover the third largest land area (on average 7%) for the seven towns, ranging from less than 5% cover in Llandysul and Tregaron, to 13% in Aberystwyth.

2.5.6. The remaining habitat groups make up a small, but important, proportion of overall land area in the buffer zones, at just 0-2%, though this varies amongst the seven towns. Naturally, only the three coastal towns (Aberystwyth, Aberaeron and Cardigan) contain any coastal habitat, where it covers approximately 4% of the land area. Almost all of the mire habitat can be found in the vicinity of

Tregaron, covering 6% of the study area for this town. Cardigan has a larger proportion of open water compared to the other towns, at 3% of land area, whilst it also has the most farmland, at 4%. The proportion of amenity grassland is highest in Aberystwyth, at 3% of land area.

2.5.7. A detailed breakdown of these broad habitat types into Phase 1 habitat typologies are shown both numerically and graphically for each town in Appendix C.

2.6 CONNECTIVITY FOR WILDLIFE

2.6.1. Just as connectivity for people is important, so too is connectivity for wildlife. This enables species to move across the landscape unhindered, facilitating natural behaviours including dispersion, as well as gradual migration in the changing climate.

2.6.2. Core ecological assets (areas of high nature conservation value where wildlife can thrive) include 'priority habitats', European Protected Sites, sites that meet SINC criteria, SSSIs and LNRs. Priority habitats are habitats of principal importance for the purpose of maintaining and enhancing biodiversity, and are listed in Section 7 of the Environment (Wales) Act 2016. Across the seven study areas, priority habitats represent only 10.3% of the total land area. This small proportion of priority habitats highlights the need for large-scale nature restoration and creation of natural habitats necessary to reverse the continuing biodiversity loss in Wales, the UK and indeed globally. Green infrastructure assets in and around towns were long forgotten but play an important part in landscape-scale nature restoration. This encompasses:

- Around half (56%) of the woodland (i.e. the broadleaved semi-natural woodland);
- A very small proportion (0.4%) of the grassland (i.e. the acid grassland);
- All of the heathland;
- All of the mire;
- All of the swamp;
- All of the open water;
- Most (92%) of the coastal water habitats; and
- A small proportion (5.2%) of the rocks and waste (i.e. the inland cliff and scree).

2.6.3. To enable connectivity for wildlife, these core ecological assets require linking together by means of linear corridors (comprising hedgerows, watercourses and wetlands, grasslands and urban trees) and stepping stones (comprising SINCs, or land of SINC quality, and urban green space). Linear corridors and stepping stones are identified in the Lawton Review[19], which sets out how to establish more resilient ecological networks. There they are defined as "*spaces that improve the functional connectivity between core areas, enabling species to move between them to feed, disperse, migrate*

[19] Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborne, S., Leafe, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.J., Tew, T.E., Varley, J., & Wynne, G.R. (2010) Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra

or reproduce" (p.16). Maps showing the 'core ecological areas', 'linear corridors', and 'stepping stones' for each of the seven towns are provided in Appendix D.[20]

2.6.4. The maps reveal that Aberaeron, Aberystwyth, Adpar, Cardigan, Llandysul and Tregaron are well served by core ecological assets (largely located outside of the urban settlements, in the buffer zones). These core ecological assets are also moderately well connected to each other, either through other core areas, through linear corridors (particularly intact hedgerows) or through stepping stones (especially areas meeting SINC criteria).[21] Though benefitting from fewer core ecological assets than the other towns, Lampeter is well served by linear corridors – particularly hedgerows in the buffer area, and urban trees within the town itself, whilst there is also good stepping stone habitat within the town. Within the settlement boundaries, there is fairly good provision of stepping stone habitat in all towns, though linear corridors are less well represented (except for Aberystwyth and Lampeter).

2.7 SUMMARY AND IMPLICATIONS

2.7.1. Ceredigion's coastal towns in particular benefit from easy access to the extensive coastline which is completely designated as SAC and includes several sections of the heritage coast connected via coastal paths – all of which represent very valuable GI assets for the County, its residents and visitors. Other towns away from the coast benefit from close proximity to the river Teifi which is also designated as SAC and provides valuable opportunities for people to connect with nature. Most terrestrial designated areas are located in the north and east of the County and are therefore geographically somewhat disconnected from the major population centres.

2.7.2. In terms of physical GI assets in Ceredigion, there appears to be good provision in Aberystwyth but to a lesser extent in other towns, especially with respect to in-land informal recreational spaces. Aberystwyth appears to have good access to the coastline and good coverage of active travel routes, cycle routes, accessible green space, play spaces and urban tree cover throughout the town, further benefitting from Local Nature Reserves and bathing areas in close proximity. Opportunities for GI creation may therefore need to focus on Ceredigion's other towns. For example, Aberaeron has good access to the coastline through the coastal paths network, good provision of PROW, and relatively good provision of accessible green space, but the lowest provision of cycle routes and urban tree cover. Cardigan also benefits from coastal paths and active travel routes, but lacks much other GI – especially accessible green space. Lampeter benefits from the river and lake, but with poor provision of linear recreational routes. As the smallest of Ceredigion's main towns, GI provision in Adpar is particularly low, though there is relatively good provision of cycle routes and urban forest

[20] This is based on an (unpublished) approach currently being used by Stockport Borough Council and the Greater Manchester Ecology Unit.

[21] Please note that for the purpose of this study, we assessed ecological connectivity on the basis of the proximity of areas of green space. This encompassed taking into account the key features of ecological networks as identified in 'Making Space for Nature'. These include linear corridors, core areas and stepping stones. Measures of connectivity are never prefect for all species as the ability to dispersal and their requirements vary. As such, connectivity measures are only ever a proxy measure and one aspect of the viability of the ecological network. It should also be noted that habitat suitability for species in terms of nesting areas, food provision etc. has not been assessed as part of this exercise.

cover. Llandysul and Tregaron similarly benefit from the presence of a main river, but overall provision of GI is poor in these towns – especially in terms of accessible green space and urban tree cover.

2.7.3. Looking at connectivity for people, Aberystwyth, Aberaeron and Tregaron benefit the most from PROW and other linear features linking GI assets with each other; and with the surrounding countryside. In the other towns, the network of GI assets is far more fragmented and there is little connection with the surrounding areas. This suggests a need for the creation of accessible GI networks in Cardigan, Adpar, Llandysul and Lampeter in particular, though specific enhancements are also recommended for the other towns (see Chapter 6).

2.7.4. In terms of broad/Phase 1 habitats, buildings make up the majority of the towns, whilst improved grassland makes up the vast majority of the land area within the 2 km buffer zones. The next largest area of habitat for the towns (located primarily within the buffer zones) is broadleaved semi natural woodland – particularly surrounding Llandysul, Adpar, Aberystwyth and Cardigan and Aberaeron – though this is generally fragmented. Several of the towns also benefit from coastal habitats (Aberaeron, Cardigan and Aberystwyth) and all benefit from river habitats to an extent (in particular Cardigan). Tregaron has a substantial area of bog and marsh approximately 1 km to the north. Opportunities for enhancement include increasing the diversity of habitats within the settlement boundaries, linking up woodland habitat, and enhancing some of the surrounding improved grassland to more biodiverse semi-improved or unimproved grassland.

2.7.5. Finally, due to fairly extensive provision of core ecological assets, linear corridors and stepping stones in the vicinity of each of the towns, sites appear to be moderately well connected for wildlife.[22] Connectivity across the urbanised areas is less apparent, however, with the wildlife in all the towns likely to benefit from additional linear corridors (e.g. tree planting, appropriately managed grassland).

[22] Please note that for the purpose of this study, we assessed ecological connectivity on the basis of the proximity of areas of green space. This encompassed taking into account the key features of ecological networks as identified in 'Making Space for Nature'. These include linear corridors, core areas and stepping stones. Measures of connectivity are never prefect for all species as the ability to dispersal and their requirements vary. As such, connectivity measures are only ever a proxy measure and one aspect of the viability of the ecological network. It should also be noted that habitat suitability for species in terms of nesting areas, food provision etc. has not been assessed as part of this exercise.

3 NEED FOR AND PROVISION OF ECOSYSTEM SERVICES

3.1 APPROACH

3.1.1. Ecosystem services are most commonly defined as *"the benefits people obtain from ecosystems"* (p. 5)[23], and are categorised into provisioning services (such as provision of food and timber), regulating services (such as air purification, heat amelioration and stormwater attenuation), cultural services (such as aesthetic beauty and opportunities for recreation), and supporting services (such as nutrient cycling and soil formation).[24]

3.1.2. The GI assets and habitats identified and mapped through the preceding Chapter have been evaluated for their likely functional benefits (i.e. ecosystem services provision). This qualitative assessment is underpinned by relevant academic and grey literature on ecosystem service provision from GI and related habitats.

3.1.3. The identification of specific social, environmental and economic benefits from existing successful GI projects in Ceredigion will also help to provide an evidence base that planners, councillors and developers can understand and use. This Chapter therefore describes a number of successful case studies from across the County (see Section 3.4).

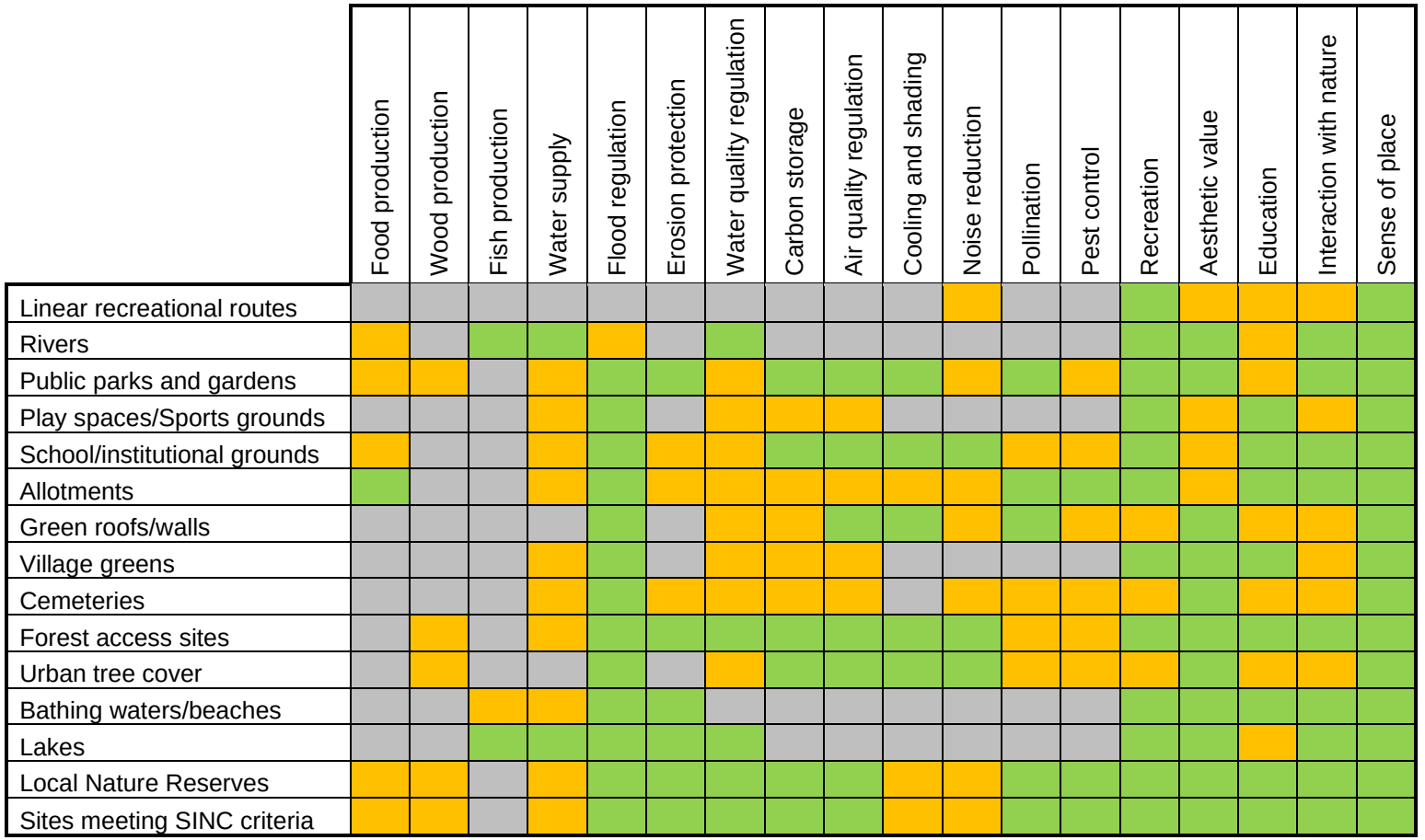
3.1.4. In addition to identifying the likely *provision* of ecosystem services from existing physical assets and habitats in Ceredigion, the *need* for ecosystem services in the seven towns and County as a whole is also set out in this Chapter. Ecosystem service needs are important to consider when planning and managing GI in specific locations. For example, areas that suffer from a high risk of surface water flooding, poor air quality, poor physical and mental health of inhabitants, a lack of recreational opportunities, or a lack of natural greenness, are particularly in need of new or enhanced GI provision. This information on GI functionality is often missing from GI assessments and strategies, but provides an important link to broader issues of importance to decision-makers, thus making GI more salient.

3.2 PHYSICAL ASSETS

3.2.1. The likely ecosystem service provision of the physical assets identified for Ceredigion in Section 2.3 is set out in Figure 3.1 below. This qualitative assessment is based on the consultants' judgement informed by available literature[25], amended to reflect the local context. The level of potential benefits provided by different types of GI assets ranges from negligible provision (shaded grey) to potential provision (shaded orange) to likely provision (shaded green). A commentary by asset type follows.

[23] MEA (2005) Millennium Ecosystem Assessment. Ecosystems and Human Well-being: Synthesis. Washington DC: Island Press.
[24] Note that 'supporting services' are now considered processes and functions rather than services: Haines-Young, R. and Potschin, M. (2018) Common International Classification of Ecosystem Services (CICES) V5.1: Guidance on the Application of the Revised Structure. Nottingham: Fabis Consulting Ltd.
[25] Green Infrastructure Valuation Network (2011). Green Infrastructure Valuation Toolkit User Guide; Defra (2008) Case study to develop tools and methodologies to deliver an ecosystem-based – Thames Gateway Green Grids. NR0109; Davies, H., Doick, K., Handley, P., O'Brien, L., and Wilson, J. (2017). Delivery of ecosystem services by urban forests. Forestry Commission Research Report, FCRP026.

Figure 3.1: Likely ecosystem service provision by Ceredigion's physical GI assets



Linear recreational routes

3.2.2. Linear recreational routes such as active travel routes, cycle routes and footpaths provide important cultural services, benefitting the wellbeing of those who use them. Such routes have been shown to have significant economic benefits, relating to the cost savings accrued from the positive effects on the heath and transport systems. [26] Another important feature of linear recreational routes is the connectivity they provide to other GI assets, as they enable the benefits of other GI assets to be enjoyed.

3.2.3. Coastal paths are of particular importance here as they connect coastal town dwellers and visitors to the coastline which provides significant cultural values such as aesthetic values and sense of place, but also offer opportunities to connect with nature and for outdoor education. The heritage coast sections are likely to provide particularly high sense of place benefits.

Rivers

3.2.4. Rivers have the potential to provide the whole range of ecosystem services (provisioning, regulating, cultural, and supporting). Examples include freshwater provision, pollution control, flood regulation and biodiversity. The connectivity they provide for wildlife to other habitats and GI assets is particularly valuable, allowing the flow of resources, organisms and vital natural processes.

3.2.5. Depending on the type and accessibility of the river, cultural services could also be provided, with the higher accessibility resulting in a larger flow of benefits. The cultural services which could be offered by rivers with public access include aesthetic value, spiritual value, ecotourism, sense of place and recreation opportunities (i.e. fishing, walking, swimming). Further, rivers provide an opportunity for education - to learn from the freshwater environment.

Public parks and gardens

3.2.6. Depending on how they are managed public parks and gardens can provide a wide range of ecosystem services, especially within urban areas where they are in particularly high demand. The key services provided include cooling and shading, improving air quality, flood regulation, and noise reduction, but also on a wider scale carbon storage and water quality regulation. [27] Where managed for wildlife, public parks and gardens can also deliver great value through the biodiversity and pollination benefits they provide.

3.2.7. Public parks and gardens are also important GI assets for the provision of cultural services. [28] Especially in the urban context where green space is less abundant, they provide recreational opportunities and make significant contributions to an area's aesthetics and sense of place. Where

[26] Department for Transport (2014). Claiming the Health Dividend: A summary and discussion of the value for money esitmates from strudies of investment in walking and cycling. Available at: https://www.gov.uk/government/publications/economic-case-for-active-travel-the-health-benefits

[27] Wentworth, J. (2017). Urban Green Infrastructure and Ecosystem Services. POSTbrief. Parliamentary Office of Science and Technology.

[28] Rall, E., Bieling, C., Zytynska, S. and Haase, D., (2017). Exploring city-wide patterns of cultural ecosystem service perceptions and use. *Ecological Indicators*, *77*, pp.80-95.

parks and gardens are managed in the interest of biodiversity, they can also provide an opportunity for people to interact with nature.

Play spaces/Sports grounds

3.2.8. Play spaces and sports grounds have obvious benefits for recreation by providing space for fun and games. Such places also have educational value as they can increase children's engagement with the natural environment, something which is known to have a range of developmental and physical and mental health benefits.[29] Play spaces and sports grounds provide regulating services to a lesser degree, however, and is largely dependent on the extent of mown grass, which can support some degree of water attenuation, as opposed to artificial surfacing which generally does not.

School/institutional grounds

3.2.9. The grounds of schools and other institutions such as universities or libraries can provide regulating services, such as flood regulation and, if wooded, carbon storage, cooling and shading and noise reduction. Such grounds can also serve to improve the visual amenity of the space, having positive effects on mental wellbeing and potentially academic performance.[30]

3.2.10. Being linked with places of learning, these assets also have potential educational value.[31] For example, 'outdoor classrooms'[32] can create spaces for students to learn about and interact with nature.

Allotments

3.2.11. The primary ecosystem services provided by allotments are food production and the health and wellbeing benefits enjoyed by those who use them. However, allotments provide a number of additional services that arise from benefits they confer to invertebrates, namely pollination and the control of pest species. Allotments also contribute to the biodiversity of the urban environment[33].

Green roofs/walls

3.2.12. Green roofs/walls are ways of introducing green space into the built environment and can confer a number of ecosystem services, predominantly regulating services. In an urban context, green roofs and walls are well placed to provide cooling and shading to the buildings they cover, reduce surface runoff and remove air pollution[34]. In addition to the regulating services they provide, green roofs and walls can soften the built environment, increasing its aesthetic value and helping to establish a

[29] Wooley, H., Pattacini, L. & Somerset-Ward, A. (2009). Children and the natural environment: experiences, influences and interventions - Summary. Natural England Commissioned Reports, Number 026.
[30] Matsuoka, R. H. (2010). Student performance and high school landscapes: Examining the links. *Landscape and urban planning*, *97*(4), 273-282.
[31] Jansson, M. (2014). Green space in compact cities: the benefits and values of urban ecosystem services in planning. *Nordic Journal of Architectural Research*, *26*(2).
[32] Potentially created in collaboration with local wildlife groups e.g. The Wildlife Trust of South and West Wales: https://www.welshwildlife.org/things-to-do/for-teachers-and-home-educators/outdoor-classrooms/
[33] Speak, A. F., Mizgajski, A., & Borysiak, J. (2015). Allotment gardens and parks: provision of ecosystem services with an emphasis on biodiversity. Urban Forestry & Urban Greening, 14(4), 772-781.
[34] Hop, M. E. C. M., & Hiemstra, J. A. (2012, July). Contribution of green roofs and green walls to ecosystem services of urban green. In II International Symposium on Woody Ornamentals of the Temperate Zone 990 (pp. 475-480).

sense of place. There are green roofs at Bwlch Nant yr Arian near Aberystwyth, Aberporth Business Park and at the University of Aberystwyth Gogerddan Campus. The latter also has green walls.

Village greens

3.2.13. As a focal point for many settlements, village greens provide a host of cultural services. Important among these is the recreational opportunities they offer (e.g. sports and leisure). By providing a reference to the past, as well as a place for social interaction, village greens can significantly contribute to a settlement's character and sense of place.

Cemeteries

3.2.14. Cemeteries provide a quiet space for reflection and connecting with loved-ones and the past. As such, they are important for the provision of cultural ecosystem services. Well vegetated cemeteries also provide regulating services, such as flood regulation, and can help support biodiversity. Managing cemeteries to include increasingly popular natural burial sites can serve to improve the provision of such services by enhancing the quantity and quality of habitat present.[35]

Forest access sites

3.2.15. Forest sites designated for recreation purposes provide a range of cultural services including community cohesion, physical and mental health and wellbeing benefits, and visual amenity. They also provide regulating services common to other forested sites, such as improving air quality, local climate regulation, carbon sequestration, and flood regulation.

Urban tree cover

3.2.16. Individual trees in urban areas provide benefits such as carbon sequestration,[36] increased urban biodiversity, and water quality and flood regulation. Notably, research shows that street trees "can regulate local surface and air temperatures by reflecting solar radiation and shading surfaces such as streets and sidewalks that would otherwise absorb heat" (p. 181), [37] thus counteracting the urban heat island effect.[38] Importantly, urban trees (especially those along streets) also contribute to human health and wellbeing through providing nature connections, reducing stress and depression, and encouraging people to walk or cycle.[39]

Bathing waters/beaches

3.2.17. Beaches and designated bathing waters provide significant cultural benefits through recreational opportunities, enhancing the visual landscape and contributing to sense of place. They also offer

[35] Clayden, A., Green, T., Hockey, J., & Powell, M. (2018). Cutting the lawn− Natural burial and its contribution to the delivery of ecosystem services in urban cemeteries. Urban forestry & urban greening, 33, 99-106.
[36] Birdsey, R. A. (1992). Carbon storage and accumulation in United States forest ecosystems. Washington, DC: U.S. Department of Agriculture, Forest Service.
[37] Gómez-Baggethun, Erik & Gren, Åsa & Barton, David & Langemeyer, Johannes & McPhearson, Timon & O'Farrell, Patrick & Andersson, Erik & Hamstead, Zoe & Kremer, Peleg. (2013). Urban Ecosystem Services. 10.1007/978-94-007-7088-1_11.
[38] Doick, K. and Hutchings, T. (2013) Air temperature regulation by urban trees and green infrastructure. Forestry Commission.
[39] Davies, H., Doick, K., Handley, P., O'Brien, L., and Wilson, J. (2017) *Delivery of ecosystem services by urban forests. Forestry Commission Research Report FCRP026.* Edinburgh: Forestry Commission, i–iv + 1–28pp.

connection areas to the culturally important coastline. In biophysical terms, beaches also provide significant regulating services. Perhaps most important among these is the protection they offer from coastal flooding.[40]

Lakes

3.2.18. Lakes confer a great number of benefits, across the whole range of ecosystem services[41]. In terms of provisioning services, lakes contribute to the provision of freshwater as well as the production of fish. By acting as a store of surge water, lakes can help to regulate flooding and reduce erosion. In addition, lakes are an attractive landscape feature that provide a range of cultural services including recreational opportunities (e.g. fishing, walking, boating), aesthetic value and sense of place.

Local Nature Reserves and Managed Wildlife Sites

3.2.19. Given the likely presence of natural or semi-natural habitat, LNRs and Wildlife Sites will provide a host of regulating services. As the habitats present in these sites vary, so too do the ecosystem services they provide. For example, a woodland will deliver significant carbon sequestration and storage benefits whilst a wildflower meadow will enhance pollination by providing an important habitat for pollinators. However, all are likely to improve water quality and regulate flooding through stormwater attenuation. If located near urban areas, they may also have the potential to provide cooling and shading, as well as noise reduction benefits.

3.2.20. Given their accessibility, LNRs and Wildlife Sites provide a range of cultural services with considerate opportunities for recreation and also provide a chance for interaction with nature. As well as natural beauty and ecological value, designation can be based on a site's heritage value. As such, LNRs can contribute to both an area's aesthetic value and sense of place.

Sites meeting SINC criteria

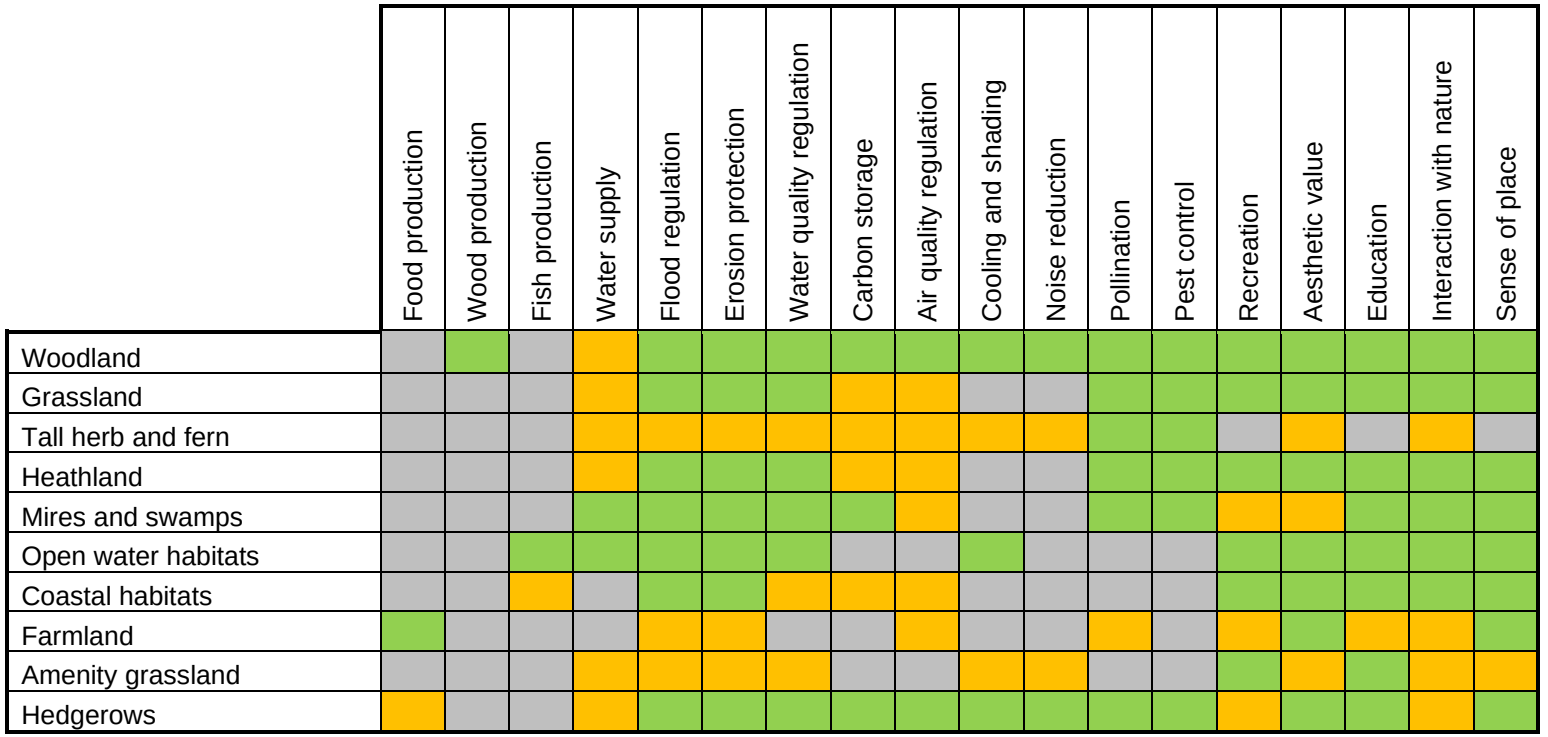
3.2.21. Like LNRs, and Wildlife Sites, SINCs (including sites which meet such criteria) provide a variety of ecosystem services which, in part, depend on the habitats present. Depending on their accessibility to people, they may also provide a host of cultural services.

3.3 HABITATS

This section describes the likely ecosystem service provision of the broad habitats identified in Chapter 2, with a summary provided in Figure 3.2. The level of potential benefits provided by the different types of GI assets ranges from negligible provision (shaded grey) to potential provision (shaded orange) to likely provision (shaded green).

[40] UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment: Synthesis of the Key Findings. UNEP-WCMC, Cambridge.
[41] Reynaud, A., & Lanzanova, D. (2017). A global meta-analysis of the value of ecosystem services provided by lakes. Ecological Economics, 137, 184-194.

Figure 3.2: Likely ecosystem service provision by Ceredigion's broad habitats



Woodland

3.3.1. Woodland provides a range of ecosystem service benefits including flood alleviation[42], improving water quality through filtration of pollutants[43] and enhancing sediment retention, [44] climate change mitigation, [45] land regeneration (through decontamination of land), [46] oxygen production and improving air quality. [47] It also provides a range of cultural services including visual amenity, [48] heritage preservation, recreation, [49] health and wellbeing and noise reduction.

