

Strathclyde University

Preliminary Ecological Appraisal &
Biodiversity Enhancement Plan of
John Anderson Campus

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1 Executive Summary

Strathclyde University is an internationally renowned academic institution leading in the field of technology. The John Anderson campus is located in the centre of the city of Glasgow and benefits from its position close to the commercial, civic and cultural city centre

The continued degradation of the world's natural environment through