Grassland

3.3.2. Semi-natural grasslands provide a wide range of goods and services, including plant species diversity, carbon storage and sequestration, biomass production for grazing animals, flood reduction, habitat for migratory and breeding birds, valuable habitat for pollinators, water infiltration, purification and storage, erosion prevention and recreation. [50]

Tall herb and fern

3.3.3. Tall herb and fern is a common habitat which can be found in both urban areas (such as along railway verges) and in rural areas. It can be a valuable habitat for foraging birds and insects, as well as providing shelter for wildlife. As such, it provides services including pollination and improved biodiversity.[51]

Heathland

3.3.4. Heathland provides a range of ecosystem services, though it should be noted that Ceredigion contains only small areas of heathland. Services include peat and game provision, climate regulation (carbon storage in heathland plants and peat mitigates climate change), pollination and flood risk reduction (vegetation found on heathland will slow water flow and therefore reduce flood

[42] Nisbet, T.R., Orr, H. and Broadmeadow, S. (2004). A guide to using woodland for sediment control. Forest Research, Farnham.
[43] Stovin, V.R., Jorgensen, A. and Clayden, A. (2008). Street trees and stormwater management. The Arboricultural Journal 30, 1–4.
[44] Jeffries R., Darby, S.E. and Sear, D. A. (2003). The influence of vegetation and organic debris on flood-plain sediment dynamics: case study of a low-order stream in the New Forest, England. Geomorphology 51, 61–80.
[45] Potchter, O., Cohen, P. and Britan, A. (2006). Climatic behavior of various urban parks during hot and humid summer in the Mediterranean city of Tel Aviv, Israel. International Journal of Climatology 26 (12), 1695–1711.
[46] Hutchings, T. (2002). The opportunities for woodland on contaminated land. Information Note 44. Forestry Commission, Edinburgh.
[47] Willis, K. G., Garrod, G. Scarpa, R., Powe, N., Lovett, A., Bateman, I. J., Hanley, N. and Macmillan, D. C. (2003). The Social and Environmental Benefits of Forests in Great Britain. Report to Forestry Commission, Edinburgh. Centre for Environmental Appraisal and Management, University of Newcastle upon Tyne.
[48] Garrod, G.D. (2002). Social and environmental benefits of forestry phase 2: landscape benefits. Report to the Forestry Commission. Centre for Research in Environmental Appraisal and Management, University of Newcastle upon Tyne.
[49] Giles-Corti, Billie, Melissa H. Broomhall, Matthew Knuiman, Catherine Collins, Kate Douglas, Kevin Ng, Andrea Lange, and Robert J. Donovan (2005). Increasing walking: how important is distance to, attractiveness, and size of public open space. American Journal of Preventative Medicine 28 (2S2), 169-176.
[50] Villoslad Pecina, M. & Ward, R (2019) Country-scale mapping of ecosystem services provided by semi-natural grasslands Science of The Total Environment Volume 661, 15 April 2019, Pages 212-225
[51] Woźniak, G., Sierka, E., & Wheeler, A. (2018). *Urban and industrial habitats: how important they are for ecosystem services* (pp. 169-193). IntechOpen.

risk). Finally, heathland also provides recreational experiences, and potentially also educational opportunities related to the cultural, historical and archaeological importance of heathland.[52]

Mires and swamps

3.3.5. Mires provide a variety of ecosystem services including climate regulation through sequestering carbon, nutrient cycling, flood regulation, freshwater provision, peat provision, and flood risk mitigation. Bogs are an ecologically important habitat for biodiversity.[53] Like other habitats which are scarce in a UK context, mires offer cultural services such as recreation, education, interaction with nature and heritage preservation.

Open water habitats

3.3.6. Open water habitats such as ponds and rivers have the potential to provide services such as fresh water provision, water pollution control, flood regulation and biodiversity. Rivers and streams are particularly important for connecting habitats and GI assets. They act as 'roads' which carry water, organisms and important gases and nutrients to many areas,[54] which serve biodiversity and wildlife.

3.3.7. Depending on the type and accessibility of a waterbody, cultural services could also be provided (i.e. a small ditch will provide a differing degree of cultural services to a large publicly accessible river or lake). The cultural services which could be offered by open water habitats include aesthetic value, spiritual value, ecotourism, sense of place and recreation opportunities (i.e. fishing, walking, swimming). In most cases public access to the river, such as through riverside paths, would be required to benefit from these services.

Coastal habitats

3.3.8. Coastal habitats are important areas for people and wildlife. Where accessible, they connect people with the Ceredigion Coast and therefore offer a variety of significant cultural benefits including aesthetics, sense of place, recreation, interaction with wildlife and education. Recreational activities also contribute to physical health, especially when coastal habitats offer opportunities for swimming. Furthermore, coastal habitats provide food (i.e. shellfish from intertidal habitats like mussels), storm and wave protection and ecotourism.

3.3.9. Salt marshes in particular provide recreational space, food, and habitat for protected species such as birds.[55] Crucially, salt marshes protect our coastline against floods and erosion by absorbing waves and locking the soils into plant root-nets.

Farmland

3.3.10. Farmland provides an important ecosystem service; it grows the food that the population eats. Other ecosystem services potentially provided by farmland are pollination, pest control and biodiversity, though this depends on the diversity and management of the farmland, e.g. mixed upland grazing is

[52] https://www.escrick.com/DB/blog/why-heathland-is-important-to-the-environment-the-
[53] Defra (No date), Ecosystem services of peat – Phase 1 Project code: SP0572
[54] NatureWorks (2020) Rivers and Streams. Available at:https://nhpbs.org/natureworks/nwep7j.htm
[55] UK Centre for Ecology and Hydrology (2016) Valuing our coastal ecosystem services. Available at: https://www.ceh.ac.uk/our-science/projects/coastal-ecosystem-services.

known to be beneficial for biodiversity[56] (Ceredigion has little arable land). Farmland can be an important habitat for bird species, simply by leaving over-wintered stubble in fields will provide an important food source to help support birds.[57] However, most farmland such as improved grassland for silage provides little value in terms of biodiversity ecosystem services provision apart from food provision.

3.3.11. Arable field margins which may be found on the borders of farmland are important if managed for wildlife, not only for resident biodiversity but also for wider connectivity of habitats. Depending on the level of public access, farmland also has the potential to provide a wealth of cultural services through provision of PROW networks, camping and caravan facilities, music festivals, and other events such as drag racing, ploughing events and sheepdog trials.

Amenity grassland

3.3.12. Amenity grassland habitats such as parks and gardens provide a range of ecosystem service and biodiversity[58] benefits despite being typically found in urban locations. Even small patches can serve as 'stepping stones' and benefit movement of some wildlife. Well-managed roundabouts and road verges support a wide variety of plants and insects, especially if they are not too intensively mown and are planted with suitable trees.[59] Crucially, urban mammal occurrences in gardens have been found to increase with the availability of nearby GI assets[60] which highlights the importance of strategically locating GI as a way of combatting the ecological crisis.

3.3.13. Amenity grassland can also provide regulating services such as water attenuation and climate regulation.[61] However, amenity grassland spaces are better at providing cultural services like recreational opportunities (particularly any spaces identified as play spaces in the maps in Appendix B), a sense of place, and community cohesion.[62]

Hedgerows

3.3.14. Intact hedgerows in urban settings offer many of the same benefits as urban trees, particularly with regards to air quality, noise reduction and shading benefits. In fact, roadside hedgerows have been found to be more beneficial than street trees for addressing transport-related air pollution (particularly in street canyons where trees are unsuitable), as they are able to both absorb and deflect air pollutants.[63] In rural environments, additional benefits of hedgerows include improved

[56] Fraser, M.D., Moorby, J.M., Vale, J.E., & Evans, D.M. (2014). Mixed grazing systems benefit both upland biodiversity and livestock production. PLoS One, 9(2), [e89054]. https://doi.org/10.1371/journal.pone.0089054
[57] RSPB (2019), Managing habitats for wildlife: Over-wintered stubbles. Available at: https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/farming/advice/managing-habitats/over-wintered-stubbles/
[58] Rudd, H., Vala, J. and Schaefer, V. (2002). Importance of backyard habitat in a comprehensive biodiversity conservation strategy: a connectivity analysis of urban green spaces. Restoration Ecology 10 (2), 368–375.
[59] Helden, A.J. and Leather, S.R. (2004). Biodiversity on urban roundabouts - Hemiptera, management and the species-area relationship. Basic and Applied Ecology 5, 367-377.
[60] Baker, P.J. and Harris, S. (2007). Urban mammals: what does the future hold? An analysis of the factors affecting patterns of use of residential gardens in Great Britain. Mammal Review 37 (4), 297–315.
[61] Yu, C. and Hien, W.N. (2006). Thermal benefits of city parks. Energy and Buildings 38, 105–120.
[62] Cohen, D. A., Inagami, S. and Finch, B. (2008). The built environment and collective efficacy. Health & Place 14, 198–208.
[63] Christof G., Nabaraj J. and Bodo R. (2016) Influence of roadside hedgerows on air quality in urban street canyons,

storage of carbon within the soil beneath and surrounding the hedge, and improved soil and water quality.[64] High cover of hedgerows in the landscape has also been found to enhance pest control and pollination.[65]

3.4 CASE STUDY SITES

3.4.1. The following GI assets have anecdotal examples of a range of ecosystem services and related benefits:

- The Cae Ffynon Win Allotments are situated along the picturesque River Aeron which has a riverside walking path. The Allotments Association was formed approximately eight years ago by the six founding members and their families. Because of the hard work and enterprise of these individuals, much interest was generated by outside parties in obtaining a plot for themselves. Additional land was acquired from CCC under licence, for the growing of fruit, vegetables and flowers and there are now seventeen plots available for cultivation. The allotments provide a great opportunity for meeting people and 'hands on' interaction with nature. The most obvious benefit of the allotments is growing food for personal consumption but the recreational and health benefits are likely to vastly outweigh the food production value. The allotments also provide an interesting, multi-faceted, green and vital space for users and walkers on the path alongside it.
- The Ceredigion Coast Path is a focal point for residents and visitors to enjoy Ceredigion's coast as it links the towns and villages dotted along the Cardigan Bay coast. The EU funded Ceredigion Coast Path project completed in 2008 linked existing disconnected PROW to a continuous path stretching 96 km from the Teifi to the Dyfi. The coastal path has routes of differing accessibility standards. For example, part of the path between Aberporth and Tresaith has a very well used surfaced path built to wheelchair gradient standards with path counters recording over 90,000 users in 2019. The Ceredigion Coast Path offers an excellent opportunity for recreation and forms part of the 1,400 km long Welsh Coast Path. It was estimated that the health benefits of walking the Welsh Coast Path amount to approximately £18.3 million annually; £3.5 million of which can be directly attributed to the existence of the path.[66] The Ceredigion Coast Path offers a great recreational opportunity and also provides easy and sustainable access to water-based sports, fishing and boating. The path adds considerable value to the Welsh economy through visitor

Atmospheric Environment 139: 75-86; Abhijith, K.V. and Kumar, P. (2019) Field investigations for evaluating green infrastructure effects on air quality in open-road conditions. Atmospheric Environment 201: 132-147.

[64] Van Vooren L., Reubens B., Broekx S., De Frenne P., Nelissen V., Pardon P. and Verheyen K. (2017). Ecosystem service delivery of agri-environment measures: A synthesis for hedgerows and grass strips on arable land, Agriculture, Ecosystems & Environment 244: 32-51.

[65] Dainese, M., Montecchiari, S., Sitzia, T., Sigura, M. and Marini, L. (2017). High cover of hedgerows in the landscape supports multiple ecosystem services in Mediterranean cereal fields. Journal of Applied Ecology 54: 380-388.

[66] NRW (2014). Economic Assessment of the Health Benefits of Walking the Wales Coast Path. Natural Resources Wales, Cardiff.

spending.[67] The path represents a valuable resource connecting both people and wildlife across the Ceredigion coast.

- Coed y Mwldan in the town centre of Cardigan is a small woodland site managed by the Woodland Trust which is popular with many residents. The site includes a new footbridge over the Mwldan which provides easy access to the river and town centre. The site was created in 1999 and is mainly managed to promote native woods and wildlife for everyone to enjoy. Hundreds of local volunteers were involved in planting the woodland which shows the importance of the site for local residents. Coed y Mwldan provides a great opportunity for a range of community and educational events including Welsh language medium broadcasting as well as sculpture and woodcraft demonstrations. Given its functionality as a green corridor linking residents to the town centre it also contributes greatly to recreation and attached health and wellbeing benefits. Art installations enhance the aesthetic and amenity value of the site. A long term management plan ensures that these benefits can be enjoyed far into the future.
- Parc Natur Penglais in Aberystwyth is a council-owned LNR, established in 1991. The Parc Natur Penglais Support Group advises and assists the Council with management of the beech woods/old quarry site, through a mutually-agreed Management Plan that is revised every 5 years. The Parc received a Prince of Wales Award in 1993, and was awarded Ceredigion's first Green Flag Community Award in 2011. The Support Group has been successful in securing additional funding for Penglais and this has recently led to substantial improvements to public access at the site, with a range of guided walks also provided for members of the public. The reserve is an excellent example of what can be achieved when local people work together in partnership with the Council. The site offers a range of cultural services including community and education events as well as woodcraft demonstrations. Easy access to the site also provides great recreational opportunities for relaxation and exercise. The variety of trees and shrubs within the park provides a constantly changing aspect and stunning views out over the town and sea which add to the amenity value. Tree cover also provides an air quality buffer, reducing air pollution from the adjacent road. The park furthermore helps Aberystwyth to adapt to climate change as it provides cooling and shading functions.
- The 34 km long Ystwyth Trail links Aberystwyth, Llanfarian, Ystrad Meurig and Tregaron with substantial sections following the old Great Western railway line. The trail was partially completed in 2008 with some sections still missing. The trail, which passes by sections of the River Ystwyth, offers access to circular walks around Trawsgoed, Cors Caron NNR and other linear and circular routes. Several level sections are suitable for persons with disabilities or for using mobility scooters. The trail has boosted local tourism and also provided new business opportunities such as serviced bicycle hire. The trail provides easy access to historic buildings and infrastructure which highlights its cultural importance. The mixture of woodland corridors and open areas provide a great setting to enjoy the aesthetics nature provides. The tree cover along stretches of

[67] NRW (2014). Economic Assessment of the Health Benefits of Walking the Wales Coast Path. Natural Resources Wales, Cardiff.

the trail also provides shading and stores considerable amounts of carbon, thus mitigating climate change.

3.5 NEEDS MAPPING

3.5.1. Ecosystem services needs maps have been produced for Ceredigion's seven towns (see Appendix E). These reflect the following environmental and social issues:

- Air quality – this shows the average level (µg/m^3) of background air pollution for each 1km grid square in the study areas, based on Defra's 2016 annual emissions of particulate matter (PM_{10});
- Flood reduction – this shows the proportion of each 1 km grid square in the study areas that is at risk of surface water flooding from a 1 in 100 year event (using NRW data);
- Recreation - this shows the proportion of each 1 km grid square in the study areas that is covered by physical GI assets (those accessible for recreation, but excluding linear assets such as PROW/cycle routes as the latter could not be included in the area-based analysis);
- Health and wellbeing – this shows the level of health deprivation (on a scale of 1 = most deprived to 10 = least deprived) for each 1km grid square in the study areas, based on the Health & Wellbeing domain of the Welsh Indices of Multiple Deprivation (IMD); and
- Level of tree and woodland cover – this shows the proportion of each 1km grid square in the study areas that is covered by tall, woody vegetation (i.e. trees, hedges and woodlands) – one of a number of possible measures of aesthetic beauty and carbon sequestration capacity.

Air quality

3.5.2. Particulate matter (PM_{10}) comprises tiny particles of soot, dust, soil, salt or other chemicals that travel deep into people's lungs, causing irritation and damage. In Wales PM_{10} is mostly caused by road vehicles and industry.[68] The dataset reveals that, the average annual emissions of PM_{10} are 9.0 µg/m^3 and 10.1 µg/m^3 for Ceredigion and Wales, respectively. In Ceredigion, background levels of PM_{10} are highest in the south-west of the County, and lowest in the north-east. Consequently, Cardigan and Adpar have the poorest air quality of Ceredigion's main towns (with background PM_{10} levels of over 10.5 µg/m^3), followed by Llandysul and Lampeter (above 9.7 µg/m^3), then Aberaeron (around 9.4 µg/m^3) and Tregaron (where background levels are below 9.1 µg/m^3). In the map for Aberystwyth, the air quality is noticeably poorer within the settlement boundary than it is in the buffer zone – particularly in the more densely developed western and southern parts of the town (where it reaches 10.5 µg/m^3). It should be noted that as Defra's PM_{10} data is averaged for each 1km grid square, it is not possible to see from these maps specific locations where World Health Organisation

[68] Abernathy, R (2018). National Assembly for Wales Research Briefing – Air Quality. 18-009.

(WHO) recommended limits (20µg/m^3) or European Union legal limits (40µg/m^3) for PM_{10} may actually be exceeded.[69]

3.5.3. At the scale of a County or town, vegetated GI plays an important part in removing air pollutants by the process of deposition to leaf surfaces. Trees (especially evergreens) are particularly effective in this regard. However, at the localised scale, the main value of GI for urban air quality is not its ability to remove pollutants, but its ability to disperse pollutants away from people.[70] Hedges are therefore more effective than trees for protecting pedestrians from road traffic emissions, though trees can provide protection for sensitive sites located adjacent to roads, such as schools and hospitals. It should be noted that extensive or continuous tree planting is inappropriate in narrow streets with tall buildings either side (known as canyons) since their canopies can trap pollutants within the air above the road.[71]

Flood reduction

3.5.4. Impervious surfaces such as buildings, roads and car parks reduce the ability of rainfall to infiltrate into the soil and increase the speed at which it moves over the surface. This increases surface water runoff and peak discharge rates and increases the likelihood of flood events. Flooding may occur on impervious surfaces (particularly during extreme weather events when the drainage system is often unable to cope), or downstream/downhill of impervious surfaces and water courses. The dataset reveals that the proportion of Ceredigion at risk of surface water flooding is 2.7%, whilst the proportion of Wales is also 2.7%. Whilst only a small proportion of the land within and surrounding Ceredigion's seven main towns is at risk of a 1 in 100 year surface water flood event, this is higher than the County and national averages in some cases. Less than 4% of Aberaeron, Cardigan, Aberystwyth, Llandysul and Adpar is at risk of surface water flooding, though as much as 8% of land is at risk in neighbouring Newcastle Emlyn. The need for flood reduction measures is slightly higher in the east of Tregaron and for almost all of Lampeter, where the maps reveal up to 8% of land is at risk of surface water flooding.

3.5.5. Within urban settlements, large areas of GI (such as public parks and playing fields) can provide essential flood storage benefits in times of extreme weather, whilst reducing flood risk at other times simply through their pervious nature. Urban trees also regulate stormwater by intercepting and storing rainfall on their leaves, which either subsequently evaporates, or reaches the groundwater more slowly as a result of gradual release as throughfall.[72] Trees also improve infiltration into the soil by channelling water onto pervious surfaces around the stem, and through the soil along root

[69] WHO (2005) Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide – Summary of risk assessment; Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. *OJ L 152,* p. 1.
[70] Abhijith, K.V., Kumar, P., Gallagher, J., McNabola, A., Baldauf, R., Pilla, F., Broderick, B., Di Sabatino, S. and Pulvirenti, B., 2017. Air pollution abatement performances of green infrastructure in open road and built-up street canyon environments–A review. *Atmospheric Environment*, *162*, pp.71-86.
[71] Donovan, R., 2003. The Development of an Urban Tree Air Quality Score (UTAQS) using the West Midlands, UK Conurbation as a Case Study Area (Doctoral thesis). University of Lancaster.
[72] Davies, H., Doick, K., Handley, P., O'Brien, L., and Wilson, J. (2017) Delivery of ecosystem services by urban forests. Forestry Commission Research Report FCRP026. Edinburgh: Forestry Commission.

channels. In urban areas subject to regular flooding, purposefully designed GI is recommended, i.e. Sustainable Drainage Systems (SuDS) such as swales and rain gardens.

Recreation

3.5.6. The recreation needs maps are based on the availability of GI assets (per 1km grid square) for the purpose of passive or active recreation, and therefore include public parks and gardens, playing fields, play spaces, other sports grounds, village greens, cemeteries, forest access sites, open access land, bathing water and LNRs. The maps reveal Aberystwyth to have particularly good provision of accessible GI, covering more than 15% of land in much of the town, and between 10-15% in the town centre. However, the eastern part of Aberystwyth has far lower levels of accessible GI provision, at below 2.5% coverage. Llandysul and Lampeter also have fairly good provision for recreation, covering 10-15% of the settlement area, though in Cardigan and Tregaron there is only 5-10% coverage. In Aberaeron there is even less accessible GI available for recreation (2.5-5%), whilst Adpar has the least, at less than 2.5% coverage (though neighbouring Newcastle Emlyn fares better with up to 10% coverage in the east).

3.5.7. Despite being a rural County, GI assets are essential for providing for the daily/weekly recreational needs of Ceredigion's urban residents. Those areas with poor coverage would therefore benefit from additional provision of accessible GI suitable for a range of user groups and uses. Note that linear recreation routes such as cycle routes and PROW could not be included in this area-based assessment, but are just as important as parks and sports grounds for addressing recreational needs.

Health and wellbeing

3.5.8. The Health and Wellbeing domain of the Welsh IMD is based on indicators such as GP-recorded chronic and mental health conditions (e.g. heart disease and depression), limiting long-term illnesses, premature deaths, and childhood obesity. Calculated at the level of 'small areas', Ceredigion is one of three Welsh counties to have no areas in the most deprived 10% in terms of health and wellbeing.[73] Like the other needs maps produced for Ceredigion's seven main towns, the health and wellbeing needs maps are displayed based on 1 km grid squares. Whilst none of the areas within or surrounding these towns fall within the 20% most deprived in Wales, Cardigan and the southern part of Aberystwyth are within the 30% most deprived areas in Wales. Health and wellbeing is a little better in central and western parts of Aberystwyth, which fall within the 50% *least* deprived parts of Wales – as does Llandysul. Health and wellbeing are better still in Tregaron, Lampeter and Adpar, which are amongst Wales' 40% least deprived areas. The eastern and far north-western parts of Aberystwyth have the best health and wellbeing of Ceredigion's main towns, falling within the 30% least deprived in Wales.

3.5.9. Through encouraging physical activity, accessible GI can benefit people's physical health, particularly in terms of reducing obesity and cardiovascular diseases. [74] Accessible GI, green streets

[73] StatsWales (2019). Welsh Index of Multiple Deprivation (WIMD) 2019 – Results Report.
[74] Lachowycz, K., & Jones, A. P. (2011). Greenspace and obesity: a systematic review of the evidence. *Obesity reviews*, *12*(5), e183-e189.

(e.g. with street trees) or even just a view of a pleasant green area can also benefit people's mental health and wellbeing through providing an escape from sources of anxiety/depression, or stresses associated with everyday life, as well as a greater connection with nature.[75]

Level of tree and woodland cover (aesthetic beauty and carbon sequestration capacity)

3.5.10. These maps are based on the percentage of tree and shrub cover (including urban trees, woodlands and hedgerows) for each 1km grid square across the study areas. The UK has one of the lowest proportions of tree cover of any country in Europe (13% compared to the EU average of 44%).[76] Across Wales, the average tree canopy cover in urban areas is 16%, though this varies widely from 6% in Rhyl to 30% in Treharris.[77] Ceredigion's towns all fall below the national average, except Aberystwyth at 18%. However, the needs maps show that even in Aberystwyth, tree cover in much of the town is below 10% (e.g. the northern, western and central parts), with more average levels in the southwest, and over 20% in the eastern part of the town. The needs maps show less variation in tree cover across Ceredigion's other towns, with most of Aberaeron, Cardigan, Adpar and Tregaron having below 10% canopy cover, and Llandysul and Lampeter having 10-20%. However, Lampeter does benefit from having an area of woodland immediately to the north of the town.

3.5.11. Woody vegetation can give the impression of a pleasant leafy environment, and there are studies in both urban and rural landscapes that suggest people consider trees to be aesthetically pleasing.[78] It should be noted, however, that aesthetic preferences vary widely across the population, and some people will prefer views of historic buildings, water features or flower beds to trees. There is also correlation between tree canopy cover and the level of deprivation of a town,[79] whilst trees and woodlands provide a whole range of other ecosystem services than just aesthetics, as revealed in Figure 3.1 and Figure 3.2.

3.6 SUMMARY AND IMPLICATIONS

3.6.1. Based on the identification of GI assets within each of the 2km buffers, and the ecosystem services likely to be provided by these GI assets, it would appear that Aberystwyth has by far the greatest ecosystem service provision of Ceredigion's towns. This is due to the good provision of linear recreation routes which also connect to the valuable coastline, accessible green spaces, urban tree cover and LNRs in and surrounding the town, which are all important for the provision of regulating and cultural ecosystem services to urban residents.

[75] Davies, H., Doick, K., Handley, P., O'Brien, L., and Wilson, J. (2017) *Delivery of ecosystem services by urban forests. Forestry Commission Research Report FCRP026.* Edinburgh: Forestry Commission, i–iv + 1–28pp.
[76] Davies, H. (2017). Woodland Creation in European Countries (Research Briefing). Cardiff: National Assembly for Wales Research Service.
[77] Natural Resources Wales (2016). Tree Cover in Wales' Towns and Cities. Aberystwyth: Natural Resources Wales.
[78] Davies, H., Doick, K., Handley, P., O'Brien, L., and Wilson, J. (2017) Delivery of ecosystem services by urban forests. Forestry Commission Research Report FCRP026. Edinburgh: Forestry Commission.
[79] Dobbs, C., Kendal, D. and Nitschke, C.R. (2014) Multiple ecosystem services and disservices of the urban forest establishing their connections with landscape structure and socio-demographics. Ecological Indicators, 43, 44-55.

3.6.2. In contrast, there is a lack of significant ecosystem service provision in the other towns due to the relative lack of GI assets in these areas compared to Aberystwyth. Aberaeron's coastal paths, PROW, and accessible green space provide recreational benefits, but other cultural and regulating services are far less well addressed although proximity and connectivity to the coastline is likely to mitigate for a lack of cultural services within the town itself. Cardigan also benefits from coastal paths and active travel routes, but overall provides limited ecosystem services to its inhabitants. Lampeter, Adpar, Llandysul and Tregaron benefit from regulating and aesthetic ecosystem services associated with the main rivers which run through or adjacent to them, but little else. Tree planting and creation of LNRs and additional accessible green spaces in these towns is therefore recommended to improve the extent and variety of ecosystem services in these towns. Enabling public access to wetlands and mosaic habitats on brownfield sites may also be considered.

3.6.3. Based on the identification of broad habitats within each of the 2km buffers around towns, and the ecosystem services likely to be provided by these habitats, it would appear that the towns which benefit the most from higher levels of habitat-based ecosystem service provision are Aberystwyth, Aberaeron and Cardigan. This could be in part because these are coastal towns which benefit from the cultural and regulating services provided by Ceredigion's coast and it's habitats. Tregaron has notable ecosystem service provision to the north, where the Ramsar site and mire habitat is located. In terms of public access, this area is poorly connected to the main town. It would be beneficial to link these areas up with new paths or cycleways. These would need to be developed carefully to ensure that increased access doesn't result in disturbance of the protected species on the site or degradation of the habitat.

3.6.4. In terms of ecosystem service needs, Cardigan, Adpar, and the more densely developed western and southern parts of Aberystwyth would benefit from the creation of GI (e.g. planting of trees and hedges and appropriately managed grasslands) to reduce levels of particulate air pollutants.

3.6.5. Sustainable flood management measures, such as installation of sustainable drainage systems, tree planting, or creation of large-scale green space (where feasible) aligned with natural flood management approaches such as managed retreats, may be beneficial in Lampeter and in the east of Tregaron where the risk of surface water flooding is highest. In terms of meeting recreational needs of Ceredigion's urban residents, Adpar, Aberaeron and the eastern part of Aberystwyth would benefit from increased provision of accessible GI. Cardigan and the southern part of Aberystwyth would benefit from more accessible and/or attractive GI in order to address issues of poor physical and mental health. Finally, the level of tree cover could be improved in Aberaeron, Cardigan, Adpar, Tregaron, and northern, western and central parts of Aberystwyth to improve aesthetics and potentially inward investment by businesses (as research suggests that businesses prefer to locate in green areas).[80]

3.6.6. At the scale of the County, increased provision of woodland and expansion/restoration of peat bogs would help to remove carbon dioxide from the atmosphere (as well as reducing flooding downstream and providing cooling benefits), thus contributing towards CCC's commitment to become a net zero

[80] Davies, H.J., Doick, K.J., Hudson, M.D., Schaafsma, M., Schreckenberg, K. and Valatin, G. (2018) Business attitudes towards funding ecosystem services provided by urban forests. *Ecosystem Services,* 32, 159-169.

carbon local authority by 2030, and supporting the Council in addressing the recently declared global climate emergency. Peat bog restoration and woodland planting are accepted measures to offset carbon emissions within the local authority.

4 STAKEHOLDER CONSULTATION

4.1 APPROACH

4.1.1. In addition to the seven wellbeing goals, the Wellbeing of Future Generations (Wales) Act 2015 sets out a number of principles of involvement for public bodies to adhere to. These include involving people at the earliest opportunity (e.g. in relation to planning and other matters), and using a variety of accessible, inclusive engagement methods and formats when doing so.

Planning

4.1.2. As part of the project, two public stakeholder events were organised to obtain a wide range of views and to enhance the data collected. Originally it was envisaged that these events would be held in different locations, grouping towns into two rough geographical areas. But upon reflection of the task and the stakeholders involved, it was agreed between the Council and consultants that the two events would be held in Aberaeron, and instead targeted at:

- Those attending in a professional capacity who would be able to attend a full half-day session during the working day, such as third sector organisations; and
- General members of the public who were given the opportunity to attend an evening session on a drop-in basis (arriving at a time to suit them and staying for as long as they wished).

4.1.3. Each event provided opportunities for participants input to cover all of the towns, as well as the County as a whole.

4.1.4. A stakeholder list of existing contacts was provided by CCC as a basis for the invitations. This long list was refined by location, ensuring that those invited were largely Ceredigion-based. There were some exceptions, such as some third sector organisations who were based outside the County but who operated within its borders. For members of the public on the list (i.e. those not representing an organisation), only those that were located in or around the seven towns were invited.

4.1.5. Invitations were sent to shortlisted stakeholders and members of the public, inviting them to the most appropriate session, but allowing them to attend whichever session was the most convenient for them to allow them to engage even if they could not attend the most appropriate session.

Delivery

4.1.6. The sessions, facilitated by BRO Partnership, were held in the Council Chamber in Aberaeron on the evening of 26th February 2020, with 15 attendees, and the afternoon of 27th February 2020, with 26 attendees. Upon arrival, participants of both sessions were introduced to the GI Assessment project and the benefits of GI. Participants were then asked to undertake two tasks:

- To review the ‘County Designations’ map and the ‘Town GI Assets’ maps showing the GI already identified to consider if any key elements had been missed, or if they had additional information about these assets (e.g. on land ownership or accessibility) which could be useful to the Council.
- To identify on a separate set of the same maps any potential opportunities for creating new GI, or enhancing the quality or accessibility of existing GI, for future consideration by the Council.

4.1.7. The information for both tasks was recorded by selecting a numbered card, writing the relevant information on the card and placing a similarly numbered sticky dot on the map indicating the location the comment refers to.

4.1.8. This process was repeated for all seven towns, as well as the County as a whole, allowing collection of information on location-specific GI. In some cases, more generic (non-spatial) views, which applied across the whole area, were provided. The process worked well, allowing people to comment in a legible way and ensuring all views were captured.

4.1.9. Though the numbered sticky dots were visible on the maps, the data cards were collected as they were completed. Whilst some participants wanted to see what others had written, by collecting the cards immediately it was possible to ascertain everyone's individual view (including repeated, opposing and unique comments), uninfluenced by those of others. If the cards had been left for others to read, another participant who held the same view may not have repeated it. Equally, one person's view might well have influenced the thinking of others, narrowing the range of documented ideas.

4.1.10. Finally, at the end of the formal afternoon session, each participant was asked to consider their top 5 priorities for GI in Ceredigion (which could be location-specific or general issues) and to write these down on cards.

Bilingual Online Survey

4.1.11. In addition to the stakeholder events, it was agreed between CCC, BRO Partnership and WSP to undertake a bilingual online survey (hosted on Survey Monkey) to allow a wider cross-section of the community to participate in the study. To facilitate this, the survey was widely promoted through CCC's social media channels. Those originally invited to the two stakeholder events were also encouraged to complete the survey, via a weblink emailed to them.

4.1.12. Though it was not possible to identify location-specific information through this medium, the survey instead sought to find out how Ceredigion's residents use green spaces in their local towns and elsewhere in the County, what they consider to be important and why, and any improvements they would like to see made. The full survey is provided in Appendix F.

4.1.13. The online survey was particularly successful, with a total of 246 responses received.

4.2 STAKEHOLDER WORKSHOPS

4.2.1. The information collected at the two stakeholder sessions was collated and digitised to allow the location-specific information to be included in mapped form. The specific suggestions that were made are listed and mapped in Appendix G. These suggestions can be categorised as follows:

- Creation of additional GI (specifically green spaces, walking routes, cycling routes, and tree planting);
- Protection of existing GI;
- Improvements to existing GI (specifically regarding maintenance and access, and biodiversity enhancements);
- Promoting the awareness and use of GI;
- Installing flood reduction measures; and
- Other environmental initiatives (e.g. improving public transport or installing electric vehicle charging points).

4.2.2. There is significant variation in the suggestions made across the different towns. For example, tree planting was the most commonly specified suggestion in Aberystwyth, Lampeter and Llandysul; whilst new cycle routes were preferred in Aberaeron and Cardigan; new walking routes in Tregaron; and new green spaces in Adpar. A summary of these suggestions is provided by general location, in Figure 4.1 below.

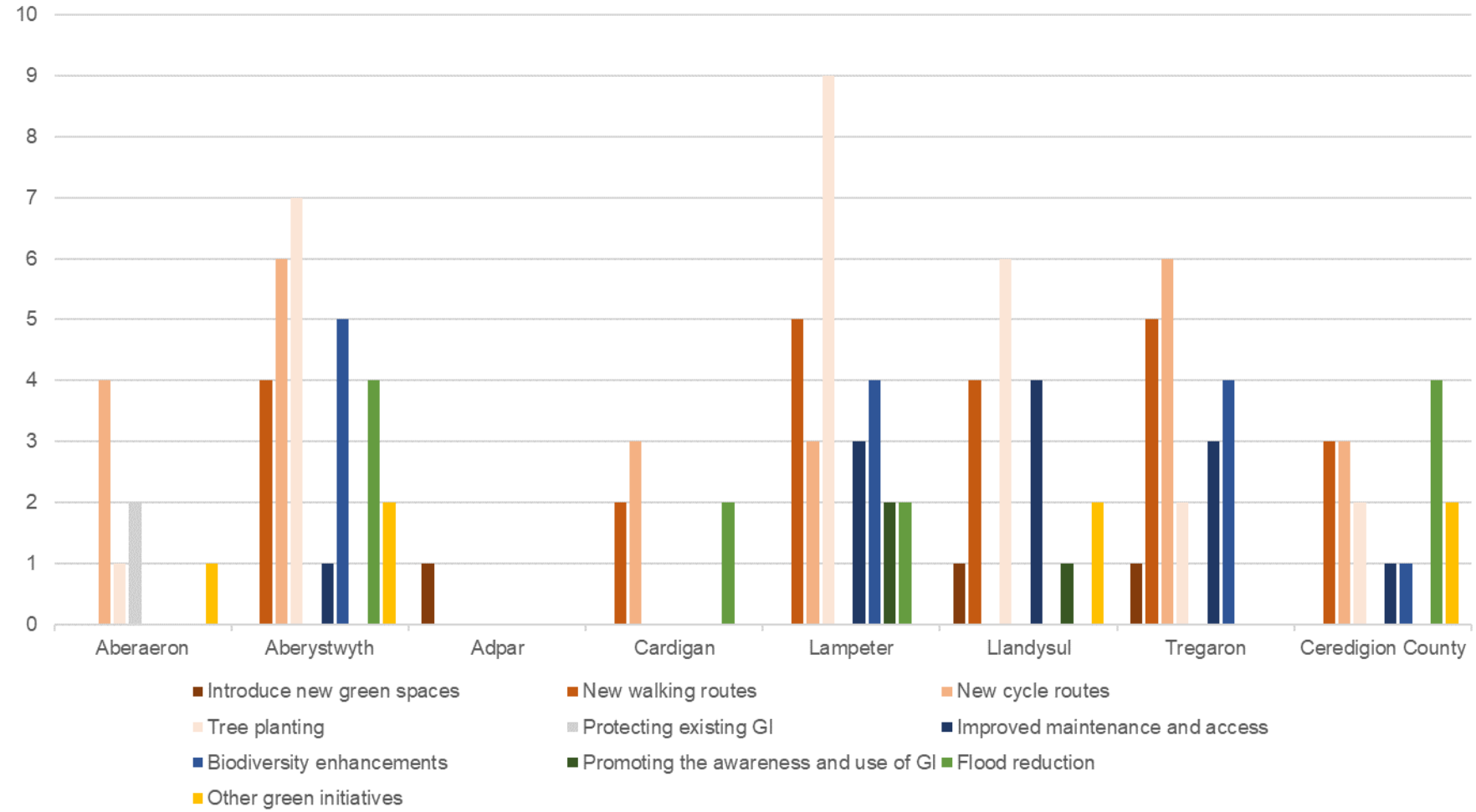


Figure 4.1: Summary of stakeholder comments on spatially-specific opportunities

4.2.3. As mentioned in the preceding section, some of the comments linked to the maps were more general comments on County-level GI opportunities, as opposed to being specific to any particular location. These responses centred around three core themes as shown in Figure 4.2. These are: enhancing GI, increasing accessibility, and communication and collaboration (numbers in parentheses relate to the number of respondents making each comment).

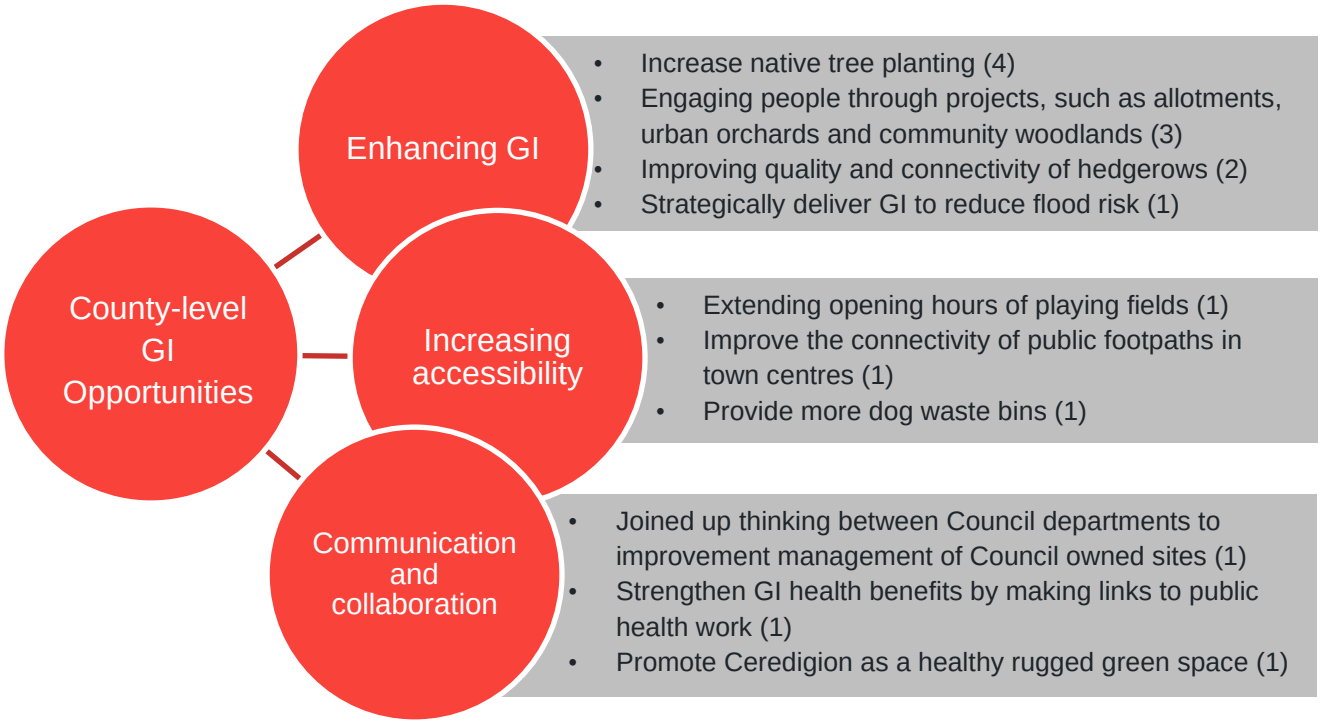


Figure 4.2: Stakeholders' general comments on County-level GI opportunities

4.2.4. At the end of the formal afternoon event, attendees were asked to provide their top 5 priorities for GI within Ceredigion. The responses from the stakeholders focused around three central themes: physical improvements (47 comments), changing awareness and behaviour (23 comments), and maintenance of existing GI (9 comments). Responses were further categorised into the various themes presented in Figure 4.3, Figure 4.4, and Figure 4.5. Here, the numbers in black represent the overall (aggregated) responses in the more general categorisation, whereas the numbers in white represent the number of actual responses within that category.

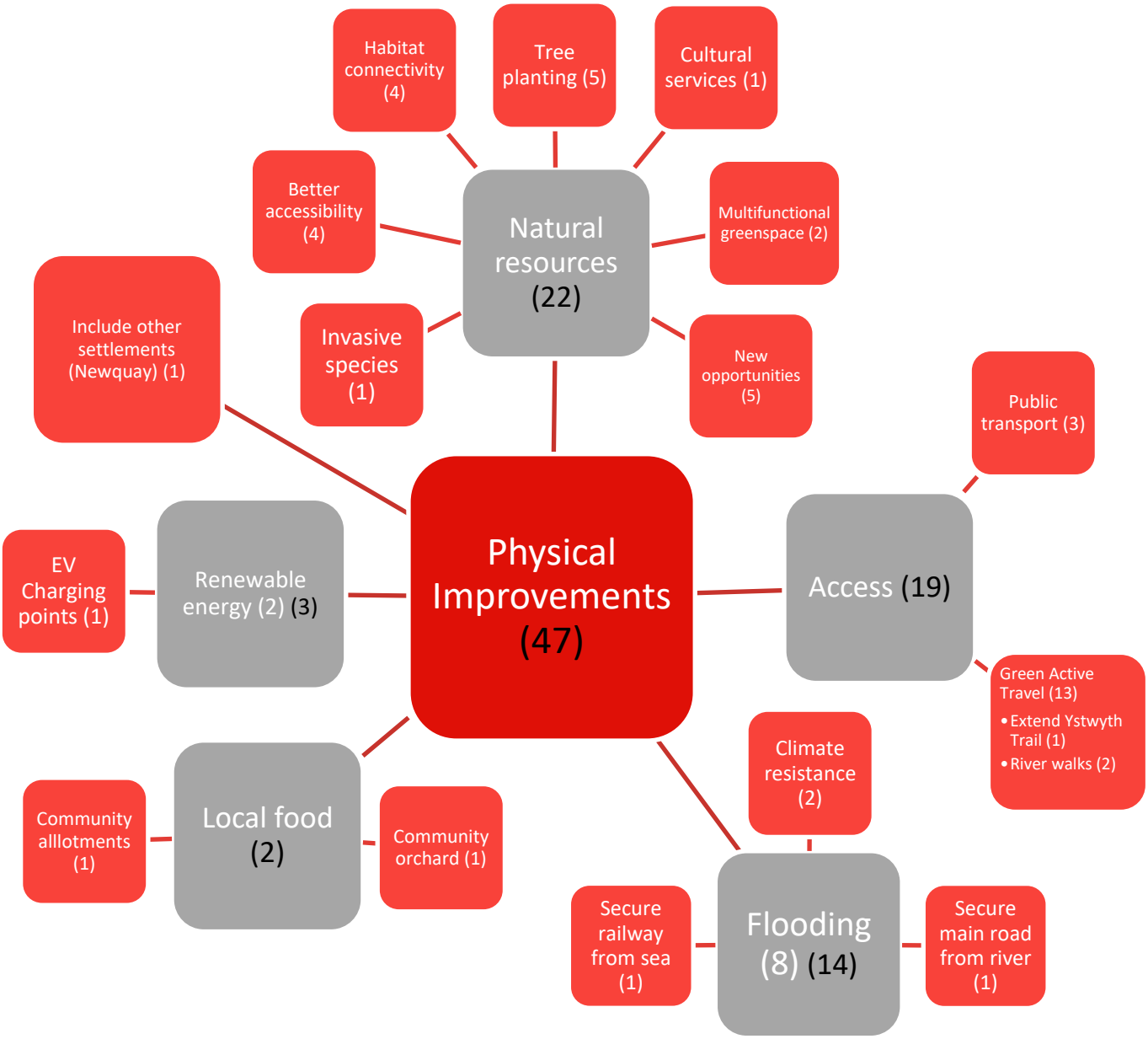


Figure 4.3: Stakeholders' top priorities related to physical improvements to Ceredigion's GI

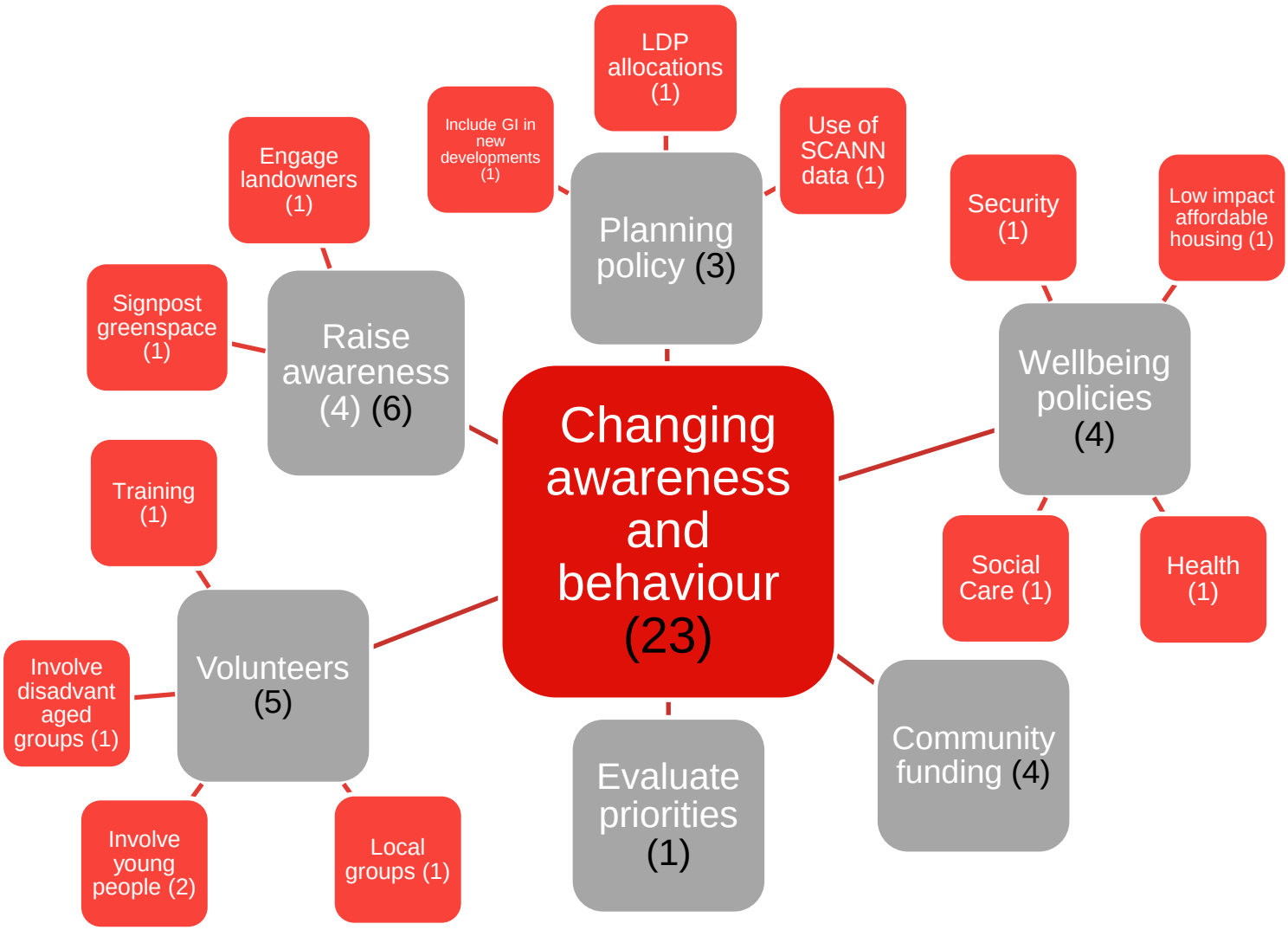


Figure 4.4: Stakeholders' top priorities related to changing awareness and behaviour

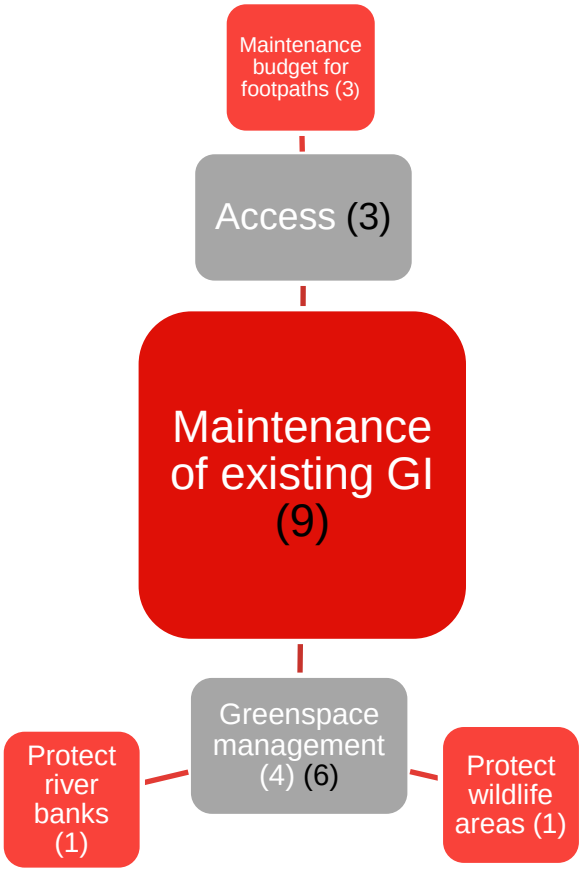


Figure 4.5: Stakeholders' top priorities related to maintenance of Ceredigion's existing GI

4.3 ONLINE SURVEY

4.3.1. The responses to the questions in the survey are set out in turn below.

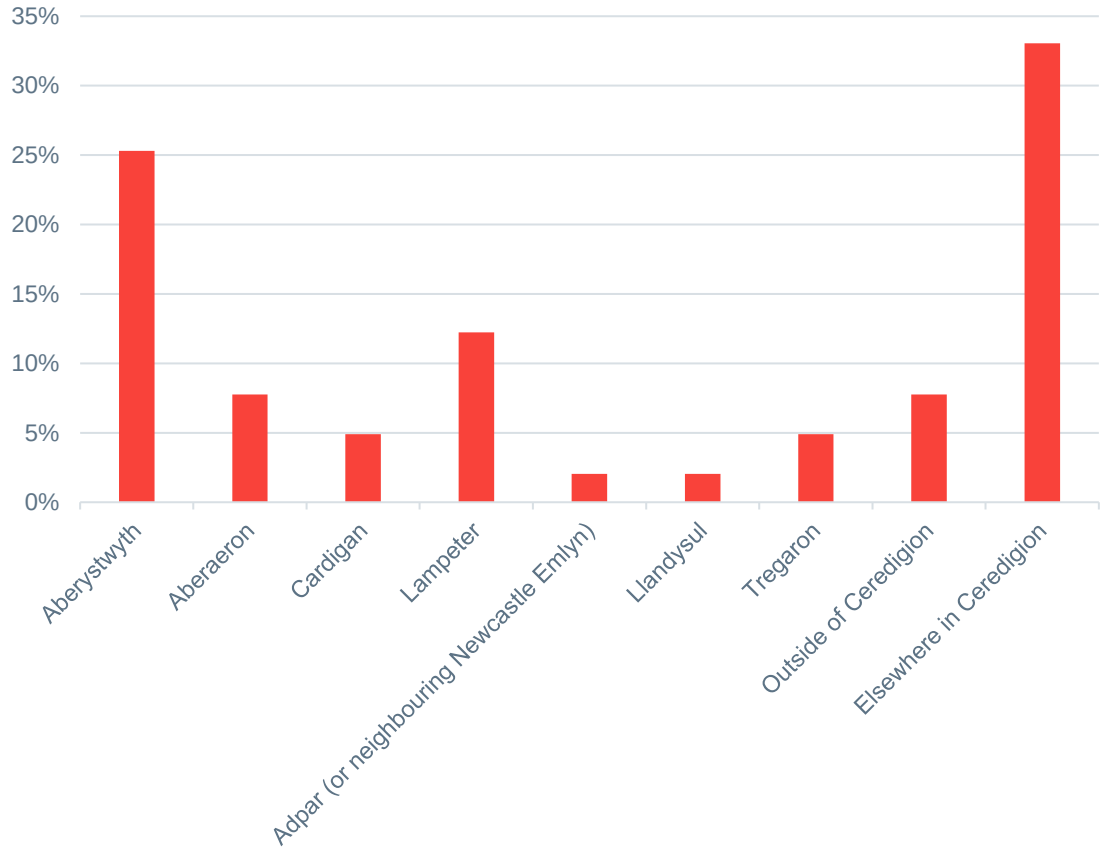


Figure 4.6: Place of residence of those responding to the survey

4.3.2. Figure 4.6 reveals that only 59% of respondents reside in one of the seven study towns. Of the 33% residing elsewhere in Ceredigion, 60 different locations were mentioned. The most commonly specified locations included New Quay (4 respondents), Borth, Goginan, Penrhyncoch, Rhydlewis and Tal-y-bont (3 respondents each). The remaining 7% of respondents reside outside of the County.

4.3.3. In terms of the use of the study towns for recreational and green space needs, only Aberystwyth satisfied the needs of its residents (see Figure 4.7). In each of the other towns, some respondents chose to use green spaces in other towns for their recreational needs – typically either Aberystwyth (6 respondents), Aberaeron or Cardigan (3 respondents each). A minority of respondents in Lampeter and Adpar did not use urban green spaces at all, with two stating that they use the countryside instead.

4.3.4. For those respondents residing elsewhere in Ceredigion (or outside of the County), the towns most commonly used for recreational and green space needs were Aberystwyth (34% of these respondents), Aberaeron (13%), Lampeter (9%) and Cardigan (8%). Of this group, 19% used other towns/villages, whilst 10% did not use urban green spaces (e.g. because they use the countryside instead).

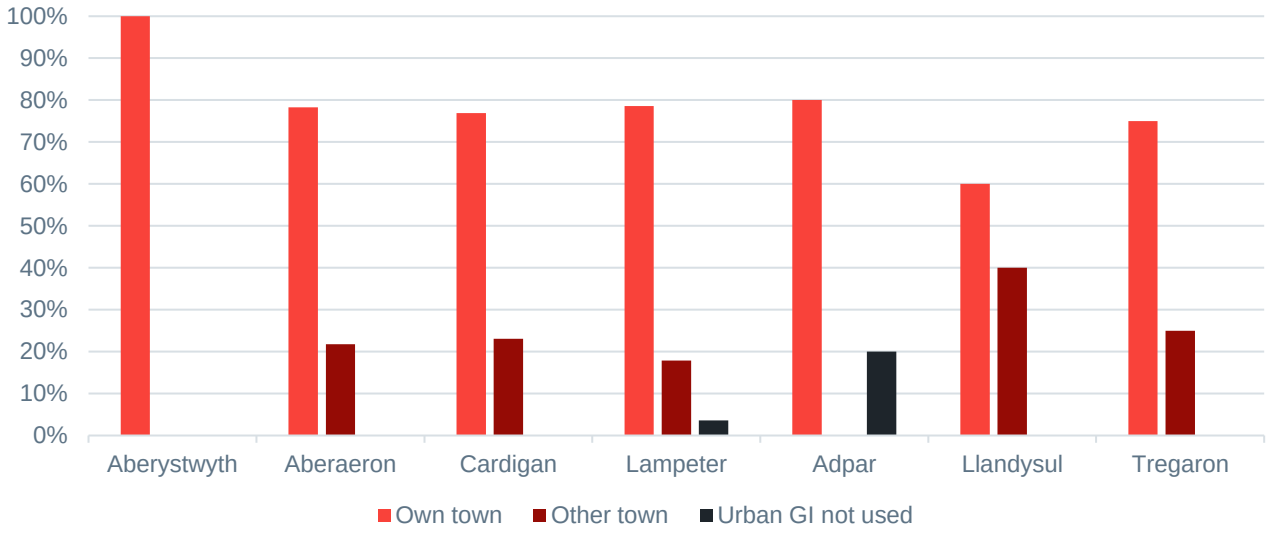


Figure 4.7: Towns used for recreational and green space needs by those living in each of the seven study towns

4.3.5. The reasons for using urban green spaces are set out in Figure 4.8 below. The majority of respondents use green space for either active or passive recreation, including keeping fit and relaxing. However, more than half of respondents also use green space as an opportunity for connecting with nature through spotting wildlife.

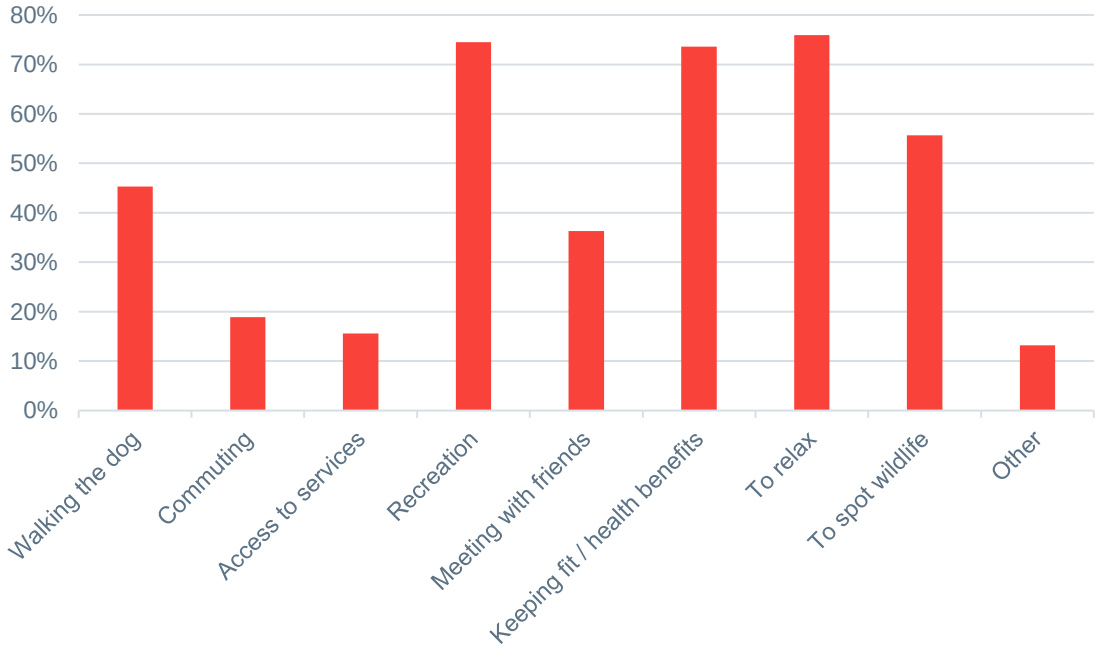


Figure 4.8: Uses of green space

4.3.6. The types of GI used by respondents, and their frequency of use, are set out in Figure 4.9. Whilst allotments are only used by around 10% of respondents, all other listed types of GI are used by at least 50% of respondents (at least occasionally). The types of GI used most often by the most people (multiple times per week, by approximately half of respondents) are local footpaths and open countryside. Other frequently used types of GI (multiple times per week, by approximately a quarter of respondents) include informal areas of local green space, woodlands, beaches and rivers. Popular types of GI used less frequently (monthly or less, by around half of respondents) include the Wales Coast Path, public parks and gardens, lakes, and nature reserves.

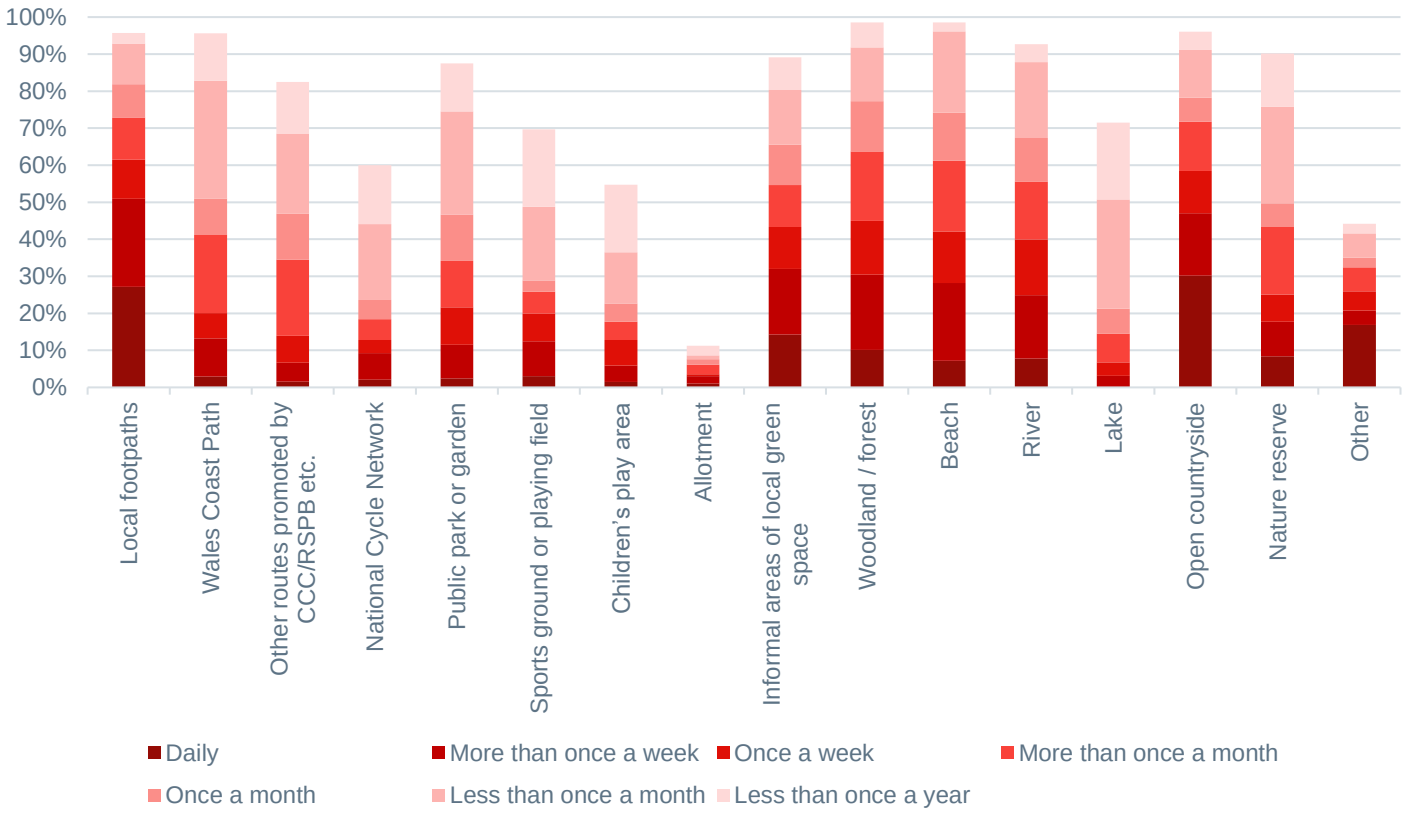


Figure 4.9: Types of GI used within the study areas, and their frequency of use

4.3.7. Given the variety of GI types used, and the frequency of use, it is not surprising that respondents consider green spaces to be important for a whole range of reasons. As shown in Figure 4.10, health and wellbeing benefits, aesthetic benefits, wildlife benefits, and general quality of life benefits were considered very important to 80% or more of respondents. A less important benefit (though still very important to 60% of respondents) was the ability of green space to bring people together.

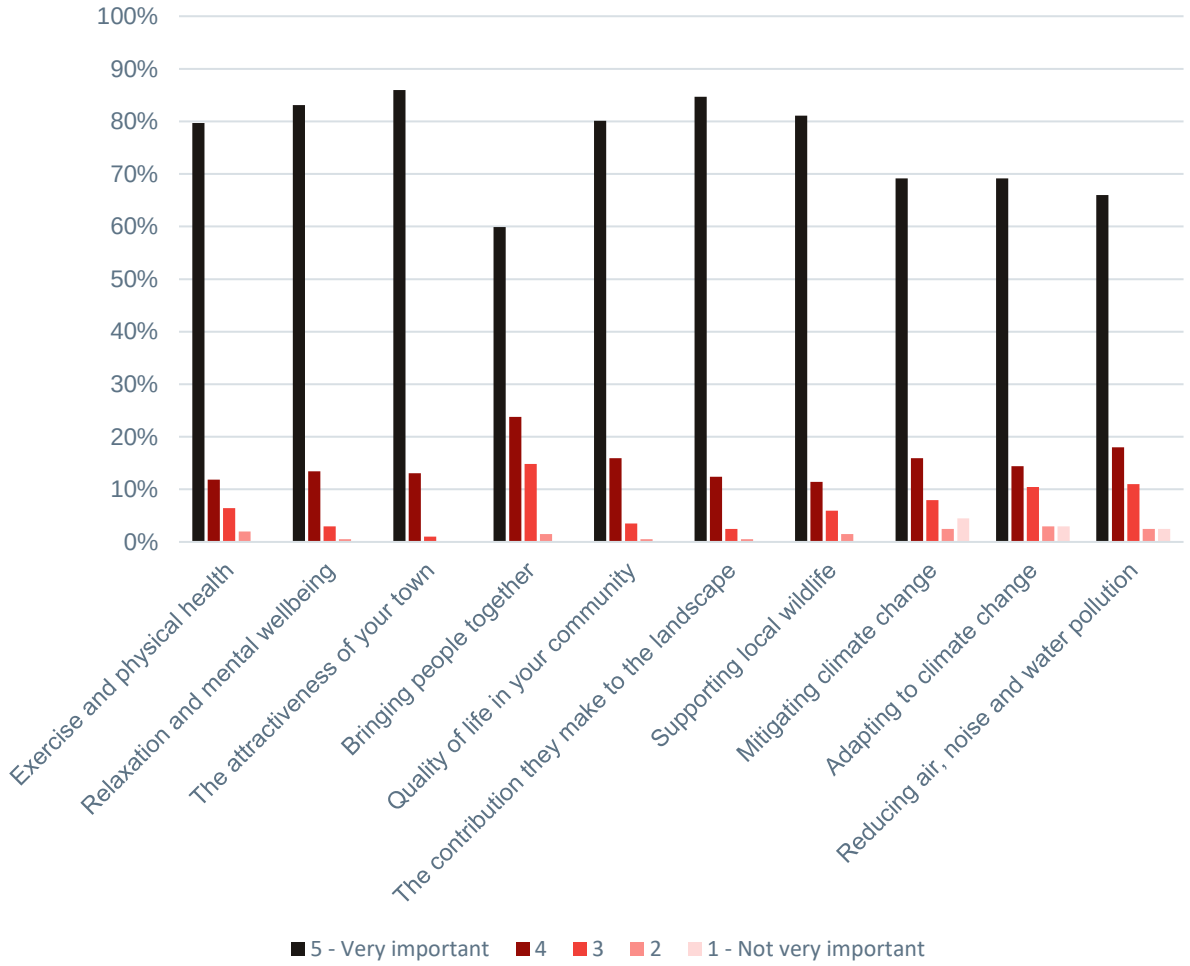


Figure 4.10: The importance of green space for various ecosystem service benefits

4.3.8. Almost 90% of respondents said they would like to make more use of green space. The barriers currently preventing them from doing so are set out in Figure 4.11. Whilst for most people it is a lack of time that stops them from making more use of green spaces, a minority of respondents (around 15%) felt that the quantity, quality or accessibility of green spaces is insufficient to meet their needs.

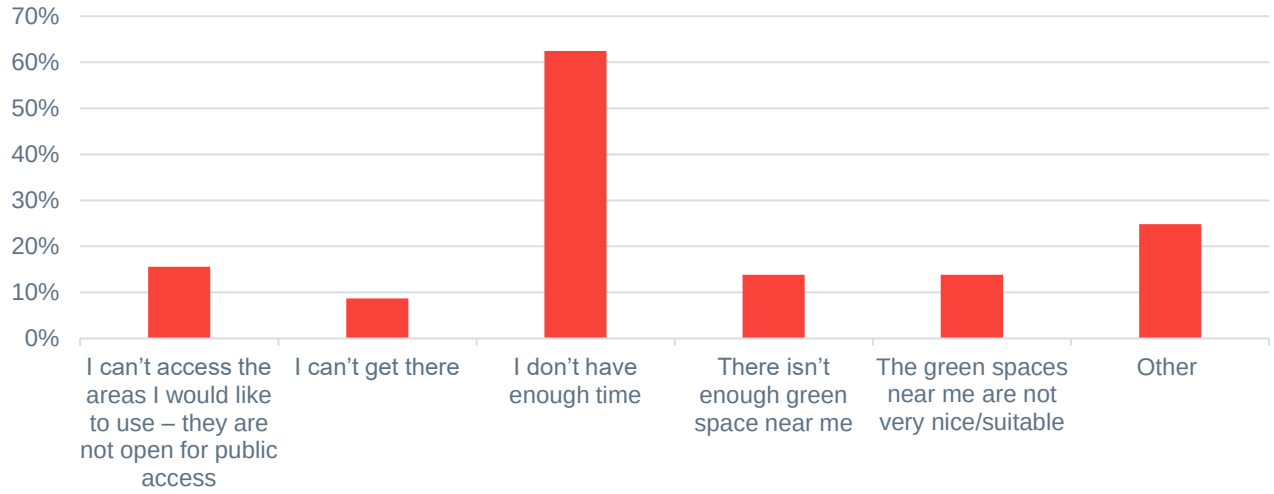


Figure 4.11: Barriers preventing stakeholders from making more use of green space

4.3.9. Around 75% of respondents said they would like to see improvements made to their local green spaces. These are predominantly centred around physical improvements – either to the GI assets themselves (e.g. habitat creation or enhancement), or to access routes and accessibility. There were also a significant number of suggestions made regarding improving the maintenance of existing GI. These comments are summarised in Figure 4.12 below. Here, the numbers in black represent the overall responses in the more general category, whereas the numbers in white represent the number of actual responses within the specific category.

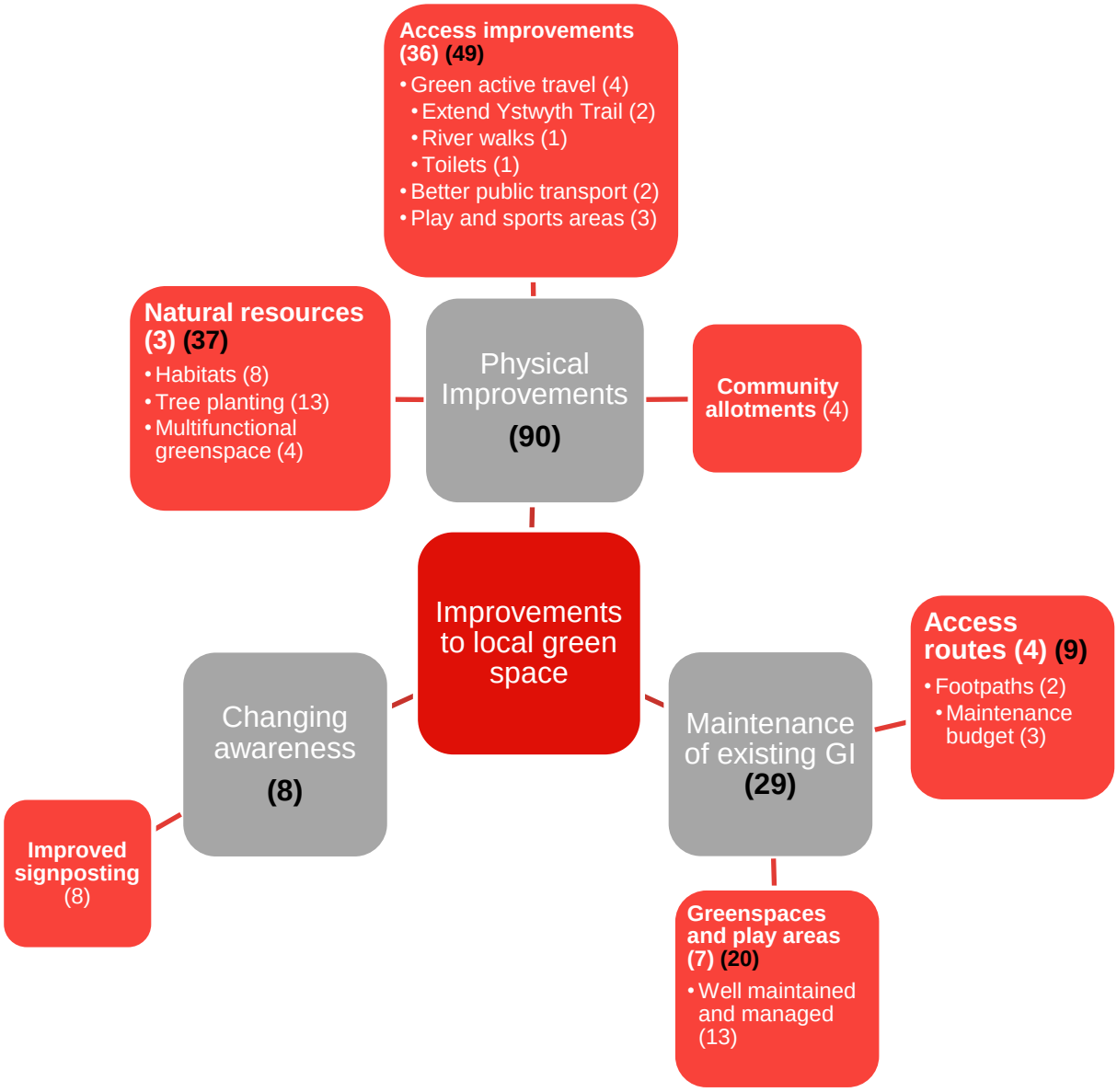


Figure 4.12: Improvements to local green spaces identified by stakeholders

4.3.10. Finally, respondents were asked if they had any additional comments to make regarding GI in Ceredigion more generally. Their responses fell into the broad categories of improving biodiversity, protecting green spaces, improving recreational access, and changing awareness and behaviour. Further detail is set out in Figure 4.13 below. Again, the numbers in black represent the overall responses in the more general category, whereas the numbers in white represent the number of actual responses within that category.

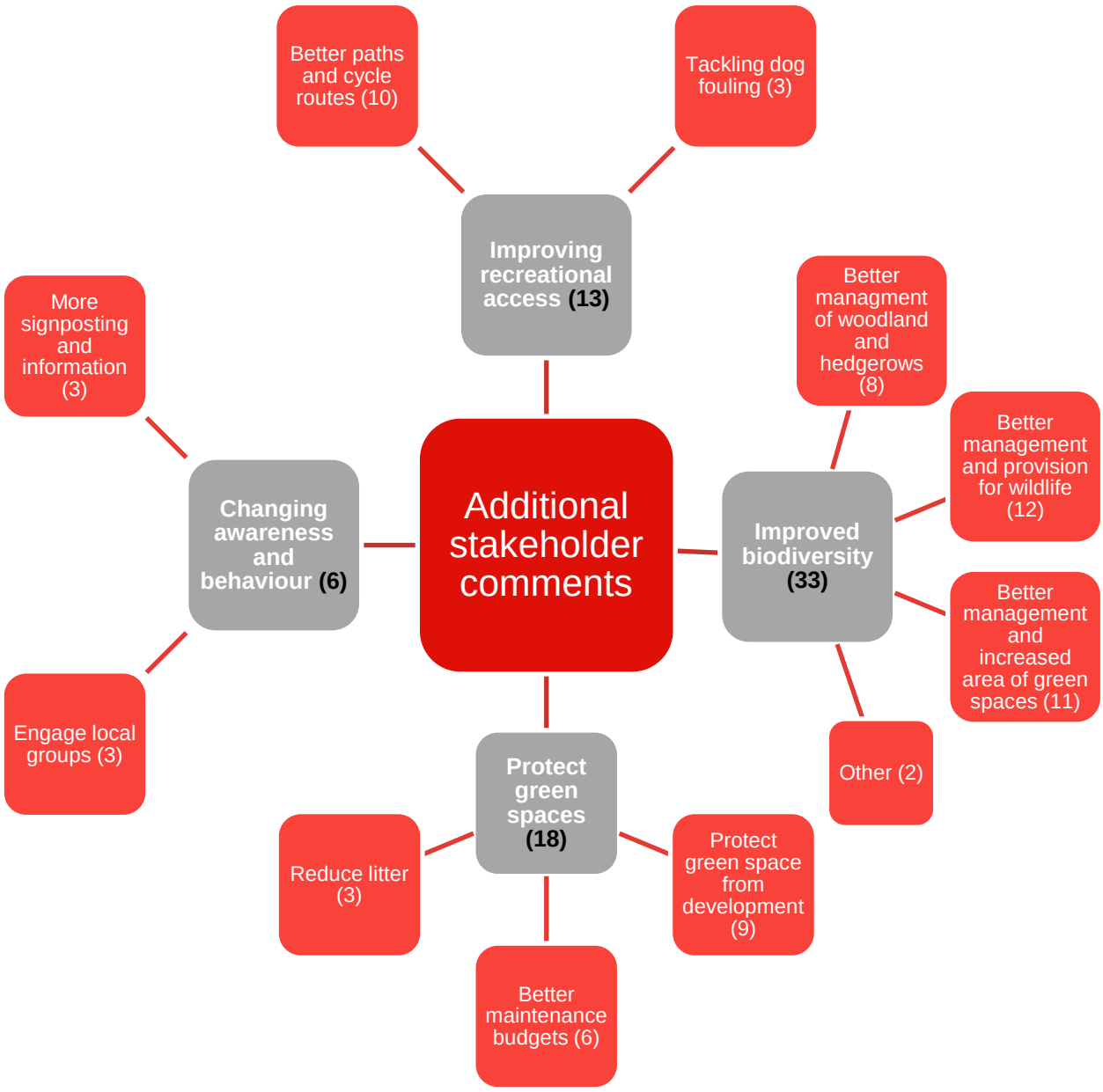


Figure 4.13: Additional stakeholder comments on Ceredigion's GI

4.4 SUMMARY AND IMPLICATIONS

4.4.1. The stakeholder events provided local stakeholders (including members of the public, third sector organisations, and representatives of town and community councils) with an opportunity to have their say on specific, geographic enhancements they would like to see made to Ceredigion's GI. These typically centred around suggestions for the creation of new GI (tree planting, and new walking and cycling routes) in specific locations, as well as suggestions to improve the maintenance of existing GI.

4.4.2. This information will be used to inform the development of specific, prioritised GI opportunities – alongside the analyses of connectivity (for people and wildlife) and ecosystem services (both need

for and likely provision of) presented in Chapters 2 and 3 of this report; preferences of CCC; and opportunities already identified in Place Plans for the towns.

4.4.3. The stakeholder events also resulted in a large number of more general (non-spatially specific) suggestions being made. Of those suggestions marked on the maps (though not specific to any particular location within the County), tree planting was the most commonly mentioned. Far more suggestions were made by attendees of the formal afternoon event, where they listed their top 5 priorities. The most common suggestions here were to make physical improvements to natural resources/habitats/green space, to accessibility, and to reducing flood risk in the County.

4.4.4. However, the number of people attending the stakeholder events was relatively small (41 people in total). The online survey (completed by 246 people) was therefore a valuable additional tool for providing suggestions on enhancing Ceredigion's GI. Improvements to accessibility of local GI resources in the towns was the most common suggestion, followed by physical improvements to GI (especially through tree planting), and better maintenance of existing green spaces and play areas. In terms of broader suggestions for the County as a whole, improving habitats for wildlife was a popular suggestion.

4.4.5. The online survey was also particularly useful regarding feedback on the use and importance of existing GI in the County's seven main towns. Overall, a wide range of types of GI are used by respondents to the survey (especially local footpaths, open countryside, local green space, woodlands, beaches and rivers), typically for recreation, relaxation, fitness and spotting wildlife, whilst aesthetic benefits of green spaces were also well recognised.

4.4.6. These more general suggestions will also be used to help inform the prioritisation of GI opportunities going forwards.

5 POTENTIAL OPPORTUNITIES FOR CEREDIGION'S GREEN INFRASTRUCTURE

5.1 APPROACH

5.1.1. This chapter sets out recommended enhancements to Ceredigion's GI (split by town and for the County as a whole) based on the following sources of information:

- The identification of GI assets and habitats, along with gaps in provision, and extent of connectivity for people and wildlife (Chapter 2);
- The likely current provision of, and need for, ecosystem services (Chapter 3);
- Spatial (and key non-spatial) opportunities suggested by those attending the stakeholder events and completing the online survey (Chapter 4);
- Other opportunities already proposed through documents such as Place Plans; and
- Opportunities suggested by the project steering group at CCC.

5.2 ABERYSTWYTH

5.2.1. Chapter 2 revealed that relative to the other towns, Aberystwyth has good coverage of GI assets which benefit from relatively high connectivity for people and ecology. As recognised in the LDP, it is important that the linear corridor between the LNRs is kept intact to maintain ecological connectivity.

5.2.2. Chapter 3 revealed Aberystwyth to have the best provision of regulating and cultural ecosystem services of all Ceredigion's main towns, as a result of its greater provision of GI assets. The area surrounding Aberystwyth also has good ecosystem service provision from its coastal, woodland and grassland habitats (as well as from 25 ha of heathland). However, the ecosystem service needs mapping suggested that there are certain parts of Aberystwyth that would benefit from additional GI creation. For example, the planting of trees and hedges in southern parts of the town could help to reduce levels of particulate air pollutants, whilst tree planting in northern, western and central parts would improve aesthetics and potentially inward investment by businesses. Increased provision of good quality, accessible green spaces is recommended in the east of the town for recreation purposes, and in the south to address issues of poor physical and mental health (see Aberystwyth Air Quality map in Appendix E).

5.2.3. Chapter 4 revealed tree planting to be the most frequent opportunity identified by stakeholders for Aberystwyth (see points 1, 4, 13, 26, 27 and 38 of the Aberystwyth map in Appendix G). The tree planting opportunities included: increasing ecological connectivity between the two LNRs through a tree corridor; increasing urban canopy cover; and enhancing the river corridor by planting at the edges of Aberystwyth University's playing fields. The creation of new cycle routes to increase connectivity ranked the second highest among stakeholders (see points 9, 21 and 26 of the Aberystwyth map in Appendix G). These included connecting Penrhyncoch, Bow Street, Capel Dewi, and Bwlch Nant yr Arian with Aberystwyth town centre. There is also an opportunity to connect the Ystwyth Trail to the Rheidol Trail via Penparcau and Pen-y-Bont Hill.

5.2.4. The Place Plan for Aberystwyth identifies enhancing Pen Dinas, Constitution Hill, and Parc Natur Penglais as an opportunity for tourism. It also advocates walking and cycle paths along the Rheidol and Ystwyth to improve accessibility. The Place Plan promotes protecting and enhancing existing GI assets through wildflower planting and increasing biodiversity. Tree planting is encouraged to improve climate resilience, especially street trees and upland woodlands. The creation of growing spaces and community allotments is also identified as an opportunity.

5.2.5. Opportunities proposed by CCC include: better connecting the Ystwyth Trail into the Rheidol Trail and harbour; general access improvements to improve permeability within the harbour itself; and other new walking, cycling and shared use travel routes as proposed through the Integrated Network Map (INM) for active travel.[81] Further out from the town, CCC proposes improving the Ystwyth Trail link to Llanilar connections from the north (also shown on the INM).

5.3 ABERAERON

5.3.1. With the lowest provision of cycle routes, Aberaeron could benefit from expanding its network of cycle routes. The town also has the lowest provision of urban tree cover and as such could benefit from tree planting within the settlement boundary. Doing so could have the additional benefit of improving ecological connectivity within the town through creating linear corridors.

5.3.2. Ecosystem service provision within the settlement boundary is likely to be low due to the relative lack of GI assets in Aberaeron (at least compared to Aberystwyth). Whilst PROW, coastal paths and the Forest Access Site will contribute to recreation and sense of place benefits, the town would benefit from urban tree planting to enhance a range of regulating and cultural services. Across the buffer area, a range of regulating and cultural services are provided by the wealth of coastal, woodland and grassland habitats, though a greater proportion of broadleaved semi-natural woodland (as opposed to coniferous plantation woodland) would be beneficial. The needs maps also suggest that provision of recreational and aesthetic benefits could be enhanced in Aberaeron from increased provision of accessible green space and tree cover, respectively.

5.3.3. Of the opportunities identified for Aberaeron through the stakeholder events and online survey, increasing connectivity through new cycle routes were the most numerous (see points 11, 12, 20 and 22 of the Aberaeron map in Appendix G). Potential routes improvements include creating a new route to Aberystwyth and extending the Llanarchaeron cycle path to Ciliau Aeron and Lampeter. The protection of Council owned green space between the school and the sea was the next most frequently mentioned opportunity (see point 1 of the Aberaeron map in Appendix G).

5.3.4. The Aberaeron Place Plan recognises improvements to the South Beach area as an opportunity for tourism. The Place Plan also recognises the benefit of GI for residents and tourists, encouraging a high standard of maintenance and, where possible, enhancements. Active travel routes are identified as opportunity for health improvements and to address traffic issues within the town.

[81] The Integrated Network Maps for Aberystwyth are available on the CCC website, at http://www.ceredigion.gov.uk/resident/travel-roads-parking/active-travel/.

5.3.5. Opportunities proposed by CCC include extending access along the old railway beyond Llanerchaeron, past the National Trust property and on towards Ciliau Aeron (as set out in CCC's Rights of Way Improvement Plan project list);[82] and improving accessibility within and around the harbour, as it is a key focal point for the town

5.4 CARDIGAN

5.4.1. Improving access to the River Teifi and its tributaries could have major recreational benefits. As well as opening up these linear GI assets, Cardigan could benefit from the creation of accessible green space, especially within the settlement boundary. Doing so could have the additional benefit of enhancing biodiversity within the town through creating stepping-stone habitat. Ecological connectivity could be further improved within the area by the creation of linear corridors.

5.4.2. Chapter 3 of this report revealed that Cardigan's coastal paths and active travel routes provide benefits to some residents in terms of recreation and improved health and wellbeing, but overall the town's limited GI assets provide few ecosystem services. Accessible green space is greatly needed in order to extend these benefits to a larger proportion of Cardigan's population. As with the other two coastal towns, Cardigan benefits from the ecosystem services associated with its coastal, woodland and grassland habitats, but would benefit from more of the grassland being enhanced to a semi-improved or unimproved state. Cardigan would also benefit from planting trees and hedges to reduce levels of particulate air pollutants; more accessible and/or attractive GI in order to address issues of poor physical and mental health; and general tree cover increase to improve aesthetics and potentially inward investment by businesses.

5.4.3. The creation of new cycle and walking routes were the most important opportunities identified by stakeholders at the two public engagement events for Cardigan (see points 2, 3, 7, 8 and 13 of the Cardigan map in Appendix G). Such opportunities included the creation of a footpath along St Dogmael's road, as well as connecting Cardigan to Blaenannerch, Llangoedmor and Llechryd.

5.4.4. The Place Plan identifies improving connectivity through active travel routes as a key opportunity. Connections from Cardigan to Penparc, Llechryd and Cillgerran are explicitly stated. Wildflower and tree planting on common ground, verges and roundabouts are recognised as an opportunity to enhance biodiversity. Reforestation in the uplands is further recognised for climate resilience benefits. The Place Plan also identified improvements to the play spaces and sports grounds at Netpool as an opportunity to enhance existing GI.

5.4.5. Opportunities proposed by CCC include better linkages to St Dogmaels over the border in Pembrokeshire, and other new walking, cycling and shared use travel routes as proposed through the INM[83] to encourage active travel. There have also been talks within the Council to improve public access along the riverside, subject to addressing any ecological constraints.

[82] Ceredigion County Council (2019). Rights of Way Improvement Plan 2019-29. Available at: https://www.ceredigion.gov.uk/resident/coast-countryside/public-rights-of-way/rights-of-way-improvement-plan/
[83] The Integrated Network Maps for Cardigan are available on the CCC website, at http://www.ceredigion.gov.uk/resident/travel-roads-parking/active-travel/.

5.5 LAMPETER

5.5.1. Chapter 2 showed that Lampeter is poorly served by linear recreation routes relative to some the other towns and could greatly benefit from a more accessible GI network. Opening up the disused railway for recreational use by the public would help to address this issue. Improving access to the relatively fewer core ecological assets, such as Falcondale Lake, by strengthening the network of PROW would also be valuable.

5.5.2. Lampeter's main assets for provisioning, regulating and cultural ecosystem services are the river Teifi which flows just south of the town, and the lake situated to the northwest. However, ecosystem services provision within the town itself is fairly limited due to the relative lack of 'green' assets and linear recreation routes. The town would therefore benefit from the opening up of its extensive disused railways for recreational purposes. Though well provided through hedgerows, ecosystem service provision in the area surrounding Lampeter would benefit from a substantial increase in the proportion of broadleaved semi-natural woodland compared to coniferous plantation woodland. Enhancement of some of the expanse of improved grassland habitat to semi-improved condition would also be beneficial. Sustainable flood management measures, such as installation of sustainable drainage systems, tree planting, or creation of large-scale green space (where feasible) aligned with natural flood management approaches, may also be beneficial in Lampeter to reduce the risk of surface water flooding.

5.5.3. Of the opportunities identified by stakeholders for Lampeter in Chapter 4, the most numerous were for tree planting (see points 9, 20, 26, 28, 29, 33 and 34 of the Lampeter map in Appendix G). These included opportunities for increasing urban tree cover, especially at Harford Square and the Maestir Road fork, and community woodland creation. The second most important category of opportunities identified related to creating new walking routes (see points 2, 4, 15, 27, and 30 of the Lampeter map in Appendix G). These opportunities include connecting the town to Long Wood; linking the north of the town to the south via the railway; and creating PROW between Cwrt Dulas estate and the rugby club.

5.5.4. The Place Plan for Lampeter identified the need to improve pedestrian links of the Pont Steffan Business Park with the rest of the town. Similarly, the creation of new cycle routes to link Lampeter town to the larger National Cycle Network is recognised as an opportunity. Signposting existing links between the town and GI assets, such as the Llangybi route along the old railway line, is seen as an opportunity to improve their use. Strategic planting of trees in appropriate locations, such as Harford Square, is an opportunity to enhance GI within the town. Similarly, planting native willow and hedgerows on the floodplain on the Cwmann and Llanybydder border is an opportunity to improve climate resilience through flood regulation. 'Village Green' and LNR designation is identified as an opportunity to protect existing GI, such as the recreation ground at the university, the town's surrounding woodland, and Parc St Germain Sur Moine. The Place Plan also recognises the potential to approve the use of greenbelt land for allotments.

5.5.5. Opportunities proposed by CCC include new walking routes as proposed through the INM[84] for active travel, and the two GI schemes recently put forward for funding through the Welsh Government's Green Infrastructure Fund:

- Lampeter Green Corridor – This would involve the development of a 600 m all-access footpath (currently a PROW through mainly University-owned land) identified as a priority in the Active Travel Plan consultations. It would link an employment area in the north with the University Campus in the centre with new housing in the south (and adjacent designated housing land) with the Co-op supermarket. Following a watercourse it would have a hard surface with adjacent swales/wet areas and planting regimes.
- Market Street Pedestrian Prioritisation – This scheme aims to remove on-street parking, replacing it with small 'bays' created by tree planting (suitable for market and pop-up stalls). A road drain would collect run-off and feed into the tree pits before overflowing into the conventional drainage system.

5.6 ADPAR

5.6.1. Chapter 2 revealed that GI provision is particularly low in Adpar, largely due to its relatively smaller size. Opportunities identified included creating a more accessible GI network. By improving the network of PROW, people will be better connected to the existing GI which is in relatively short supply. The same is true for improving the accessibility of the River Teifi. Ecological connectivity could also be improved through additional linear habitats.

5.6.2. Chapter 3 revealed Adpar's greatest GI asset in terms of ecosystem service provision to be the tree-lined RiverTeifi, which, given its location between Adpar and neighbouring Newcastle Emlyn is likely to benefit the majority of the town's inhabitants in terms of aesthetics and connection with nature. However, GI provision is otherwise fairly low in the town, and it would benefit from additional PROW and accessible green space to improve other cultural services. In terms of ecosystem service provision from habitats in the buffer zone, Adpar benefits from the highest proportion of woodland cover of all the towns (and the highest proportion of broadleaved semi-natural woodland). But like the other towns, it would benefit from improvement in the condition of the surrounding grassland. In terms of ecosystem service needs, Adpar would benefit from the planting of trees and hedges to reduce levels of particulate air pollutants; increased provision of accessible green space to address recreational needs; and more tree planting to improve the town's aesthetics.

5.6.3. Only one opportunity was identified by stakeholders for Adpar, which was the introduction of new green space through development of the land opposite Parc y Trap (see point 7 of the Adpar map in Appendix G). An attempt at place making was recommended in which GI is a central element of the design.

[84] The Integrated Network Map for Lampeter is available on the CCC website, at http://www.ceredigion.gov.uk/resident/travel-roads-parking/active-travel/.

5.6.4. Being a small settlement there is no Place Plan for Adpar. However, opportunities proposed by CCC include creating better linkages across the border to Newcastle Emlyn – both to green spaces and to commercial/business areas.

5.7 LLANDYSUL

5.7.1. Chapter 2 revealed how the overall provision of GI is relatively poor within Llandysul, particularly with respect to accessible green space and urban tree cover. Much of the town's urban canopy falls outside of the LDP settlement boundary, presenting tree planting within this area as a significant opportunity. Urban tree planting could also help to create linear corridors for wildlife, improving ecological connectivity within the town by linking with broadleaved semi-natural woodland outside. Connectivity for people could be improved by linking the fragmented PROW and increasing access to the Teifi and Tyweli rivers.

5.7.2. The ecosystem service assessment in Chapter 3 revealed that Llandysul benefits from the second highest provision of cycle routes[85] of the seven towns, thus contributing to recreation and health and wellbeing for a small proportion of its inhabitants. However, the town is let down by poor provision of PROW and accessible green space which would provide these services to more people. Urban tree cover is also particularly low, depriving residents of a range of regulating and cultural ecosystem services. As for most of the other towns, ecosystem service provision in the wider area comes predominantly from the woodland and grassland habitats, but again, the vast majority of the latter is improved grassland, which provides fewer benefits than semi-improved or unimproved grassland. However, the needs assessment did not reveal any particular enhancements to be necessary for Llandysul (relative to the other towns) in terms of the five mapped ecosystem services.

5.7.3. The most important opportunity identified by stakeholders for Llandysul was tree planting (see points 5, 14, 22, 23 and 24 of the Llandysul map in Appendix G). This included increasing ecological connectivity through woodland planting along the river corridor. Also recommended was amenity tree planting in areas of public land and along council-maintained highways, such as Llyn y Fran Road. New walking routes (points 10, 13 and 18) and improving the maintenance and access of existing GI (points 4, 11, 20, and 21) were also recognised as important opportunities. The opportunities for walking routes include circular routes connecting the Teifi to the town. Access and maintenance opportunities include controlling Japanese knotweed along the river, improving footpath surfaces, and introducing self-closing gates along the Teifi Trail to improve its accessibility.

5.7.4. A key theme of the opportunities identified in the Place Plan for Llandysul is connectivity. Potential improvements include: a cycle path five miles out in every direction from the school; a riverside footpath leading from Llandysul Bridge to the quarry area; and a footbridge over the Teifi at Tirderf Fields to create a circular walking route. Other opportunities identified include the creation of new GI assets, such as parkland and allotments at the former Ysgol Dyffryn Teifi playing fields.

[85] Dataset includes on-road cycling.

5.7.5. Opportunities proposed by CCC include linking across the river to Pont Tyweli in neighbouring Carmarthenshire, e.g. through new active travel routes. This would provide better access to GI assets and opportunities outside of Llandysul.

5.8 TREGARON

5.8.1. Despite Tregaron benefitting from a substantial network of linear features, the provision of other GI assets is poor, especially with respect to accessible green space and apparently limited tree cover; issues which need addressing. Furthermore, though the network of PROW linking the town to the surrounding countryside is fairly complete to the south and west, it is more fragmented towards the north. Connecting Tregaron to the area of bog and marsh to the north (the Cors Caron NNR) via new PROW along the disused railway presents a significant opportunity to improve recreational accessibility. Similarly, so is opening up the river Brennig and river Teifi for use as recreation routes. With regards to habitats, Tregaron has the lowest percentage of woodland cover of all the towns (just 4%). Woodland planting therefore presents an opportunity to increase biodiversity in the area, especially if these are connected through linear corridors such as hedgerows.

5.8.2. Tregaron provides cultural ecosystem services mainly from its PROW network and the river Brennig which flows through the centre of town (the latter providing aesthetic and nature connection benefits). As mentioned above, recreational benefits could be enhanced through greater provision of accessible green space and opening up of the disused railway to the north. The Cors Caron NNR (comprising largely mire habitats) provides the vast majority of the ecosystem services in the Tregaron study area, as woodland cover is especially low, and the grassland is mainly improved grassland which provides fewer benefits than semi-natural grassland. In terms of ecosystem service needs, sustainable flood management measures, such as installation of sustainable drainage systems, tree planting, or creation of large-scale green space (where feasible) aligned with natural flood management approaches in the east of Tregaron may help to reduce the risk of surface water flooding. The level of tree cover should also be improved in Tregaron to improve aesthetics and potentially inward investment by businesses.

5.8.3. Of the opportunities identified by stakeholders for Tregaron, the most numerous relate to the creation of new cycle routes (see points 1, 4, 6, and 9 of the Tregaron map in Appendix G). These opportunities include extending the Ystwyth Trail to the town centre and connecting Tregaron to Lampeter. The second most important opportunities mentioned related to the creation of walking routes (see points 10 and 20 of the Tregaron map in Appendix G). These involve a riverside walk and circular walks beginning in the town that connect the wetlands, woodlands, and the disused railway.

5.8.4. The Place Plan recognises Tregaron's proximity to the Cambrian Mountains as an important opportunity, given their importance for outdoor recreation. Creating a network of walking and cycling trails has the potential to attract tourism. The Place Plan also recognises the value of creating additional GI assets for the benefit of residents. Such opportunities include creating a green area with a riverside walk in front of St Caron church and creating allotments or nature gardens on the site next to the bowling green.

5.8.5. An opportunity proposed by CCC would involve completion of the Ystwyth Trail, linking the town with Cors Caron to the north.

5.9 CEREDIGION COUNTY

5.9.1. Chapter 2 showed that the coastal towns in particular benefit from close proximity to Ceredigion's GI 'jewel in the crown', which is the extensive coastline including several heritage coast sections, beaches, estuarine and riparian zones. All of these GI assets provide great value to CCC's residents as well as visitors. The entire coast is designated as SAC. Other major towns benefit from close proximity to River Teifi and also other rivers designated as SAC, all of which also represent valuable GI assets. These marine and freshwater GI assets are often well connected by cycle routes and coastal paths. Where present, considerate enjoyment of these sites should be supported and encouraged, whilst protecting the most sensitive areas from disturbance. There may also be opportunities to improve access to the river network by for example expanding riverside walking and cycling paths.

5.9.2. A possible geographical disconnect can be observed between Ceredigion's urban dwellers and the County's terrestrial designated sites, of which the majority are located in the north and east, whilst its towns are predominantly located in the west and south. It is important that opportunities are taken to connect these assets to Ceredigion's towns in a way that is sympathetic to their natural value, such as through linear recreation routes.

5.9.3. Chapter 3 recommended increasing provision of woodland and expansion/restoration of peat bogs throughout the County in order to help the Council meet its commitment to become a net zero carbon local authority by 2030 and support its actions towards addressing the global climate emergency.

5.9.4. At the County level, the most important opportunities identified by stakeholders relate to flood reduction (see points 18 and 19 on the County-level map in Appendix G). The target areas identified were Beulah, the RiverLeri at Talybont, the River Aeron above Talsarn, and Cwm Slaid. Also important were the opportunities relating to the creation of new cycle and walking routes (see points 10, 13, 21, 22 and 25 on the County-level map in Appendix G). The recommended routes aim to connect various settlements across the County, including improving connectivity between towns and their satellite villages, as well as between the towns themselves.

5.9.5. Harbours may also present an interesting opportunity. Whilst harbours are not usually considered GI assets themselves, they can be focal points of towns and provide opportunities for experiencing GI such as the coast and sea when accessible to the public. As the County's harbours may attract considerable regeneration funding, there may be an opportunity to improve access to people to enjoy the surrounding nature. Access could be improved by better connection through cycle and walking routes, but also other sustainable means of travel such as 'bay hopper buses'. There may also be opportunities to improve GI assets within and surrounding harbours to make these places more attractive for people to visit.

5.10 NON-SPATIAL OPPORTUNITIES

5.10.1. The stakeholder workshops and online survey resulted in a large number of suggestions being made to improve the County's GI – in terms of creation of new GI, improving the planning/governance of GI, and especially improving the quality and accessibility of existing GI. For example, common GI creation suggestions involved increasing tree cover across the County (with a focus on community tree

planting) and improving the capacity for local food production through the creation of allotments and orchards.

5.10.2. The key non-spatial opportunities suggested through the two events and the online survey are summarised in Figure 5.1, split by source.

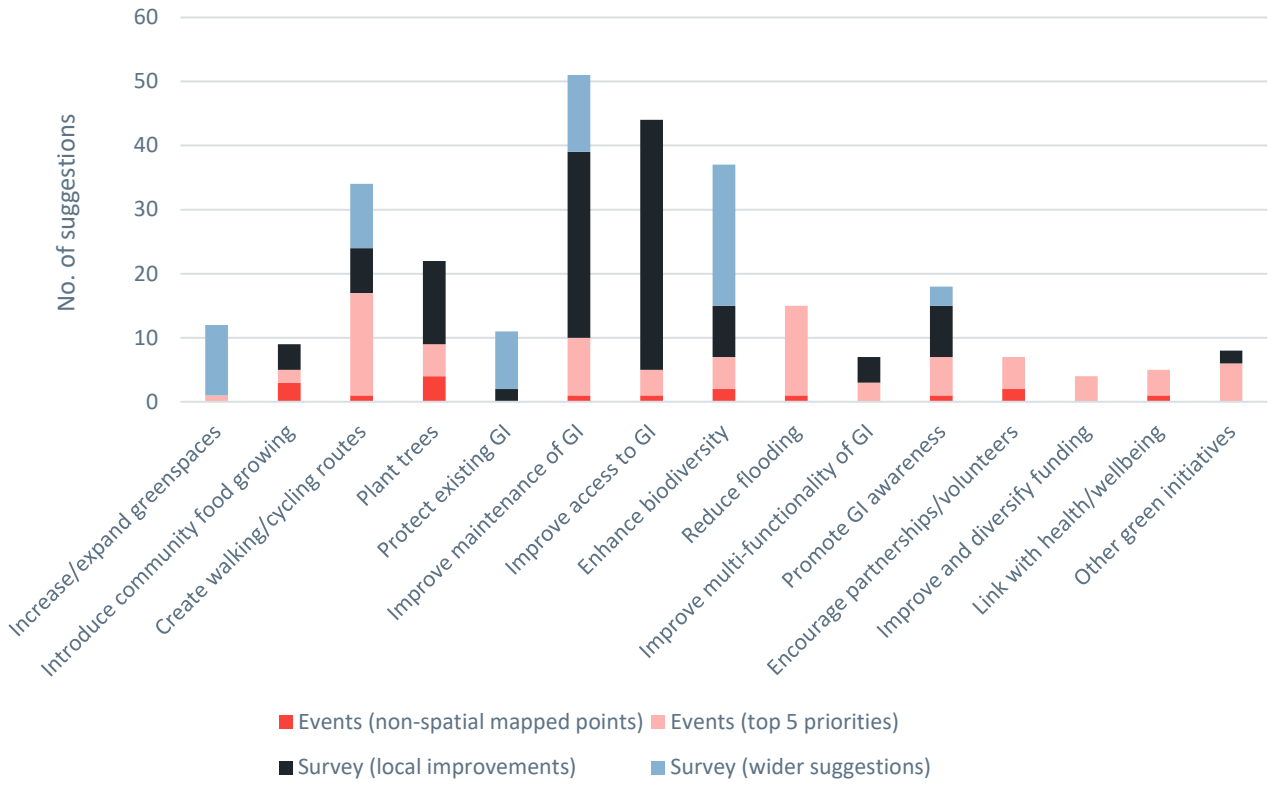


Figure 5.1: Non-spatial opportunities suggested by stakeholders

5.10.3. A key opportunity proposed by CCC is to make further sections of disused railways across the County – particularly those extending into urban areas – accessible for recreation purposes, and to enhance their biodiversity value.

5.11 SUMMARY AND IMPLICATIONS

A brief summary of these opportunities for the seven towns follows:

- Aberystwyth has good coverage of GI assets relative to the other towns but would benefit from tree planting for enhanced air quality, climate resilience and aesthetic value. Better provision of accessible green space and connectivity of linear recreational routes are also identified to benefit well-being and tourism.
- Aberaeron would benefit from expanding its network of cycle routes to improve the town's connectivity. As the town's focal point, improving the accessibility and visual amenity of the harbour area through GI provision is also recognised as an important opportunity.

- Improved connectivity via active travel and recreation routes is an important opportunity for Cardigan. Increasing tree cover and accessible green space will benefit equitable physical and mental wellbeing across the town.
- Lampeter would benefit form a more accessible GI network, strengthened through a greater provision of recreational routes. Increasing the urban tree cover would benefit the town itself, whilst a higher proportion of native woodland in the surrounding area would enhance biodiversity and climate resilience.
- Adpar would benefit from greater access to the RiverTeifi and neighbouring Newcastle Emlyn via recreational routes. The provision of more accessible green space through development is also an important opportunity.
- The recreational value of the Llandysul's existing GI assets would be increased by better connectivity, as would physical and mental wellbeing. Increasing urban tree cover and provision of accessible green space would also benefit residents.
- Strengthening Tregaron's already substantial network of linear features and connectivity to the surrounding landscape will support its aim of becoming a destination for outdoor recreation. Increasing the provision of GI assets such as tree cover and accessible green space will further benefit residents.

5.11.1. Some of the opportunities are small scale and could potentially be provided on Council land or through minor development proposals whilst others would require integration into larger scale regeneration or strategic allocations (the latter requiring a greater focus on connectivity). Other opportunities may require engagement with private landowners such as farmers, particularly for improving connectivity between urban and rural areas via new PROW, cycle trails and tree planting.

5.11.2. The Council will prioritise the recommended opportunities, using these to help guide the future development of Ceredigion – particularly in urban areas. Priority will be given to creating new GI that addresses identified deficiencies in GI and ecosystem services provision, and extends and connects the existing network. Other prioritised opportunities will relate more to enhancing the quality, accessibility and awareness of existing GI.

6 DELIVERING GREEN INFRASTRUCTURE IN PRACTICE

6.1 APPROACH

6.1.1. As revealed by the preceding chapters, GI is crucial for ensuring mitigation and adaptation to climate change, and the health and wellbeing of Ceredigion's residents. To guide the way in which Ceredigion's towns evolve in the future, this Chapter discusses a number of good practice principles for incorporating new and enhanced GI into place planning, masterplanning and initial site appraisals. It also sets out general principles and practical requirements of delivering long term GI maintenance and management; in particular working to minimise ongoing costs while providing high quality GI for people and nature.

6.1.2. The Welsh Government is preparing guidance on GI and its delivery within the planning system, to be published later in 2020. This guidance is expected to set out five key principles of GI: Multifunctional, Biodiverse, Adapted for Climate Change, Healthy, and Smart and Sustainable.

6.1.3. With the current absence of Wales-specific guidance, this Chapter is therefore based on a range of sources, including Natural England's emerging 'National Framework for Green Infrastructure Standards', the academic and grey literature, and the experience of the project team and other Local Authorities in the UK. Once the Welsh guidance is published, this should take precedence.

6.2 EMBEDDING GI IN PLANNING AND DEVELOPMENT

6.2.1. To successfully embed GI within planning and development decisions, we recommend that local authorities develop an overarching GI 'framework' specific to their area; irrespective of the stage they are at with their Local Plan and strategic allocations. This framework should set out some overarching principles for achieving good GI, along with local aspirations as to how these should be delivered, and more specific place-based objectives. It should also include a recommendation that GI is considered at the earliest possible opportunity in the plan-making, masterplanning, and development management cycles.

6.2.2. Rather than being an onerous task, the framework should be seen as a useful and important starting point for CCC, underpinning all other planning decisions of relevance to GI (see Figure 6.1).

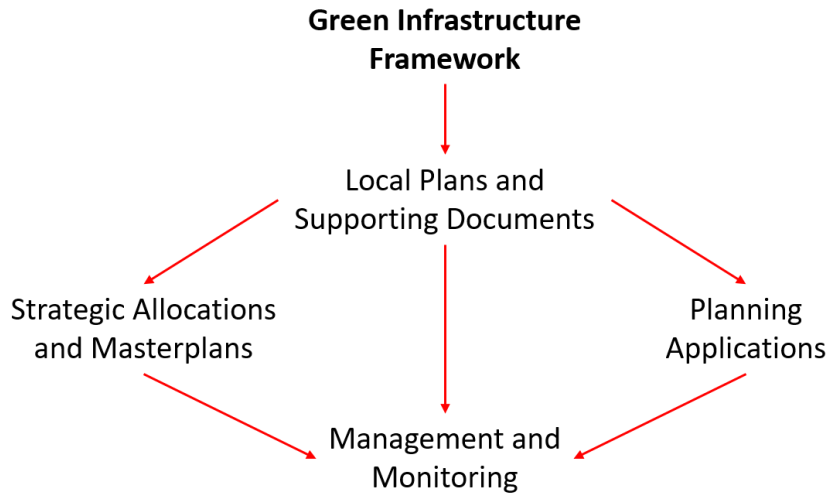


Figure 6.1: Proposed process for embedding GI in planning and development

Establishing a GI framework

6.2.3. The stepped process set out in Figure 6.2 below has been proposed to guide CCC (and other UK local authorities) through the development of a GI framework. Additional guidance on each of these steps follows.

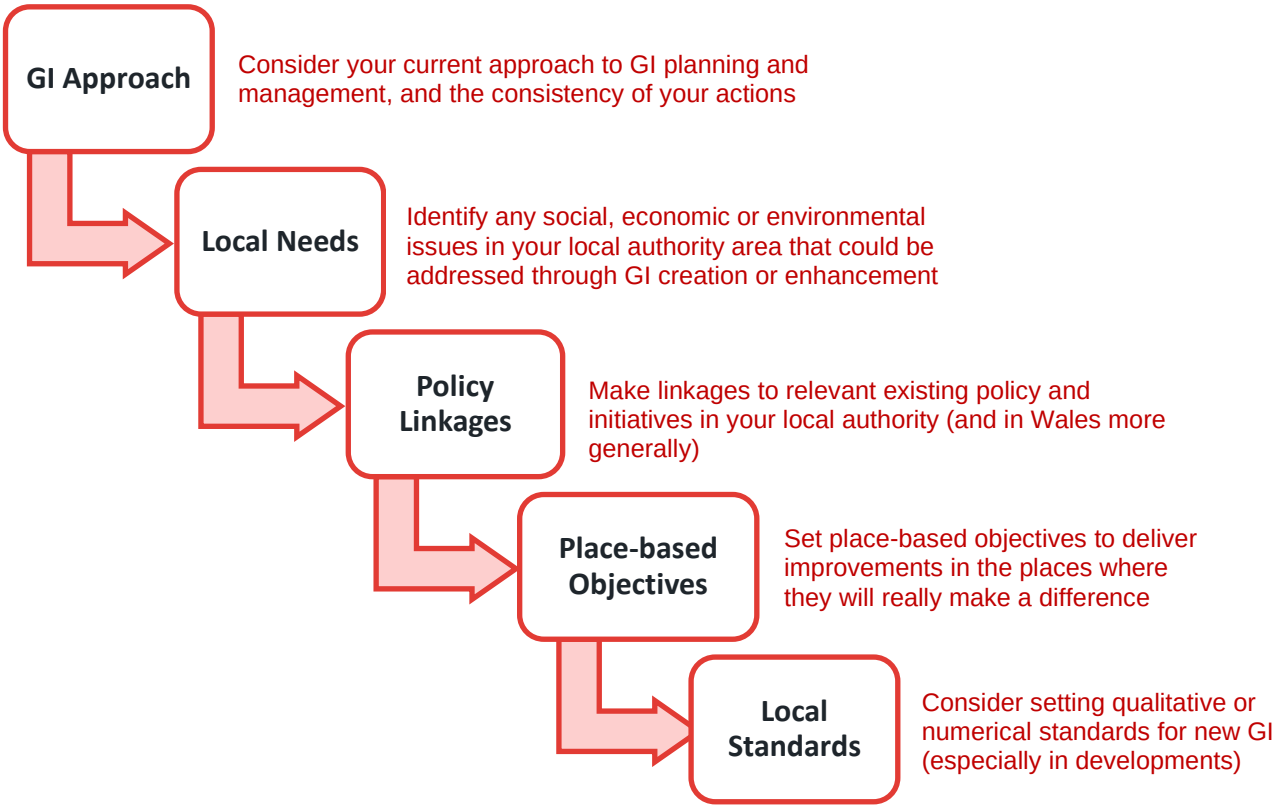


Figure 6.2: Proposed approach for developing an overarching GI Framework

6.2.4. Step 1: GI Approach

Consider your current approach to GI planning and management (both regarding land in council ownership and other land within the County), and the consistency of your actions by asking yourself the following questions:

- Which stakeholders do you involve in GI policy development, and how?
- To what extent is your GI designed and managed for multi-functionality?
- How is your GI managed and maintained over the short and long term?
- How do you determine which GI to finance, and how do you resource this?
- Do you monitor the quantity or quality of your GI, and if so, how?
- Do you plan your GI to fit into the wider strategic network?
- Do you tie GI planning in with other strategic objectives, such as nature recovery or landscape objectives?

- How do you ensure that new GI is well designed and fits in with the local landscape/townscape?
- Do you know which ecosystem services your GI is delivering?
- How do you identify and ensure that your GI is providing multiple benefits?
- Are you aware of synergies and trade-offs in the provision of ecosystem services from GI, and how to manage these to your advantage?
- Do you know where you have gaps in GI provision?
- Do you know what the needs and preferences of local communities are regarding GI?
- How do you account for these needs and preferences when improving the quality and functionality of existing and new GI?
- What are you doing about inequalities and inequity of both provision and quality of GI?
- Do you know where to target GI to help deliver the best health outcomes?
- Does your GI encourage more active lifestyles?
- Do you actively seek to create environments that help people maintain and improve good mental health? How does GI planning and design fit into this?
- Do you design GI in order to manage environmental hazards such as air quality or local issues such as road safety?
- Do you use GI for delivering biodiversity enhancement?
- Do you seek to create networks of GI that will help nature recovery?
- To what extent do you use GI as a nature-based solution to climate change mitigation and adaptation?
- In what ways do you use GI to contribute to local place making and create better places in which to live and work?
- Do you use, or encourage the use of, GI to make development (more) acceptable to communities?
- Do you target those areas where GI can contribute to the regeneration of existing communities or make less attractive places more investable?
- Are you aware of the value of your GI (e.g. in monetary terms), and how this can be enhanced?

6.2.5. Step 2: Local needs

Identify any social, economic or environmental issues in your local authority area that could be addressed through GI creation and/or enhancement. This may require discussions across local authority departments, and review of relevant local level spatial and non-spatial data (for example, including the needs maps presented in Appendix E of this report).

6.2.6. Step 3: Policy linkages

Make linkages to relevant existing policy and initiatives in your local authority (and in Wales more generally). This could include, for example:

- LDP policies LU24, DM04 or DM11 (relating to open space, sustainable travel and climate change, respectively);

- Supplementary Planning Documents and other documents already produced in Ceredigion, such as the Poverty Strategy, Transport Plans, Place Plans, Rights of Way Improvement Plan and the Nature Recovery Plan;[86] and
- PPW10 planning principles (e.g. on facilitating accessible and healthy environments).

Published documents that are of particular relevance to GI (such as the Rights of Way Improvement Plan and the Nature Recovery Plan) should be brought in to sit under this overarching framework, as they will contribute to delivering GI across the County.

6.2.7. Step 4: Place-based objectives

Consider what are the most important issues/ecosystem services to address (e.g. climate change, human health or biodiversity), and identify those places and communities that need the benefits of GI most. Then set place-based objectives to deliver improvements in the places where they will make the greatest difference. This is especially important if resources are already stretched, as it can assist with targeting and prioritisation of resources and interventions. Strategically targeting areas to maximise the benefits provided by GI can also strengthen the case for investment.

6.2.8. Step 5: Local standards

Consider setting qualitative or numerical standards for GI provision, particularly through new developments. For example NRW's Accessible Natural Greenspace Standards, or the Building with Nature standards (see Section 7.3 for more details on GI standards).[87]

Planning policy

6.2.9. Following on from the overarching GI framework, GI-relevant policy should be developed for inclusion within the Local Plan. Chapter 7 of this report reviews a selection of Ceredigion's existing development management policies for their GI content and strength, and provides recommendations for improvements based on good practice policies identified in local plans elsewhere.

6.2.10. Whilst a specific GI policy is recommended, it is important that principles of good GI are embedded into the LDP as a whole – particularly within overarching core policies and those relating to climate change and health and wellbeing. Planning policy could further commit to embedding GI in all grey infrastructure schemes (e.g. highways and urban regeneration).

Working with developers

6.2.11. Collaboration with developers has great potential to contribute to the provision of new GI within the County. To ensure that GI proposed through development will be deliverable and continue to be 'good' in perpetuity, detail on long-term funding, management and maintenance should therefore be required from developers before applications can be approved. In particular, developers should demonstrate that any service charges to be imposed on future residents are realistic (neither too low, ensuring sufficient funds for maintenance, nor too high, preventing lower socio-economic

[86] Ceredigion County Council (2019). Rights of Way Improvement Plan 2019-29. Available at: https://www.ceredigion.gov.uk/resident/coast-countryside/public-rights-of-way/rights-of-way-improvement-plan/; Ceredigion County Council, Powys County Council, Gwynedd Council (2015). Mid Wales Joint Transport Plan 2015. Available at: https://www.ceredigion.gov.uk/your-council/strategies-plans-policies/mid-wales-joint-local-transport-plan/

[87] Countryside Council for Wales (2011). The Greenspace Toolkit: A Practical Guide to Assessing the Resource and Implementing Local Standards for Accessible Natural Greenspace Provision in Welsh towns and cities; Building with Nature (2019) Building with Nature User Guide Version 1.4.

groups from being priced-out of the area), and that any shortfall in funding (e.g. to cover renovations/upgrades) is met through a 'sinking fund' paid for upfront by the developer.

6.2.12. For large scale, strategic developments, appointing external master planners with ecosystem services knowledge specified in their brief is recommended. For developments of any scale, providing developers with a proforma to complete as part of their planning application showing how they have included (multifunctional) GI in their designs will ensure that GI and ecosystem services are considered at an early stage. An example proforma (used by Teignbridge District Council in Cornwall) is provided in Appendix H. As mentioned above, CCC could also introduce voluntary and/or mandatory GI standards for future developments in Ceredigion.

6.2.13. Where responsibility for the management of the sites is to pass to the relevant Community/Parish/Town Council (particularly for small-scale developments), focus should be placed on ensuring sufficient developer contributions will be provided before planning permission is granted. New GI assets often receive funding only for five years, or in some cases simply for the installation, but long-term funding of perhaps 30 years will be necessary to maintain ecosystem service provision into the future. Depending on individual circumstances, planning conditions, planning obligations, Section 106 agreements or the Community Infrastructure Levy (if applicable in Ceredigion) all represent potential mechanisms for securing and funding GI through development (either on-site or off-site).

6.2.14. Alternatively, developer contributions could be put towards prioritised GI projects across the County (such as those set out in Chapter 5) to supplement funding from CCC or elsewhere. There are also more innovative options such as 'Payments for Ecosystem Services' (PES) schemes which have been trialled and rolled out in both urban and rural environments in the UK, which could be funded by either mandatory or voluntary contributions from developers, businesses or citizens.[88]

6.3 MANAGEMENT, MAINTENANCE AND MONITORING

6.3.1. Whilst active management of GI improves ecosystem services provision and therefore quality of life for those living and working nearby, conversely, a lack of maintenance reduces ecosystem services provision and both perceived and actual accessibility, and can potentially lead to an increase in anti-social behaviour. GI therefore needs to be governed, funded, managed, maintained and monitored sustainably if it is to provide ecosystem services and related benefits in the long term.

6.3.2. The successful long-term management of GI, for example climate change adaptation measures such as through managed retreat schemes, requires support from landowners/decision-makers and beneficiaries/users. When developing a funding and management plan, exploring opportunities for collaboration with local groups can be an effective way of aligning investment and can tailor benefit provision towards local priorities. Communities, landowners, businesses, the lead local flood

[88] Davies, H.J., Doick, K.J., Hudson, M.D., Schaafsma, M., Schreckenberg, K. and Valatin, G. (2018) Business attitudes towards funding ecosystem services provided by urban forests. Ecosystem Services, 32, 159-169.

authority, Health Boards, Public Service Boards (PSBs)[89], tourism operators and others may all have an interest in the multiple benefits that GI can provide. Highlighting the potential benefits to and engaging with these stakeholders can therefore lead to a shared responsibility of ongoing funding, management and monitoring.

6.3.3. Local community engagement in particular can assist with support for changes and approaches, gaining buy-in, and helping to serve local needs and wants. If appropriate, CCC and Community Councils could consider encouraging community 'ownership' and stewardship of local green spaces. Examples include community woodlands, as well as 'Friends of' groups for parks. In Lampeter, CCC is collaborating with the Town Council and community organisations to make ongoing maintenance of vegetation a local task through schemes like 'Adopt A Path'.

6.3.4. As a major landowner, CCC is responsible for much of Ceredigion's urban GI and has greater strategic oversight. CCC can therefore play a key role in protecting/enhancing GI, and creating GI networks across the County. However, it should be noted that the governance and management of GI is the responsibility of multiple local authority departments – particularly those with authority, budget, responsibility for land, and connections with human health and wellbeing (i.e. not just those with an environmental remit). Support for GI enhancement by CCC's political and senior management is also needed, ideally via a vocal 'champion'.

6.3.5. Working to minimise ongoing maintenance costs and increase the value of green spaces to landowners (including CCC) and broader society is crucial if these areas are to be protected from future development. This is because developing existing urban green spaces can exacerbate social and environmental issues (such as surface water flooding, stress/anxiety/depression, and nature deficit disorder), reducing their long-term (as opposed to short-term) social value, and creating a negative image for the town/local authority. One approach to reducing management costs whilst concurrently increasing long-term value is to replace labour-intensive, low-benefit, mown amenity grassland with biodiverse and aesthetically pleasing wildflower meadows.

6.3.6. Related to this, where developers are unable to provide biodiversity enhancements on-site (noting that failure to enhance biodiversity is a reason to refuse planning permission under PPW10), if appropriate, they could be required to provide offsite biodiversity enhancements by funding habitat creation elsewhere. This may also be appropriate for important developments that are unable to mitigate or compensate for any losses in biodiversity on-site. CCC (or other landowners in Ceredigion) could consider developing 'habitat banks' on their land, funded by developer contributions for offsetting purposes.[90] This would provide landowners with good incentives to manage their redundant green spaces for biodiversity, instead of allowing them to become poorly maintained, or selling them off.

6.3.7. For Council-owned green spaces, CCC could consider setting up a charitable trust (funded by different local authority departments) to manage these. For example, Torbay Coast & Countryside

[89] Especially the Climate Change and Natural Resources PSB project group and the Social & Green Prescribing PSB project group.
[90] Habitat banking is a market-based system in which developers offset their biodiversity impacts on-site by purchasing 'credits' to pay for nature conservation efforts offsite delivered by a habitat bank.

Trust has taken on the management of all local authority farms and nature sites in Torbay, whilst Edinburgh & Lothians Greenspace Trust works with partners to create, improve and promote parks, green spaces and vacant land. Alternatively, an existing third sector organisation (such as the Land Trust or the Wildlife Trust of South and West Wales) could take on management of/responsibility for some of the larger green spaces in Ceredigion. Collaboration with neighbouring local authorities and large infrastructure developers can also provide a cost-effective way of managing larger scale GI, providing better value for money, and delivering better managed and more connected GI.[91]

Monitoring

6.3.8. Regularly gathering evidence supporting the provision of intended benefits and outcomes of GI is crucial for justifying investment and showcasing value for money. In practice, this means:

- Developing a clear business case for the sustained funding of effective GI;
- Developing a structure of governance that will ensure successful maintenance and management of GI in the long-term;
- Consistent and efficient monitoring of GI performance in terms of ecosystem services that is aligned with existing data collection and analysis; and
- Enhanced monitoring of the local economic health and social impacts of GI to improve future decision making (linking in with Wellbeing and PSB objectives).

6.3.9. Wherever possible, it is recommended to align monitoring of GI with existing data capture processes to reduce the requirement for additional resource and improve efficiencies of data collection and analysis. This could be through adding criteria relating to ecosystem services provision to open space assessments; and adding GI questions to resident surveys and public consultation events for related issues. Involving local partners (e.g. local biodiversity groups or citizen scientists) in the gathering of data at the local level can be a useful and cost-effective approach, especially regarding data on the quality of GI (as opposed to the quantity). For example, the citizen science tools Treezilla and Observatree are used for the mapping of trees and identification of tree health, respectively.[92]

6.3.10. Monitoring the provision of ecosystem service benefits (typically through proxy measures) is also possible, though will require additional resources. A range of tools are available for monitoring ecosystem services; each requiring varying input data and underpinned by various assumptions. For example, the Ecometric tool developed for use in England (though adaptable for Wales) can be used to quantify multiple ES at a site before and after a change (e.g. development or restoration), requiring the input of Phase 1 habitat data.

[91] LDA Design (2019) National Framework of Green Infrastructure Standards Guidance: Open space and natural capital managers (Appendix 14.0). Unpublished draft to Natural England.
[92] For more information on Treezilla, visit: https://www.forestresearch.gov.uk/research/urban-trees-and-greenspace-in-a-changing-climate/quantification-and-valuation-of-ecosystem-service-provision-of-urban-trees/treezilla/; For more information on Observatree, visit: https://www.observatree.org.uk/

6.4 SUMMARY AND IMPLICATIONS

6.4.1. Possible approaches for delivering GI across the County of Ceredigion include:

- Setting out a strategic ‘GI framework’ with input from multiple CCC departments, focusing on connectivity and addressing key local community needs.
- Working collaboratively so that prioritised GI initiatives deliver wider CCC policy and emerging Welsh Government GI principles (Multifunctional, Biodiverse, Adapted for Climate Change, Healthy, and Smart & Sustainable), and support delivery of Place Plans.
- Embedding GI throughout future planning policy – especially policies relating to climate change, health and wellbeing, highways and urban regeneration schemes.
- For land to be developed (whether publicly or privately owned), set requirements within the GI framework, LDP and/or relevant Supplementary Planning Guidance (SPG; e.g. the Allocated Site Specifications SPG) for masterplanners and developers to show how (multifunctional) GI is included in the design and how it will be managed into the future before planning permission is granted.
- To improve the efficient use of developer contributions, include within the Allocated Site Specifications SPG a requirement for developer contributions to be made available to Community Councils for enhancement of identified community green space assets (and/or to execute Place Plan projects).
- For council-owned green spaces, engage with potential public/third sector partners, communities and developers to attract additional funding or maintenance support in order to enhance the quality of these sites for people and/or wildlife.
- Utilising and extending existing monitoring data (whether council or third sector-generated) to provide evidence on the delivery of benefits from GI and therefore justify further investment.
- Mixing short-term wins with long-term goals, ideally supported by a ‘GI Champion’, to maintain focus and achieve the best outcomes.

7 LDP RECOMMENDATIONS

7.1 APPROACH

7.1.1. The chapter starts by setting out Welsh legislative and policy requirements for GI in relation to development management, along with GI standards in operation in Wales and elsewhere in the UK. 'Good practice' LDP development management policies from UK local authorities (focusing where possible on rural counties) have also been identified.

7.1.2. This is followed by a review of relevant development management policies from the Ceredigion LDP 2007-2022 (i.e. DM06, 10, 11, 12, 13, 14, 15, 20, 22 and 23) for their existing GI content, using a 'Policy Assessment Tool' recently developed and tested by academics for the Central Scotland Green Network area.[93] More information on this process is set out in Section 7.5 below.

7.1.3. Drawing on the above 'good practice' information and policy review, and the findings of the GI Assessment described in the preceding chapters of this report, this chapter concludes with a set of recommendations for change to CCC's development management policies. This also takes into account the need to be 'future ready', ensuring that GI planning (and the assets themselves) are ready for climate change.

7.2 WELSH LEGISLATIVE AND POLICY REQUIREMENTS

7.2.1. The Well-being of Future Generations Act 2015, Planning (Wales) Act 2015 and the Environment (Wales) Act 2016 provide the legislative context for delivering GI across Wales. GI is also a key thread that runs through Planning Policy Wales 10 (PPW10) and the draft National Development Framework. For example, a key planning principle in PPW10 is that built and natural environments should be planned to promote mental and physical wellbeing. Section 6.2 of PPW10 goes into specific detail on GI, with paragraph 6.2.6 stating that "planning authorities should adopt a strategic and proactive approach to green infrastructure and biodiversity by producing up to date inventories and maps of existing green infrastructure and ecological assets and networks". Other relevant recommendations of PPW10 include:

- Maintain and enhance resilience of ecosystems and the benefits they provide (3.30);
- Increase habitat connectivity and secure GI benefits along transport networks (4.1.32);
- Protect green spaces from development, particularly in urban areas where they fulfil multiple purposes (4.5.3);
- Use disused land and routes as parks, linear parks or greenways in urban areas (4.5.7);

[93] The Ceredigion LDP 2007-2022 is available at: https://www.ceredigion.gov.uk/resident/planning-building-control-and-sustainable-drainage-body-sab/planning-building-control/ceredigion-local-development-plan/; Scott, A. & Hislop, M. (2019) Green Infrastructure Self-Assessment Tool – Draft Guidance.

- Unless other significant material considerations indicate otherwise, refuse permission for developments that fail to include biodiversity enhancement measures (6.4.5); and
- When considering multi-functionality of GI, prioritise flood management followed by biodiversity and water quality improvements (6.6.29).

7.2.2. As mentioned in Section 6.1 of this report, the Welsh Government is preparing guidance on GI and its delivery within the planning system, expected to be published in early 2020. This guidance will be a live document, designed to empower local authorities through a focus on procedure and process, proactivity and responding to the local context. Key to this aim is guidance on GI assessments, which will focus on 5 central steps:

- Understanding demand for GI;
- Spatially mapping existing infrastructure;
- Understanding the value existing infrastructure and the benefits it provides;
- Determining where the demand for GI is being met and where it is not; and
- Determining how best to meet demand.

7.2.3. It will also signpost to other relevant information, including spatial data and maps, and resource libraries. Key principles for GI in Wales are expected to include the need to be multifunctional, biodiverse, adapted for climate change, healthy, and smart and sustainable.

7.3 GI STANDARDS

7.3.1. NRW promotes the use of a Green Space Toolkit (developed by the Countryside Council for Wales in 2006, and updated in 2011) to help local authorities plan and improve natural green spaces for people in towns and cities.[94] A key component of the toolkit is the 'Accessible Natural Greenspace Standards', which enable local authorities to identify if there are enough of the right kind of green spaces, in the right places, to keep their citizens healthy. In this context, 'natural greenspace' means that the structure and quality of management of the green space combine to support high biodiversity and a distinctive sense of place. However, this does not preclude managed parkland or playing fields from being considered natural, as they may be considered so in part (if they are multifunctional as GI should be). The Toolkit's Accessible Natural Greenspace Standards are set out (on p.2) as follows:

> "CCW [now NRW] recommends that no person should live more than 300 m from their nearest natural greenspace. This is roughly the equivalent of a six-minute walk. A minimum of 0.25 ha is recommended. Provision should be made for at least 0.25 ha of accessible natural greenspace per 1000 population following a system of tiers into which sites of different sizes fit:
>
> - Tier 1: no person should live more than 300m from their nearest natural greenspace;

[94] Countryside Council for Wales (2011). The Greenspace Toolkit: A Practical Guide to Assessing the Resource and Implementing Local Standards for Accessible Natural Greenspace Provision in Welsh towns and cities.

- Tier 2: there should be at least one accessible site of >20ha within 2km of home;
- Tier 3: there should be one accessible 100ha site within 5km;
- Tier 4: there should be one accessible 500ha site within 10km."

7.3.2. NRW also supports the Green Flag Awards,[95] which encourage good management of local green spaces, and independently assesses how well these are being looked after. The Green Flag Awards is a voluntary standard, with 27 qualitative assessment criteria split across eight categories, including:

- A Welcoming Place – covering good and safe access for all as well as signage.
- Healthy, Safe and Secure – covering appropriate provision of good quality facilities, equipment and activities, personal safety, and issues around dogs.
- Well Maintained and Clean – covering litter/cleanliness and maintenance of grounds, trees, buildings and equipment.
- Environmental Management – covering use of energy, resources, chemicals and peat, production of waste, and climate change adaptation.
- Biodiversity, landscape and Heritage – covering management and conservation of natural and landscape features, buildings and structures.
- Community Involvement – covering active involvement in decision-making and site projects, and meeting of community needs.
- Marketing and Communication – covering provision and communication of events, activities and information.
- Management – covering the implementation of the site's management plan.

7.3.3. Outside of Wales, the emerging Framework of Green Infrastructure Standards being developed by Natural England sets out useful principles for achieving 'good GI' that could be applied in any location:

- NP01 - Engagement and multifunctionality: Engage with local communities and other stakeholders regarding LDP development and develop GI policies and partnerships in consultation with a wide variety of stakeholders and community groups.
- NP02 - Managed, maintained and funded: Ensure that proposals for GI are embedded within LDPs and/or GI strategies. GI proposals emerging from development (both on- and off-site) should include clear provision of long term management and stewardship (including the funding for this).
- NP03 - Strategically planned: GI should be considered as a network, with strategic sites contributing to ecological networks and the wider landscape. Local level GI should continue to be targeted at meeting local needs.

[95] NRW (2020). Green spaces (online). Available from: https://naturalresources.wales/about-us/what-we-do/green-spaces/local-green-spaces/?lang=en. Accessed 8th April 2020.

- NP04 - Well designed: The design of developments and associated GI should take into account local landscape character and geodiversity.
- NP05 - Multiple benefits: GI should be planned and delivered with ecosystem service provision in mind, with multi-functionality being a clear goal (where this is feasible).
- NP06 - Meets people's needs: Addressing gaps and quality/accessibility deficiencies in GI provision should take the needs of local communities into account, with a focus on tackling inequalities and inequity in provision, e.g. in places with high levels of deprivation.
- NP07 - Health and wellbeing: GI planning and design should include measures to encourage more active lifestyles, environments that help people maintain and improve good mental health and designs capable of helping to manage issues such as air quality or road safety.
- NP08 - Biodiversity and nature recovery: Where possible, new GI should seek to provide stepping stones and linear connectivity for wildlife as well as for people, linking in to existing ecological networks.
- NP09 - Resilience to climate change: All GI provision and management should contribute to both climate change mitigation (e.g. carbon storage/sequestration or lowering fossil fuel usage through building energy use and transport choices), and adaptation measures to cope with increasing heat stress and surface water flood risk due to climate change.
- NP10 - Drives value: GI is a key aspect of sustainable development, creating better places in which to live and work, making less attractive places more investable, and helping to make development (more) acceptable to communities.

7.3.4. Other standards in operation elsewhere in the UK include:

- Building with Nature Standard

  This is a voluntary UK-wide standard. If a development site meets a minimum number of the 23 specified qualitative standards, then the developer, or local authority, may apply for 'Building with Nature Accreditation'. A successful application will be awarded either 'Building with Nature Good' or 'Building with Nature Excellent', depending on which standards have been met. There are five 'core' standards, and six standards for each of the thematic groups of 'wellbeing', 'water', and 'wildlife'. For example:

  - "CORE2: The scheme identifies important local character features as a starting point for the green infrastructure proposals and incorporates them into the scheme to reference, reflect and enhance the local environment…
  - WELL4: The scheme supports local priorities for reducing and/or preventing health inequalities…
  - WAT1: Green infrastructure is integral to sustainable drainage and features are designed to minimise surface runoff, manage flood risk, and maintain the natural water cycle…

- WILD3: Green infrastructure delivers key measures that contribute to the target conservation status of key species."[96] (p.15-16)

To be eligible for either level, an applicant must demonstrate that they have met all five core standards. For 'Building with Nature Good' an applicant must demonstrate they have met all nine 'Good' standards (standards 1-3 in each theme). For 'Building with Nature Excellent', an applicant must demonstrate they have met all nine 'Good' standards plus six out of nine 'Excellent' standards.

- Fields in Trust's Green Space Index

  The Green Space Index (GSI) covers Great Britain and analyses publicly accessible local park and green space provision as mapped by Ordnance Survey. It is a freely available tool which includes map layers which are updated on an annual basis. The Green Space Index does not include regional park and green space land, such as national parks and common land, or other aspects of green infrastructure such as canal towpaths and grass verges. All of the data is included within the map tool and comprises the following: (1) Fields in Trust's unique GSI Score, where a score of 1 indicates a minimum standard of provision; (2) The total provision of parks and green spaces; (3) The provision per person; (4) The number of people who are not within a ten-minute walk of a park or green space. (For more information on the tool see http://www.fieldsintrust.org/green-space-index).

- Green Space Factor

  In general, a Green Space Factor (GSF) is a tool that assigns GI within a new development a score to determine whether it has met the requirements set by the relevant local authority. Variations of this have been adopted by a number of local authorities across Europe. For example, Swansea Council will apply a GSF in consideration of all development in the Swansea Central Area to identify the appropriate amount of permeable surface cover required in new developments.[97] On a scale of 0 (no permeability) to 1 (full permeability), a target score of 0.3 is expected by Swansea Council for predominantly commercial developments, and 0.4 for predominantly residential developments. As stated in the Swansea document, NRW considers the GSF tool as useful in demonstrating compliance with the Welsh Government's statutory SuDS Standard 2019.

- Biodiversity Net Gain

  The forthcoming Environment Bill, applicable in England, will "require development to achieve a 10% net gain for biodiversity". Unlike the more qualitative 'maintain and enhance biodiversity' requirement of the Environment (Wales) Act 2016, this standard will mandate the *quantification* of biodiversity units pre- and post-development to ensure a measurable net improvement.

[96] Building with Nature (2019) Building with Nature User Guide Version 1.4.
[97] Green Infrastructure Consultancy (2019). Swansea Central Area - Regenerating Our City for Wellbeing and Wildlife. Natural Resources Wales and City and County of Swansea.

7.4 GOOD PRACTICE POLICIES

7.4.1. This section sets out some examples of 'good practice' LDP development management policies from Wales, England and Scotland, focusing where possible on rural counties similar to Ceredigion.

Wales

7.4.2. Within rural Wales, GI is an increasingly important policy focus within emerging LDPs. For example, Flintshire's Deposit LDP (2019)[98] positions GI as a policy focus. Policy 57 (EN2: Green Infrastructure) states that:

"Development proposals will be required to protect, maintain and enhance the extent, quality and connectivity of the green infrastructure network, including designated green spaces…, and where appropriate:

> *a. create new green infrastructure linkages from the proposed development to the existing network; b. fill in gaps in the existing network to improve connectivity.*

Where the loss or damage of existing green infrastructure is unavoidable, appropriate mitigation and compensation will be required."

7.4.3. Whilst Policy 13 (STR13: Natural and Built Environment, Green Networks and Infrastructure) recognises the multiple benefits that environmental networks provide:

"Development will identify, respect, protect, enhance and connect Flintshire's environmental assets, to create a multifunctional network of natural and historic resources. To achieve this all development will:

- *i. Protect open countryside and the undeveloped coastline;*
- *ii. Protect the open character and appearance of green barriers;*
- *iii. Conserve, protect and enhance the quality and diversity of Flintshire's natural environment including landscape, biodiversity, the Dee Estuary and the Clwydian Range and Dee Valley AONB;*
- *iv. Promote opportunities to enhance biodiversity and ensure resilience;*
- *v. Maintain, enhance, and contribute to green infrastructure;*
- *vi. Create and protect green spaces and open space / play environments that encourage and support good health, well-being, and equality;*

  …
- *vii. Make financial contributions where appropriate, to facilitate and maintain the favourable conservation status of key environmental assets*
- *viii. Support measures to minimise the consequences of climate change;*
- *ix. Protect playing fields and open space from development; and*
- *x. Ensure adequate new open space and playing fields are provided as part of new housing development."*

[98] Available at: https://www.flintshire.gov.uk/en/Resident/Planning/Flintshire-Local-Development-Plan.aspx

7.4.4. Flintshire's Deposit LDP (2019) also recognises the importance of a well-developed GI network for the County's tourism industry. For example, Policy 10 (STR10: Tourism, Culture, and Leisure) states that:

"The intrinsic appeal of Flintshire's natural and built environment makes the County an attractive destination for sustainable tourism development. Development that capitalizes on these assets and creates a year round broad appeal will be supported. Particular emphasis will be placed on:

…

ii. Support development that promotes accessibility to Flintshire's landscape, cultural and historic assets, including the Clwydian Range AONB, coastline, rights of way, cycling and active travel networks;

…

iv. Conserving and enhancing Flintshire's natural, built and cultural heritage"

7.4.5. Finally, and most recently, GI is a thematic thread that runs throughout Monmouthshire's Pre-deposit Replacement LDP (2020)[99]. Strategic Policy S18 (Green Infrastructure, Landscape and Nature Conservation) focuses on the potential opportunities for local communities, stating that:

"Green Infrastructure assets and opportunities should embrace the placemaking approach and be designed and managed to deliver a multifunctional resource; capable of delivering a wide range of social, economic, environmental and health and well-being benefits for local communities and the County as a whole, including climate change action and mitigation."

7.4.6. In terms of development, the same policy states that:

"Development proposals must… maintain, protect and enhance the integrity and connectivity of Monmouthshire's green infrastructure, including landscape, biodiversity, public rights of ways and heritage assets through the following key functions:

i) Landscape Setting and Quality of Place, by identifying, protecting and, where appropriate, enhancing the distinctive landscape, historical, cultural, ecological and geological heritage, including natural and man-made elements associated with existing landscape character;
ii) Biodiversity and Resilient Ecosystems by protecting, positively managing and enhancing biodiversity and geological interests, including designated and non-designated sites, and habitats and species of importance and the ecological connectivity between them;
iii) Greenspace Provision, Connectivity and Enjoyment by ensuring the creation of accessible multifunctional interconnected spaces that offer opportunities for recreation and health and well-being;
iv) Sustainable Energy Use;
v) Local Food Production; and
vi) Flood Attenuation and Water Resource Management."

7.4.7.

[99] Available at: https://www.monmouthshire.gov.uk/planning-policy/pre-deposit-ldp-documents/

England

7.4.8. Academics have reviewed the environmental policies of a number of LDPs in England (specifically Birmingham, Central Bedfordshire, Greater London, Shropshire, Solihull, the South Downs, and Southampton)[100]. Alongside specific policies on GI, each of these LDPs had moderate to strong coverage of GI within other policies and the plan's overall strategic principles. Central Bedfordshire, Shropshire and the South Downs each comprise a mix of rural and small market towns and villages, and so are most similar to the County of Ceredigion.

7.4.9. The Central Bedfordshire North Core Strategy (2009)[101] embeds GI within strategic objective 11, policy CS17, and policy DM18. The authors of the review have commended the use of a strategically orientated planning policy supported by a development management policy; as well as the area-based and protection focus of the policy wording. In particular policy DM18 states that:

> *"The Council will promote and protect green infrastructure by ensuring that proposed residential and commercial development:*
>
> *• will contribute to the provision, extension and maintenance of green infrastructure in accordance with the requirements outlined in the area profiles in Chapter 3 Spatial Strategy, and in accordance with the mechanisms in the Planning Obligations Strategy.*
>
> *• which adversely affects identified green infrastructure assets and/or prevents the implementation of green infrastructure projects will not be permitted."*

7.4.10. The Shropshire Core Strategy (2011)[102] sets out strategic priorities linking to specific policies, which the authors of the review suggest reinforces GI linkages across multiple policy domains, thus helping integration. However, they also note that the term 'GI' does not feature explicitly in the plan policies, though the environmental networks policy (CS17) addresses GI indirectly and makes explicit reference to financing mechanisms. For example, it states:

> *"Development will identify, protect, enhance, expand and connect Shropshire's environmental assets, to create a multifunctional network of natural and historic resources. This will be achieved by ensuring that all development:*
>
> *• Protects and enhances the diversity, high quality and local character of Shropshire's natural, built and historic environment, and does not adversely affect the visual, ecological, geological, heritage or recreational values and functions of these assets, their immediate surroundings or their connecting corridors;*

[100] Scott, A., Hölzinger, O., Sadler, J., 2017. Making Plans for Green Infrastructure in England: Review of National Planning and Environmental Policies and Project Partners' Plans. Northumbria University & University of Birmingham.
[101] Available at: https://www.centralbedfordshire.gov.uk/info/45/planning_policy/462/adopted_north_local_development_framework/2
[102] Available at: https://www.shropshire.gov.uk/planning-policy/local-planning/core-strategy/

• Contributes to local distinctiveness, having regard to the quality of Shropshire's environment, including landscape, biodiversity and heritage assets, such as the Shropshire Hills AONB, the Meres and Mosses and the World Heritage Sites at Pontcysyllte Aqueduct and Canal and Ironbridge Gorge;

• Does not have a significant adverse impact on Shropshire's environmental assets and does not create barriers or sever links between dependant sites;

• Secures financial contributions, in accordance with Policies CS8 and CS9, towards the creation of new, and improvement to existing, environmental sites and corridors, the removal of barriers between sites, and provision for long term management and maintenance. Sites and corridors are identified in the LDF evidence base and will be regularly monitored and updated."

7.4.11. Most innovative of all is the South Downs Local Plan (2015)[103] which has adopted an ecosystem approach to its development management decisions. The authors commend Core Policy SD2 (Ecosystem Services) for helping to ensure that GI has a positive role in all planning applications through the focus on opportunities rather than constraints. For example, it states:

"Proposals that deliver sustainable development and comply with other relevant policies will be permitted provided that they do not have an unacceptable adverse impact on the natural environment and its ability to contribute goods and services. Proposals will be expected, as appropriate, to:

a) provide more and better joined up natural habitats;
b) conserve water resources;
c) sustainably manage land and water environments;
d) improve the National Park's resilience to, and mitigation of, climate change;
e) increase the ability to store carbon through new planting or other means;
f) conserve and improve soils;
g) reduce pollution;
h) mitigate the risk of flooding;
i) improve opportunities for peoples' health and wellbeing;
j) stimulate sustainable economic activity; and
k) deliver high-quality sustainable design."

7.4.12. Another English local plan with good practice policies on GI (published after the aforementioned academic review) is that of Cheshire East. The authority's Local Plan Strategy (2017)[104] recognises GI's contribution to sustainable development, with Policy SD 2 (Sustainable Development Principles) stating that:

[103] Available at: https://www.southdowns.gov.uk/planning/south-downs-local-plan_2019/local-plan/
[104] Available at: https://www.cheshireeast.gov.uk/planning/spatial_planning/cheshire_east_local_plan/local-plan-strategy/local_plan_strategy.aspx

"All development will be expected to… (ii) Contribute positively to an area's character and identity, creating or reinforcing local distinctiveness in terms of:

d. Massing of development - the balance between built form and green/public spaces;

e. Green infrastructure"

7.4.13. Meanwhile, Policy SE 6 (Green Infrastructure) states that:

"Cheshire East aims to deliver a good quality, and accessible network of green spaces for people to enjoy, providing for healthy recreation and biodiversity and continuing to provide a range of social, economic and health benefits. This will be done by:

Strengthening the contribution that sport and playing fields, open space and recreation facilities make to Cheshire East's green infrastructure network by requiring all development to:

i. Protect and enhance existing open spaces and sport and recreation facilities;

ii. Encourage multiple use and improvements to their quality;

iii. Provide adequate open space…;

iv. Contribute to the provision of outdoor sports facilities…;

v. Create or add to the networks of multi-functional Green Infrastructure;

vi. Secure new provision to help address identified shortages in existing open space provision, both in quantity, quality and accessibility;

vii. Locate open space facilities in appropriate locations, preferably within developments; and

viii. Promote linkages between new development and surrounding recreational networks, communities and facilities."

Scotland

7.4.14. As part of the testing of the 'Policy Assessment Tool' by academics for the 19 local authorities within the Central Scotland Green Network area in 2019, 'model' GI policies were also identified from the assessed local plans.[105] These model policies cover what development proposals should aim for in relation to water management, habitat enhancement, access networks, open space, stewardship, and GI more broadly (see Figure 7.1).

[105] Hislop, M., Scott, A.J. and Corbett, A. (2019) What Does Good Green Infrastructure Planning Policy Look Like? Developing and Testing a Policy Assessment Tool Within Central Scotland UK, *Planning Theory & Practice*, 20:5, 633-655, DOI: 10.1080/14649357.2019.1678667

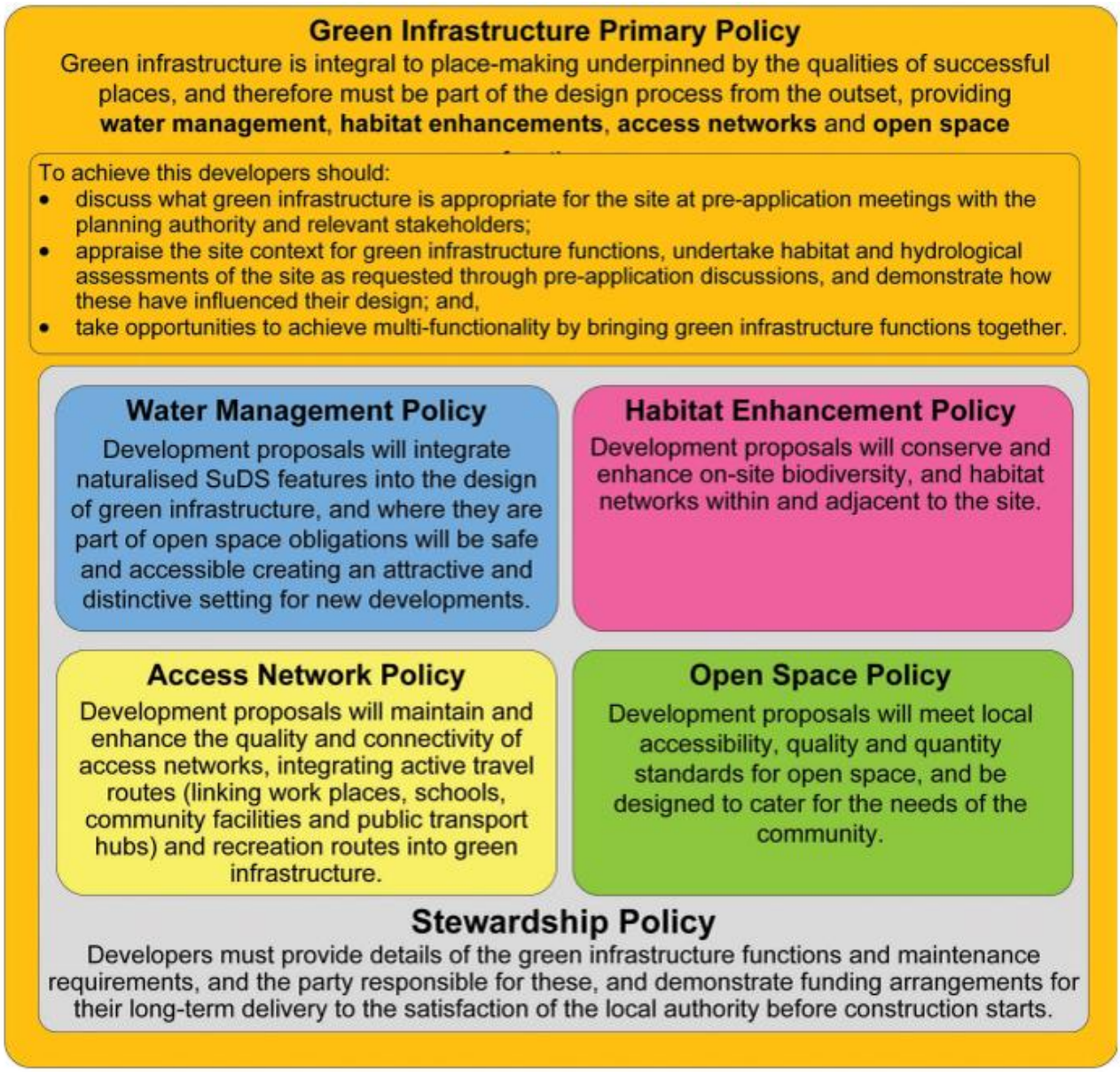


Figure 7.1: Model GI policies identified through the Central Scotland Green Network GI policy review (Source: Hislop et al., 2019, p.650)

7.5 REVIEW OF CEREDIGION'S LDP POLICIES

7.5.1. The Ceredigion LDP 2007-2022 was adopted in 2013, and is currently in the process of being updated.[106] An assessment of adopted development management policies has therefore been undertaken using the Policy Assessment Tool[107] to help inform updates to these policies so that they reflect the recent prominence given to GI through the Environment (Wales) Act 2016 and PPW10. Newly proposed policies have not been assessed.

7.5.2. The Policy Assessment Tool is useful for identifying the functional coverage of GI-related policy and the strength of associated policy wording across development plans (i.e. not just within specific GI policies). The tool uses a matrix approach with 26 assessment criteria – relating to seven different GI design elements within the three themes of integration, functions and aftercare – to assess each policy (see Figure 7.2 on the following page).

7.5.3. Note that the first GI design element (encompassing assessment criteria A-C) is only used when assessing a plan in its entirety, as these look at the mainstreaming of GI concepts across a plan. For this project, only development management policies within Chapter 8 of the LDP have been assessed using criteria D-Z.

7.5.4. For each policy, a score of 1-3 (or N/A) is given for each assessment criterion to indicate its level of GI coverage (e.g. frequency of references to GI terminology such as habitat, access, greenspace, Sustainable Drainage Schemes (SuDS) etc). For assessment criteria with relevant policy wording, the strength of this wording is then scored (also on a scale of 1-3) to indicate whether strong or weak phrasing has been used, e.g. 'must incorporate' vs. 'should incorporate if appropriate', or 'will be required' vs. 'is encouraged'. The key for the scoring is shown in Table 7.1.

Table 7.1: Key for scoring coverage of criteria and strength of policy wording (Source: Scott & Hislop, 2019, p.2)

Coverage of criteria	Score	Strength of policy wording
Some coverage	1	Weak phrasing
Reasonable coverage	2	Average phrasing
Full coverage	3	Strong phrasing

7.5.5. Summary scores are calculated automatically for each assessment criterion at the bottom of the matrix. As stated in the Policy Assessment Tool guidance, it is these summary scores that should be focused on to identify any gaps or weaknesses in the plan as a whole in relation to GI. However, in

[106] The emerging Replacement Local Development Plan (LDP2) underwent initial public consultation in mid-2019 (see https://www.ceredigion.gov.uk/resident/planning-building-control-and-sustainable-drainage-body-sab/planning-building-control/ceredigion-local-development-plan/ldp2-preferred-strategy-consultation/).
[107] Scott, A. & Hislop, M. (2019) Green Infrastructure Self-Assessment Tool – Draft Guidance.

this case it should be noted that the 2007-2013 LDP was written over 10 years ago when GI was not a requirement within planning policy.

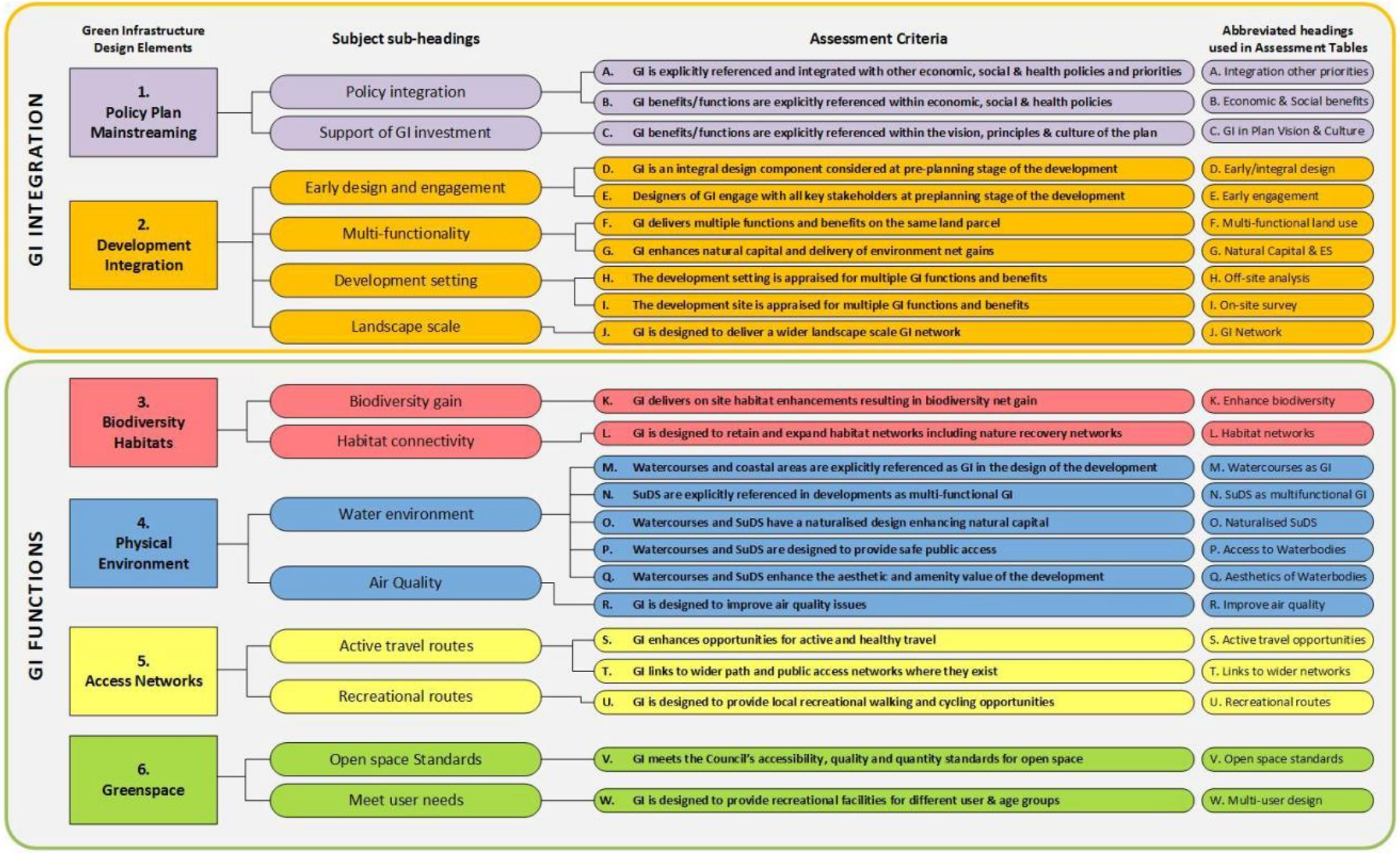


Figure 7.2: Themes and assessment criteria used in the Policy Assessment Tool (Source: Scott & Hislop, 2019, p.1)

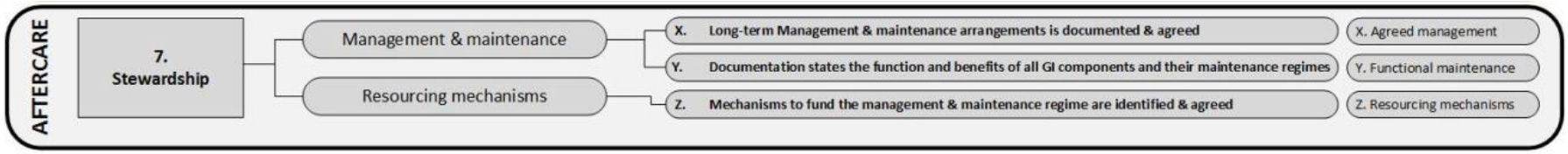


Figure 7.3 (Continued): Themes and assessment criteria used in the Policy Assessment Tool (Source: Scott & Hislop, 2019, p.1)

7.5.6. The matrix for the assessed development management policies (i.e. DM6, 10, 11, 12, 13, 14, 15, 20, 22 and 23), showing the coverage and strength scores for each of the assessment criteria is presented in Table 7.2 (see following page). A commentary based around the summary scores for the six assessed GI design elements follows. To assist CCC with identifying enhancements to individual development management policies (to be conducted later on in this project), an additional commentary is provided for each of the policies.

7.5.7. For the reviewed development management policies, the GI coverage is scored at 49%, whilst the strength of that policy wording is scored at 42% (out of a maximum of 100% for both).

Summary of Design Elements

7.5.8. The GI design element of Development Integration is fairly well addressed through the development management policies with reasonable coverage and average phrasing for the majority of assessment criteria. An exception is criterion E (some coverage and weak phrasing) as engagement with key stakeholders at pre-planning stages of the development is insufficiently addressed – there is just one reference to involving communities: “where a community is actively involved in the establishment of a woodland it *can be* very beneficial”. Criterion F has strong coverage via the same policy (DM20) where there are numerous references to the multi-functionality of woodland, including “visual amenity, ecological diversity, recreation and conservation”, “historic, cultural”, “community spirit and pride” and “reduce flood risk, increase land stability… and help screen out noise pollution”. Criterion H, though of reasonable coverage, has weak phrasing, using terms such as “will encourage” and “where appropriate”.

7.5.9. The Biodiversity element has the highest overall scores, reflecting full coverage through policies DM14, DM15 and DM20. Of these, DM20 also has strong phrasing, e.g. "Development will be permitted providing... it would achieve appropriate biodiversity gain". However, though requiring protection of biodiversity and habitats, policies DM14 and DM15 are let down by weaker phrasing in terms of enhancement, e.g. “Development will be permitted where it protects and, *where possible*, enhances biodiversity, geodiversity and ecological connectivity across Ceredigion...”.

7.5.10. Physical Environment has mixed coverage, and generally weak phrasing, whilst also being addressed through far fewer policies. Most promising is the frequent references to watercourses alongside other GI features (criterion M) in policy DM10, though these are only encouraged to be retained/replaced. Meanwhile, policy DM23 has adequate coverage and strength in terms of criterion P (access to waterbodies), e.g. “Coastal management schemes will be permitted provided: 4. Facilities for recreation and leisure are provided, where appropriate; and 5. Public access can be provided, where appropriate and maintained where already in existence.”

Table 7.2: Coverage and strength assessment scores for each of the DM policies

Total (Max=78)	**Score**	**%**
Coverage	38	49%
Strength	33	42%

Ceredigion Local Development Plan 2007-2022 Development Management Policies

		Green Infrastructure Design Elements and Assessment Criteria																							
		Development Integration							**Bio-diversity**		**Physical Environment**						**Access Networks**			**Green-space**		**Stewardship**		
		Early/integral design	Early engagement	Multi-functional land use	Natural Capital & ES	Off-site analysis	On-site survey	GI Network	Enhance biodiversity	Habitat networks	Watercourses as GI	SUDS as multifunctional GI	Naturalised SUDS	Access to waterbodies	Aesthetic of waterbodies	Ameliorate air quality	Active travel links	Links to wider networks	Recreational routes	Open space standards	Multi-user design	Agreed management	Functional maintenance	Resourcing mechanisms
		D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Policy DM6: High Quality Design & Placemaking	Coverage																							
	Strength																							
Policy DM10: Design & Landscaping	Coverage																							
	Strength																							
Policy DM11: Designing for Climate Change	Coverage																							
	Strength																							
Policy DM12: Utility Infrastructure	Coverage																							
	Strength																							
Policy DM13: Sustainable Drainage Systems	Coverage																							
	Strength																							
Policy DM14: Nature Conservation and Ecological Connectivity	Coverage																							
	Strength																							
Policy DM15: Local Biodiversity Conservation	Coverage																							
	Strength																							
Policy DM20: Protection of Trees, Hedgerows and Woodlands	Coverage																							
	Strength																							
Policy DM22: General Environmental Protection and Enhancement	Coverage																							
	Strength																							
Policy DM23: Coastal Management	Coverage																							
	Strength																							
Overall Scores	**Coverage**																							
	Strength																							

7.5.11. The element of Access Networks is not sufficiently addressed, as none of the assessed policies seek to provide links to wider recreational/travel networks beyond the development site[108]. However, provision for recreation (e.g. walking) *within* a site is addressed through DM14 (where 'opportunities exist'), DM20 (where new/enhanced woodland is 'encouraged' to improve recreation) and DM23 (though the latter does not specify whether 'facilities for recreation and leisure' relates to the coast itself, or man-made facilities).

7.5.12. The green space design element is least well addressed across the policies. There is only a brief reference to providing recreation opportunities for different user and age groups (criterion W), which is not explicitly linked to GI. The open space (criterion V) is only indirectly referred to in policies DM10 (landscaping) and DM20 (native broadleaf planting) and does not refer to standards. Policy DM06 also states that "development should…provide a safe environment by ensuring that the design of…open spaces consider safety principles".

7.5.13. Finally, Stewardship also has mixed coverage, with very little and only weak reference to maintenance of GI benefits (criterion Y) or their funding (criterion Z). For example, policy DM22 states "Where development *could significantly impact* these [ecosystem] services or processes it will be necessary to include a Management Plan to ensure that mitigation, compensation, restoration, works to achieve condition and enhancements will be successful", whilst policy DM20 states "The Council *may support* appropriate tree planting schemes in partnership with local communities and landowners." The documentation and agreement of long-term management plans (criterion X) has better coverage and strength, being covered by many policies. For example, DM15 states "It will be necessary for a development to include a management plan where it requires specific management to ensure that avoidance, mitigation, compensation and/or enhancements will be successful", and furthermore that management plans "should show how these factors will be managed over a period of time agreed by the LPA".

Summary of DM Policies

7.5.14. In terms of the development management policies specifically, DM06: High Quality Design and Placemaking has limited coverage across the GI design elements, excluding Physical Environment and Stewardship. However, there are few explicit mentions of GI but the phrasing of this policy is weak e.g. "Development *should*… retain important natural features…and [embrace] opportunities to enhance biodiversity and ecological connectivity".

7.5.15. DM10 (Design & Landscaping) has *some* coverage across all of the GI design elements except for Access Networks. Stronger elements of the policy relate to the range of different GI types, functions and benefits referred to, e.g. trees, hedgerows, water courses, SuDS, open space, biodiversity gains, surface water flooding and aesthetics. However, much of the phrasing for this policy is weak,

[108] Note, however that policy DM04 'Sustainable Travel Infrastructure as a Material Consideration' (not requested for inclusion in the review) states that this "should be achieved by providing connections to existing routes from new development, re-instating infrastructure that has fallen into disuse…", where such infrastructure includes existing/former/disused railway lines and rail sidings, public rights of way, and footways.

e.g. “Landscaping *can potentially* meet several of the LDP’s requirements... It *could also help* in relation to the implementation of SUDS and provision of open space”.

7.5.16. DM11: Designing for Climate Change is surprisingly silent on almost all of the GI design elements, though it does refer to PPW, TAN12 and TAN15 which contain additional “requirements and recommendations”. The only relevant (though weakly phrased) text is: “…further local design principles need to be considered. For example, there is an opportunity, *though not a requirement* to exceed the current Code for Sustainable Homes (CFSH) requirements or including design features that are not part of the CFSH. This *could for example* include overhanging roofs to accommodate greater rainfall or shutters on windows to allow for greater shade protection.” Mention of green infrastructure such as trees is surprisingly absent.

7.5.17. Policy DM12: Utility Infrastructure does not contain text of relevance to any of the GI design elements – it simply aims to “minimise damage or disturbance to the environment”.

7.5.18. Though SuDS are required for new development through the Flood and Water Management Act 2010, DM13: Sustainable Drainage Systems fails to discuss the stormwater attenuation benefits of SuDS, and does not acknowledge that SuDS are a multifunctional GI asset that can additionally provide aesthetic, amenity and biodiversity benefits. The strongest aspect of this policy is criterion X: “the maintenance and management of the system *will need to be secured* by either Section 106 agreements or in the future potentially via the Community Infrastructure Levy”.

7.5.19. Policy DM14: Nature Conservation and Ecological Connectivity is, as expected, strongest on the Biodiversity GI design elements, permitting development “where it protects and, *where possible, enhances* biodiversity, geodiversity and ecological connectivity across Ceredigion, including local sites and local priority species and habitats” – though biodiversity enhancement is mentioned as beneficial rather than as a requirement. This is one of the few policies to specifically mention consideration of off-site and indirect effects (criterion H). Furthermore, criterion U is addressed: “development should incorporate nature conservation education and access, providing the site’s ecological or geological integrity can be safeguarded”.

7.5.20. Biodiversity GI design elements are also reasonably well covered through policy DM15: Local Biodiversity Conservation. The strongest aspect is “Development will be permitted where: 2. Appropriate species, habitats and wildlife corridor/stepping stone enhancements have been incorporated into the development through good landscape and building design, or where applicable will be carried out offsite”. Whilst management plans are to be produced and agreed with the local authority, this is only where the development “requires specific management to ensure that avoidance, mitigation, compensation and/or enhancements will be successful”.

7.5.21. Policy DM20: Protection of Trees, Hedgerows and Woodlands has full coverage and strong phrasing in relation to requirements for biodiversity enhancement (criterion K), adding that “enhancement should in the first place be looked to be achieved adjacent to the area of loss and secured through planning condition or S106 agreements”. There are also frequent references to the multi-functional benefits that trees, hedgerows and woodlands provide, though wording is weak around enhancing these. This is the only policy that encourages early engagement with stakeholders (criterion E).

7.5.22. DM22: General Environmental Protection and Enhancement is the strongest of the development management policies in terms of appraising GI benefits on- and off-site (criteria H and I), stating “'development will be permitted provided that... a step-wise approach is adopted to ensure that it does not have a significant adverse effect on natural processes and ecosystem services, both on

and off site, and, where possible, seeks to restore, achieve favourable condition of or enhance associated features". It also has some coverage of many other GI design elements, though phrasing is frequently weak, e.g. "*where possible*, seeks to restore", "it also *aims to help*", "there *may be* conservation measures", and "'there *may* also be cases where restoration, works towards achievement of condition or enhancement *could occur*'".

7.5.23. Finally, policy DM23: Coastal Management has some coverage for a number of the assessment criteria, but generally refers to protecting the environment (i.e. reducing impacts) rather than enhancing benefits (of which a coast should have many), and again, phrasing is often weak. Its strongest aspects are the provision/maintenance of public access to the coast (criterion P) and provision of facilities for recreation and leisure 'where appropriate' (though it is unclear whether the latter would be natural or man-made facilities). Reference is also made to the Shoreline Management Plan (SMP) which "aims to identify sustainable coastal management options, taking into account the influences and needs of both the natural environment and the human and built environment".

7.6 SUMMARY AND IMPLICATIONS

7.6.1. PPW10 requires local authorities to take a strategic and proactive approach to GI, protecting, enhancing, and improving the use and multifunctionality of existing assets. Meanwhile NRW encourages local authorities to create new GI (of the right kind, in the right places) and to manage existing GI (to the best possible standard) in order to keep their citizens healthy; meeting Accessible Natural Greenspace Standards and Green Flag Award criteria will help with this process.

7.6.2. However, with the Ceredigion LDP 2007-2022 predating legislation, policy and guidance on GI in Wales, it is not surprising that the concepts of 'green infrastructure' and 'multi-functionality' are absent from the adopted development management policies. As such, there are a number of opportunities for the emerging LDP2, particularly regarding policies on landscaping (DM10) climate change (DM11), SuDS (DM13) and coastal management (DM23) which would benefit from explicit references to enhancing natural capital and ecosystem service provision. Policies which do seek to protect and enhance biodiversity and ecosystem services (DM14, DM15 and DM20) would benefit from stronger phrasing that requires overall improvement (which ideally can be objectively measured), as well as a requirement to connect to wider GI, habitat and public access networks.

7.6.3. Based on this review, and the identified best practice policies from across the UK, it is recommended that emerging LDP2 policies related to development management commit landowners and developers to protect and enhance GI on their sites wherever possible, and to link this with surrounding GI in order to improve wider connectivity for both people and wildlife. The Environment (Wales) Act 2016 and PPW10 both give significant weight to biodiversity and GI; LDP2 will need to reflect this prominence. In addition, the emerging LDP2 should take into account the Welsh Government's forthcoming guidance on GI, expected to be published later in 2020.

7.6.4. More specific recommendations for inclusion in development management LDP2 policies include requiring developers to:

- Discuss with CCC at the pre-application stage regarding what type of GI and GI functions (ecosystem services) may be appropriate for the site;

- Set out through a GI proforma submitted with their planning application how GI (and ecosystem services) is taken into account in the scheme's design, and how it will be maintained and funded into the future;
- Protect existing on-site GI wherever possible;
- Improve the multi-functionality of any required sustainable drainage features (focusing in particular on biodiversity, aesthetic, and connection with nature benefits);
- Enhance on-site biodiversity, and where possible link with core ecological areas, linear corridors or stepping stones beyond the site boundary;
- Ensure that on-site recreation routes link in with the wider PROW network and any active travel routes;
- Meet specific standards for the quality and quantity of on-site GI provision, e.g. relating to permeability (using the Green Space Factor); or wellbeing, water and wildlife (using Building with Nature); and
- Fund GI creation/enhancement projects elsewhere if they are unable to do so on-site.

7.6.5. Inclusion of a specific GI policy is also recommended for Ceredigion's emerging LDP2. As well as referring to the development-related points above, this should set out good practice principles for the planning of GI more generally (drawing on any GI framework that may be produced by CCC). For example, a Ceredigion GI policy could include points on:

- Promoting GI through collaborative and participatory processes (both within the Council, and externally with private, civic and community stakeholders);
- Enhancing connectivity within and across urban and rural areas for both people and wildlife;
- Developing GI standards which can be monitored and evaluated against measurable indicators;
- Enhancing both the variety and multi-functionality of GI, so as to improve the delivery of a suite of ecosystem services; [109]
- Improving the quantity, quality, accessibility and awareness of GI assets; and
- Monitoring, quantifying and potentially monetising the benefits of GI assets to help justify future investment and for inclusion in possible natural capital assessments and accounts.

[109] Ecosystem services can be quantified and assessed using a range of tools, for example Natural England's Ecometric, or the Natural Capital Planning Tool.

Appendix A

COUNTY DESIGNATIONS MAP

Appendix B

TOWN GI ASSETS MAPS

Appendix C

TOWN PHASE 1 HABITAT AREAS AND MAPS

The broad habitats discussed in section 2.5 are broken down into the following Phase 1 habitat typologies:

- Woodlands comprise JNCC codes A.1.1.1, A.1.1.2, A.1.2.2, A.1.3.2, A.2.1, A.4.1 and A.4.2.
- Grasslands comprise JNCC codes B.1.1, B.1.2, B.2.2, B.4 and B.5.
- Tall herbs and ferns comprise JNCC codes C.1.1, C.3.1 and C.3.2.
- Heathland comprises JNCC codes D1.1, D.2 and D.5.
- Mires comprise JNCC codes E.1.6.1, E.1.6.2, E.1.2, E.1.7, E.2.1, E.2.2, E.3, E.3.1 and E.3.1.1.
- Swamps comprise JNCC codes F.1 and F.2.2.
- Open water habitats comprise JNCC codes G.1 and G.2.
- Coastal habitats comprise JNCC codes H.1.1, H.1.2, H.1.3, H.2.6, H.3.1, H.3.2, H.4, H.6.5, H.6.7, H.6.8, H.8.1, H.8.2, H.8.4 and H.8.5.
- Rocks and waste comprise JNCC codes I.1.1.1, I.1.2.1, I.1.4.1, I.2.1, I.2.2 and I.2.4.
- Farmland is JNCC code J.1.1 only.
- Amenity grassland is JNCC code J.1.2 only.
- Urban habitats comprise JNCC codes J.1.3, J.1.4, J.3.4, J.3.6 and J.4.
- Hedgerows are JNCC code J.2.1 only.

The codes H.3.2, J.1.5 and J.3.7 are not employed as part of the JNCC Phase 1 habitat survey methodology, and so are un-named in the table.

Table C.1: Area (ha) of Phase 1 habitat types within each town (including 2 km buffer zone)

Phase 1 habitat type		Aberystwyth	Aberaeron	Cardigan	Lampeter	Adpar	Llandysul	Tregaron	TOTAL
A.1.1.1	Broadleaved semi natural woodland	179.6	77.8	168.8	55.9	183.5	157.9	55.3	**878.8**
A.1.1.2	Broadleaved plantation woodland	5.4	1.3	3.6	34.5	1.6	2.5	1.1	**49.9**
A.1.2.2	Coniferous plantation woodland	69.1	38.3	25.9	102.7	40.6	16.5	19.5	**312.5**
A.1.3.2	Mixed plantation woodland	20.4	5.9	10.8	25.5	7.1	24.8	0.9	**95.5**
A.2.1	Dense scrub	47.7	27.2	64.4	11.4	31.4	27.0	12.0	**221.2**
A.4.1	Broadleaved recently felled woodland		1.0			0.5			**1.4**
A.4.2	Coniferous recently felled woodland			1.5	9.3		0.4		**11.2**
B.1.1	Unimproved acid grassland	6.9	4.2	0.1			0.5	3.6	**15.3**
B.1.2	Semi-improved acid grassland	3.8		0.6	0.8		4.0	16.0	**25.1**

Phase 1 habitat type		Aberystwyth	Aberaeron	Cardigan	Lampeter	Adpar	Llandysul	Tregaron	TOTAL
B.2.2	Neutral semi improved grassland	69.7	30.1	95.7	63.6	72.0	59.8	17.7	**408.6**
B.4	Improved grassland	1,805	977.4	1,797	1,817	1,190	1,673	1,527	**10,786**
B.5	Marshy grassland	12.5	1.8	25.7	31.5	8.5	18.4	88.1	**186.5**
C.1.1	Continuous bracken	32.9	10.2	18.7	4.8	11.1	18.7	22.3	**118.7**
C.3.1	Other tall herb and fern - ruderal	2.5	1.4	0.5	1.8	3.1	0.1	1.2	**10.7**
C.3.2	Other tall herb and fern- non-ruderal		<0.1	<0.1					**0.1**
D.1.1	Acid dry dwarf shrub heath	9.9		<0.1					**10.0**
D.2	Wet dwarf shrub heath		0.3					0.4	**0.7**
D.5	Dry heath/ acid grassland mosaic	15.2							**15.2**
E.1.6.1	Sphagnum bog - Blanket bog			<0.1					**<0.1**
E.1.6.2	Sphagnum bog - Raised bog							85.5	**85.5**
E.1.7	Wet modified bog							28.4	**28.4**
E.2.1	Acid/neutral flush							0.4	**0.4**
E.2.2	Basic flush			0.1					**0.1**
E.3	Fen			0.1					**0.1**
E.3.1	Fen			0.9				0.2	**1.0**
E.3.1.1	Fen							7.5	**7.5**
F.1	Swamp	1.9		29.4	2.1	0.2		4.1	**37.7**
F.2.2	Inundation vegetation	2.0		2.1	1.5	0.1		0.3	**6.0**
G.1	Standing water	0.6	0.1	3.3	3.2	1.0	1.1	1.3	**10.5**
G.2	Running water	23.4	6.4	91.3	21.3	28.4	25.6	18.1	**214.4**
H.1.1	Intertidal - Mud/sand	3.7		51.9					**55.6**
H.1.2	Intertidal - Shingles/cobbles	17.5	65.5	7.0					**90.0**
H.1.3	Intertidal - Boulders/rocks	24.9	2.0	0.3					**27.1**
H.2.6	Dense saltmarsh	1.2		26.2					**27.4**
H.3.1	Coastland - shingle above high tide mark	0.9		3.2					**4.1**
H.3.2	Unknown	9.7	3.6	1.8					**15.2**

Phase 1 habitat type		Aberystwyth	Aberaeron	Cardigan	Lampeter	Adpar	Llandysul	Tregaron	TOTAL
H.4	Boulders/rocks above high tide mark	0.2	2.4	0.2					**2.8**
H.6.5	Sand dune - Dune grassland			5.4					**5.4**
H.6.7	Sand dune - Dune scrub			25.2					**25.2**
H.6.8	Sand dune - Open dune	4.1		4.7					**8.8**
H.8.1	Hard cliff	7.5	2.7						**10.2**
H.8.2	Soft cliff	0.1	1.4	1.3					**2.9**
H.8.4	Coastal grassland	5.3	0.2						**5.5**
H.8.5	Coastal heathland	1.1							**1.1**
I.1.1.1	Acid/neutral inland cliff		0.1		0.3				**0.4**
I.1.2.1	Acid/neutral scree	1.4							**1.4**
I.1.4.1	Acid/neutral other exposure	0.2			<0.1		0.1		**0.3**
I.2.1	Quarry	1.0	0.3	19.5		0.7	0.1	2.1	**23.7**
I.2.2	Spoil			1.5	0.2			0.8	**2.5**
I.2.4	Refuse-tip	6.1						0.3	**6.4**
J.1.1	Arable	9.8	25.7	114.4	15.1	30.7	33.5	7.3	**236.5**
J.1.2	Amenity grassland	101.1	9.2	42.6	14.0	14.0	11.9	6.1	**199.0**
J.1.3	Ephemeral short perennial	0.2	0.2	0.3		0.2			**1.0**
J.1.4	Introduced shrub	0.4			0.3				**0.6**
J.1.5	Unknown	23.8	0.7	15.4	6.5	6.4	2.4	2.5	**57.7**
J.2.1	Intact hedge (km)	88.1	50.6	75.4	136.8	27.5	61.8	9.4	**449.6**
J.3.4	Caravan site	36.6	15.4	0.2			1.0		**53.2**
J.3.6	Buildings	315.0	94.9	184.6	128.5	95.0	85.9	46.1	**949.9**
J.3.7	Unknown	2.3	0.5	3.6	6.4	0.8	2.7	3.7	**19.9**
J.4	Bare ground	8.6		7.2	1.8	0.5	2.5	0.3	**20.8**
NA	No access to site for survey	9.8	10.8	10.9	7.6	6.7	6.9	0.7	**21.3**
TOTAL MAPPED AREA		**2,901**	**1,419**	**2,868**	**2,367**	**1,734**	**2,178**	**1,980**	**15,415**

Appendix D

CONNECTIVITY FOR WILDLIFE MAPS

The connectivity for wildlife maps comprise the following layers:

- Core Ecological Assets:
  - Sites of Special Scientific Interest (SSSIs);
  - Local Nature Reserves (LNRs); and
  - Priority habitats, comprising the following Phase 1 habitat types:
    - A.1.1.1 Broadleaved semi natural woodland
    - B.1.1 Unimproved acid grassland
    - B.1.2 Semi-improved acid grassland
    - D.1.1 Acid dry dwarf shrub heath
    - D.2 Wet dwarf shrub heath
    - D.5 Dry heath/ acid grassland mosaic
    - E.1.6.1 Sphagnum bog - Blanket bog
    - E.1.6.2 Sphagnum bog - Raised bog
    - E.1.7 Wet modified bog
    - E.3 Fen
    - E.3.1 Fen
    - E.3.1.1 Fen
    - F.1 Swamp
    - G.1 Standing water
    - H.1.1 Intertidal - Mud/sand
    - H.1.2 Intertidal - Shingles/cobbles
    - H.1.3 Intertidal - Boulders/rocks
    - H.2.6 Dense saltmarsh
    - H.3.1 Coastland - shingle above high tide mark
    - H.6.5 Sand dune - Dune grassland
    - H.6.7 Sand dune - Dune scrub
    - H.6.8 Sand dune - Open dune
    - H.8.1 Hard cliff
    - H.8.2 Soft cliff
    - H.8.5 Coastal heathland
    - I.1.1.1 Acid/neutral inland cliff
    - I.1.2.1 Acid/neutral scree.
- Linear Corridors:
  - J.2.1 Intact hedge;
  - Watercourses; and
  - Urban tree cover.
- Stepping Stones:
  - Sites meeting SINC (Sites of Importance for Nature Conservation) criteria;
  - OS Greenspace – Accessible; and
  - Cemeteries.

Appendix E

ECOSYSTEM SERVICES NEEDS MAPS

Needs maps for each of the seven towns (plus buffer areas) have been produced for the following ecosystem services:

- Air quality – this shows the average level (µg/m^3) of background air pollution for each 1km grid square in the study areas, based on Defra's 2016 annual emissions of particulate matter (PM_{10});
- Flood reduction – this shows the proportion of each 1 km grid square in the study areas that is at risk of surface water flooding from a 1 in 100 year event (using NRW data);
- Recreation - this shows the proportion of each 1 km grid square in the study areas that is covered by physical GI assets (those accessible for recreation, but excluding linear assets such as PROW/cycle routes as the latter could not be included in the area-based analysis);
- Health and wellbeing – this shows the level of health deprivation (on a scale of 1 = most deprived to 10 = least deprived) for each 1km grid square in the study areas, based on the Health & Wellbeing domain of the Welsh Indices of Multiple Deprivation (IMD); and
- Level of tree and woodland cover – this shows the proportion of each 1km grid square in the study areas that is covered by tall, woody vegetation (i.e. trees, hedges and woodlands) – one of a number of possible measures of aesthetic beauty.

Appendix F

ONLINE SURVEY

Ceredigion County Council are currently preparing a Green Infrastructure Assessment and we would like to give you the opportunity to get involved.

Green Infrastructure (GI) is the network of natural and semi natural features, green spaces, rivers and lakes. These features can be found in both rural and urban areas and includes not just the conventional open spaces such as parks and playing fields, but also features such as street trees, PROW, and rivers. GI provides a range of benefits to the residents of Ceredigion, including access to nature and recreation opportunities, as well as reduced flood risk, improved air and water quality, and removal of carbon from the atmosphere.

Our GI Assessment will cover seven towns in the County:

- Aberystwyth
- Aberaeron
- Cardigan
- Lampeter
- Adpar
- Llandysul, and
- Tregaron

However, we would like to find out more about how you use green spaces, wherever you live in Ceredigion and how important they are to you.

Q1 Where do you live?

- Aberystwyth
- Aberaeron
- Cardigan
- Lampeter
- Adpar (or neighbouring Newcastle Emlyn)
- Llandysul
- Tregaron
- Elsewhere in Ceredigion – please specify
- Outside of Ceredigion – please specify

Q2 What areas of green space do you currently use and how often do you use it?

	Daily	More than once a week	Once a week	More than once a month	Once a month	Less than once a month
Local footpaths						
Wales Coast Path						
Other routes promoted by Ceredigion Council or an organisation such as the RSPB						
National Cycle Network						
Public park or garden such as Llandysul Memorial Park or Square Field in Aberaeron						
Sports ground or playing field						
Children's play area						
Allotment						
Informal areas of local green space						
Woodland / forest						
Beach						
River						
Lake						
Open countryside						
Nature reserve						

Q3 Why do you use green space? Please select all that apply

- Walking the dog

- Commuting
- Access to services
- Recreation
- Meeting with friends
- Keeping fit / health benefits
- To relax
- To spot wildlife
- Other – please specify

Q4 How important do you think the green spaces in your town are for:

	1 (not very)	2	3	4	5 (very)
Exercise and physical health					
Relaxation and mental wellbeing					
The attractiveness of your town					
Bringing people together					
Quality of life in your community					
The contribution they make to the landscape and the views you see					
Supporting local wildlife					
Mitigating climate change (reducing carbon emissions)					
Adapting to climate change (reducing flooding and providing shade)					
Reducing air, noise and water pollution					

Q5 Would you like to make more use of local green space?

- Yes – go to Q6
- No – go to Q7

Q6 What are the barriers to you making more use of green space? Please tick all that apply

- I can't access the areas I would like to use – they are not open for public access
- I can't get there
- I don't have enough time
- There isn't enough green space near me
- The green spaces near me are not very nice/suitable
- Other – please specify

Q7 Are there any improvements you would you like to see made to your local green spaces?

- Yes – please specify
- No

Q8 Do you have any other comments or thoughts in relation to green spaces in Ceredigion more generally?

- Yes – please specify
- No

Q9 Would you be willing to answer some additional questions about yourself?

- Yes – please continue to Q10
- No – thank you for your time completing this survey

Q10 What is your age group?

- Under 16
- 16-24 years
- 25-44 years
- 45-64 years
- 65 +

Q11 What is your gender?

- Male
- Female
- Other
- Prefer not to say

Q12 Is your gender the same now as when assigned at birth?

- Yes
- No
- Prefer not to say

Q13 Which of the flowing options best describes how you think of yourself?

- Heterosexual/Straight
- Gay Man
- Gay Woman/Lesbian
- Bisexual
- Prefer not to say

Q14 Which of the following options describes your partnership?

- Married
- Living with partner
- Single
- Divorced
- Widowed
- Civil Partnership
- Other
- Prefer not to say

Q15 How would you describe your national identity?

- Welsh
- English
- Scottish
- Northern Irish
- Irish
- British
- Prefer not to say

Q16 What is your ethnic group? Chose one option that best describes your ethnic background.

- White
- Asian
- Black/African/Caribbean
- Mixed
- Gypsy Traveller
- Prefer not to say

Q17 What is your preferred language?

- Welsh
- English
- Prefer not to say

Q18 Can you understand, speak or write Welsh?

- Understand spoken Welsh
- Speak Welsh
- Read Welsh
- Write Welsh
- None of the above
- Prefer not to say

Q19 Do you have a long term physical or mental health condition or illness that reduces your ability to carry out day to day activities?

- Yes
- No
- Prefer not to say

Q20 If you answered 'Yes' please indicate which applies to you

- Hearing Impairment
- Visual Impairment
- Speech Impairment
- Learning Difficulties
- Mental Health Issues
- Physical/ Mobility impairment
- Prefer not to say

Q21 Do you look after or give help or support to family members, friends, neighbours or others because of either: Long term physical or mental ill-health/ disability; or Problems related to old age?

- Yes
- No
- Prefer not to say

Q22 What is your religion?

- Christian (all denominations)
- Buddhist
- Hindu
- Muslim
- Sikh
- Jewish
- Atheist
- No religion
- Prefer not to say
- Other

Appendix G

STAKEHOLDER-DERIVED SPATIAL OPPORTUNITIES AND MAPS

Table G1: Spatially-specific opportunities suggested by stakeholder workshop participants for Aberaeron

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
1	Protect Council owned green space between school & sea	2	Protecting existing GI	Aberaeron
11	Extend the Llanarchaeron cycle path to Lampeter (& then to Tregaron to join Ystwyth Trail)	1	New cycle routes	Aberaeron
12	Construct a cycle route straight from Aberaeron to Aberystwyth	1	New cycle routes	Aberaeron
13	Electric bike hire, loan & charging	1	Other green initiatives	Aberaeron
15	Potential for other uses including woodland planting, public access & allotments on County Council owned farm	1	Tree planting / Introduce new green spaces	Aberaeron
16	National Trust property at Llanerchaeron (outside boundary, but important natural & cultural asset)	1	Promoting the awareness and use of GI	Aberaeron
20	Extend the cycle path from Llanerchaeron to Ciliau Aeron or future new school	1	New cycle routes	Aberaeron
22	Potential to extend the cycle route to the south west	1	New cycle routes	Aberaeron

Table G2: Spatially-specific opportunities suggested by stakeholder workshop participants for Aberystwyth

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
1	Potential for trees to create corridor between two LNRs	2	Tree planting	Aberystwyth
3	Potential to connect the footpath & Open Access land	1	New walking routes	Aberystwyth
4	Potential to create more hedgerow, small woods etc, to improve habitat connectivity	1	Tree planting	Aberystwyth
5	Possible location for bridge	1	New walking routes	Aberystwyth
7	Potential for saline habitat creation to reduce coastal flooding	1	Flood reduction / Biodiversity enhancements	Aberystwyth
8	Potential for electric shuttle bus for coast path walkers between Llanrhystud & Aberystwyth	1	Other green initiatives	Aberystwyth
9	Potential for new cycle route(s) connecting Penrhyncoch, Bow Street, Capel Dewi with Aber town centre	4	New cycle routes	Aberystwyth
11	Potential for electric & free public transport system	2	Other green initiatives	Aberystwyth
13	Street trees are an important part of GI in urban environment	1	Tree planting	Aberystwyth
19	Tanybwlch ridge unstable putting coast path & other PROW at risk. Potential to improve access (perhaps create bund behind ridge to allow flooding) and create circular route whilst in keeping with managed realignment	1	New walking routes	Aberystwyth
20	Need for flood defence - largest community at serious risk of coastal flooding	1	Reduce flooding	Aberystwyth
21	Potential for a cycle path alongside the A44 to encourage visits to Bwlch Nant yr Arian and to link with path to Bow Street train station	1	New cycle routes	Aberystwyth
23	Potential to link up the various green areas within towns to promote biodiversity	1	Enhance biodiversity	Aberystwyth
26	Potential for grassland to be designated for tree planting or renewable energy	1	Tree planting	Aberystwyth
26	Potential for a cycle route from the Ystwyth Trail into Penparcau and then down Pen-y-Bont Hill to the Rheidol Trail	1	New cycle routes	Aberystwyth
27	Opportunity to work with Aberystwyth University to enhance river corridor through tree planting along south boundary	1	Tree planting	Aberystwyth
29	Potential for NFM measures before Rheidol river passes Glanyrafon industrial estate to lower flood risk	2	Reduce flooding	Aberystwyth

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
30	Opportunity to encourage access towards Cwm Woods through better surfacing along footpath	1	Improve maintenance and access	Aberystwyth
31	Opportunity to build a footbridge across the dingle between Brynymor Road & Cliff Terrace to create a continuous route from Constitution Hill to Parc Natur Penglais and beyond	1	New walking routes	Aberystwyth
32	Consider more hydro power schemes	1	Other green initiative	Aberystwyth
34	Potential for biodiversity enhancement through maintenance of Parc-y-Llyn riverside, including further Himalayan Balsam control and pond management	1	Enhance biodiversity	Aberystwyth
36	Potential for biodiversity enhancement through management of Plascrug Avenue, including areas of less closely mown grassland and improving the alder copse area to SW of the paths next to playground	1	Enhance biodiversity	Aberystwyth
38	Consider amenity tree planting on council owned land near Byrn y Mor road	1	Tree planting	Aberystwyth

Table G3: Spatially-specific opportunities suggested by stakeholder workshop participants for Adpar

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
7	Potential for a placemaking approach to residential development, with the design of the site done on a GI basis. Alternatively, financial offsetting could be used to invest in GI elsewhere	1	Introduce new green spaces	Adpar

Table G4: Spatially-specific opportunities suggested by stakeholder workshop participants for Cardigan

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
2	Highways in process of design/feasibility work for footway along St Dogmael's road. Coast path is current link, but needs another safe, direct route	1	New walking routes	Cardigan
3	Need for pavement and/or cycle path from Caemorgan road (Sand and Gravel junction) to complete the pavement from Cardigan to Blaenannerch	1	New walking routes / New cycle routes	Cardigan
7	Potential to extend the pavement between the town centre and Parc Teifi to connect the residents of Llangoedmor / Llechryd with town centre	1	New walking routes	Cardigan
8	Active Travel Route needed	1	New walking routes / New cycle routes	Cardigan
9	This land should not be developed to limit water going into the River Mwldan and reduce flooding in Llyn y Felin, Maesycoed and Felinban. The bridge at Llyn y felin should be re-built (ref report WS Atkins).	1	Flood reduction	Cardigan
12	Need to continue with NRW Flood Protection Plan (with CSC & Dwr Cymru)	1	Flood reduction	Cardigan
13	Potential to create new multi-purpose route on south side of St Dogmaels route (behind houses & gardens) instead of trying to re-open riverside PROW	1	New walking routes / New cycle routes	Cardigan

Table G5: Spatially-specific opportunities suggested by stakeholder workshop participants for Lampeter

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
1	Potential to convert disused railway into a cycle path linking to the coast, connecting to southern end of NCN822	1	New cycle routes	Lampeter
2	Potential for river corridor walk	2	New walking routes	Lampeter
4	Potential for more links to Long Wood	1	New walking routes	Lampeter
6	Potential to link Lampeter to Tregaron Ystwyth Trail (cycle route)	1	New cycle routes	Lampeter
8	Transition Town Lampeter working on cycle route north from Lampeter on old railway line	1	New cycle routes	Lampeter
9	Potential for new community woodland in this vicinity	1	Tree planting	Lampeter
13	Potential to enhance biodiversity and public enjoyment by bringing Old Quarry Pond into public ownership (conservation opportunities for rare rock cress *Rosippa islandica*)	1	Biodiversity enhancements	Lampeter
14	Potential to improve access to Olwen Wood from the town and acknowledge it as Accessible Green Space	1	New walking routes	Lampeter
15	Potential to link pathway from north to south of town via railway (funding dependent), and green corridor improvement	1	New walking routes / New cycle routes	Lampeter
17	Extend university playing field opening hours and improve accessibility for dog walkers	1	Improved maintenance and access	Lampeter
19	Potential to increase awareness through signage promoting walks around the town & associated green spaces, college grounds, etc	1	Promoting the awareness and use of GI	Lampeter
20	Potential to enhance landscape connectivity by linking woodland & tree connections river corridor	3	Tree planting	Lampeter
22	Potential for visual enhancement and reduced flood risk through wetland management (planting willow and woodland, hedgerow creation)	1	Flood reduction / Biodiversity enhancements	Lampeter
23	Opportunities for grassland management to reduce flood risk and enhance biodiversity	1	Flood reduction / Biodiversity enhancements	Lampeter
24	Potential to improve school playing fields through biodiversity enhancements and increased access for dog walkers	2	Biodiversity enhancements	Lampeter

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
25	Development & promotion of walking routes using existing PROW through signposting/online material. Potential to open up or surface parts of routes.	1	Improved maintenance and access	Lampeter
26	Opportunity for biodiversity enhancement in parks and green spaces in town (wildflower patches, leaving areas of grass uncut along hedgerows during flowering season, planting trees - fruit & native sp.)	1	Biodiversity enhancements	Lampeter
27	Potential to extend the link from Lampeter down toward Aberaeron	1	New cycle routes	Lampeter
28	Potential to improve Market Street surface water drainage, via new trees planted with recreational area (funding application for this currently underway at CCC)	1	Tree planting / Flood reduction	Lampeter
29	Use pavement 'peninsulas' to plant small rootball trees to provide shade & greenery, whilst incorporating much-needed seating in planters	1	Tree planting	Lampeter
30	Potential to create PROW between new Cwrt Dulas estate and rugby club lane, via new riverside walk, with an opportunity to link to current planning application for housing estate	1	New walking routes	Lampeter
32	Potential for biodiversity enhancement on unmanaged field to south of old tennis court area, west bank of Dulas, with an opportunity to link to University park landscaping project. Existing proposals worked up in 2008 by CCW/EA, University & Rivers Trust	1	Biodiversity enhancements	Lampeter
33	Potential for large scale planting at Harford Square, incorporating small rootball trees & seating areas	1	Tree planting	Lampeter
34	Potential to create urban tree cover and seating area at Maestir Rd fork for tourism and recreational benefits	1	Tree planting	Lampeter

Table G6: Spatially-specific opportunities suggested by stakeholder workshop participants for Llandysul

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
3	Potential location (under power line) for electric vehicle charge point and office / garage for Dolen Teifi community transport	1	Other green initiatives	Llandysul
4	The new footbridge that forms part of Teifi Trail needs self-closing gates rather than stiles	1	Improved maintenance and access	Llandysul
5	Open park with trees as amenity for local residents (Parc yr Ynn and The Beeches)	1	Tree planting / Introduce new green spaces	Llandysul
6	Possible allotment site	1	Introduce new green spaces	Llandysul
7	Opportunity for a green heating system for leisure centre	1	Other green initiatives	Llandysul
10	Enact existing access scheme for 2 footbridges across Teifi - one from playing field to paddlers lake land, 2nd from gorge path to half moon carpark - to create circular walk. Planning permission may need renewal.	2	New walking routes	Llandysul
11	Potential for project to control Japanese knotweed below road bridge, Llandysul gorge (in co-operation with Adfywio Llandysul and Paddlers)	1	Biodiversity enhancements	Llandysul
13	Opportunities for footpath connections along Teifi for links into town & circular walks	1	New walking routes	Llandysul
14	Opportunities for connecting woodland planting into wider landscape along river corridors	2	Tree planting	Llandysul
18	Opportunity to open up access heading west along river Teifi from current bridleway	1	New walking routes	Llandysul
19	Opportunity for improved signposting of Coed Foel to/from Llandysul	1	Promoting the awareness and use of GI	Llandysul
20	Potential for project to control Japanese knotweed along river	1	Biodiversity enhancements	Llandysul
21	Improve link between the upper areas of the village and main centre by resurfacing and potentially upgrading to a cycle path	1	Improved maintenance and access	Llandysul
22	Potential for amenity tree planting along council maintained areas of highway	1	Tree planting	Llandysul
23	Potential for amenity tree planting along Llyn y Fran road	1	Tree planting	Llandysul
24	Potential for amenity tree planting and woodland management in areas of public land	1	Tree planting	Llandysul

Table G7: Spatially-specific opportunities suggested by stakeholder workshop participants for Tregaron

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
1	Need for a link from Ystwyth Trail (ends at Cors Caron) to town centre, currently NCN route but on-road & dangerous	3	New cycle routes	Tregaron
4	Opportunity for Cycle route to Lampeter following disused railway	1	New cycle routes	Tregaron
5	Potential for tree planting and greenspace in Tregaron	1	Tree planting	Tregaron
6	Potential to extend the cycle track	1	New cycle routes	Tregaron
9	Need for the cycle route to extend right into Tregaron	1	New cycle routes	Tregaron
10	Potential for biodiversity enhancements and a riverside walk behind garage	1	New walking routes / Biodiversity enhancements	Tregaron
11	Possible project to enhance NRW-owned flood asset field for public use & biodiversity, linked to riverside walk (10). Draft scheme worked up in 2012 by NRW, Shared Earth Trust & Town Council	1	Biodiversity enhancements	Tregaron
14	Potential health and wellbeing and economic benefits from increasing connectivity to Cors Caron RAMSAR	1	Biodiversity enhancements	Tregaron
15	Opportunities for a wider landscape character approach through wet grassland habitats and flood meadows linking Cors Tregaron	2	Biodiversity enhancements	Tregaron
17	Opportunities for woodland connection along rivers & fields	1	Tree planting	Tregaron
18	Council are interested in the playing field of the old primary school	1	Introduce new green spaces	Tregaron
19	Access to ROW denied by farmers	1	Improved maintenance and access	Tregaron
20	Opportunities for circular walks and paths linking wetlands/woodlands/disused railway to town, avoiding road sections	4	New walking routes	Tregaron
23	Access to ROW denied by new landowner	2	Improved maintenance and access	Tregaron

Table G8: Spatially-specific opportunities suggested by stakeholder workshop participants for Ceredigion County as a whole

Map ID	Comment	No. of respondents	Type of opportunity	Settlement
3	Potential to link Penglais and Cwm y Coed LNR woodlands with woodland	1	Tree planting	County
6	Potential for appropriate habitat enhancements to link these sites	1	Biodiversity enhancements	County
10	Potential for a circular cycle route connecting Aberystwyth, Aberaeron, Lampeter and Tregaron	1	New cycle routes	County
13	General need for footpaths to connect villages (Eglwys Fach, Ffwrnais, etc)	1	New walking routes	County
14	Potential to create barrage across the bay to produce electricity and protect the town from waves	1	Other green initiatives	County
15	Need for more electric charge points for cars, potentially at all Council offices at first. [Point shows location of a current charge point].	1	Other green initiatives	County
18	Flood defence scheme needed at rivers Beulan and Leri at Talybont, as well as work at Cwm Slaid to prevent flooding down steep slope	3	Flood reduction	County
19	Flood defence work needed at River Aeron above Talsarn	1	Flood reduction	County
20	Opportunities to enhance broadleaved woodland connections along Cwm Rheidol up to Elenydd	1	Tree planting	County
21	Opportunities to enhance walking and cycling connections to Hafod estate and between Rheidol and Ystwyth	1	New walking routes / New cycle routes	County
22	Opportunities to connect villages along Ystrad Aeron between Lampeter and Aberaeron with green infrastructure corridors	2	New walking routes / New cycle routes	County
25	Opportunity to create new cycle route between Aberystwyth and Bow Street, connecting with new park and ride station and avoiding dangerous road between Waunfawr & railway bridge	1	New cycle routes	County
28	Path closed since storm over a year ago due to trees fallen across path from Tynberllan to Penlan	1	Improved maintenance and access	County

Appendix H

EXAMPLE GI PROFORMA

The following is used by developers to explain how they have considered GI and ecosystem service provision in the design process.

Table I1: GI proforma for completion by developers in Teignbridge

	ROLES AND BENEFITS	EXPLAIN
Environmental	Biodiversity - Increased abundance and diversity Landscape - Strengthen character and quality Townscape - Improved attractiveness and sense of place	
Climate change	Flood Risk & Water Resource - Improved flood management, water quality and storage Renewables - Source(s) of renewable energy Local Food - Increased production of local foodstuffs Sustainable Transport - Improved provision for walkers, cyclists and public transport users, including better connectivity and integration Waste Management - High levels of on-site composting Heat Islands - Moderation of microclimates	
Wellbeing	Health - Improved mental and physical health Air Quality - Improved air quality Crime - Natural surveillance to reduce the level and fear of crime Communities	

	- Creation of strong, vibrant and inclusive communities with 'civic pride' Culture - Improved connections with the past and creation of assets for the future Learning - Enhanced opportunities for study and education	
Regeneration	Thriving Economy - Improved environmental quality and connectivity of employment areas Productive Landscapes - Harness the potential of our natural resources in balance with environmental limits Tourism - Improved and extended tourism offer	

Mountbatten House
Basing View
Basingstoke, Hampshire
RG21 4HJ

wsp.com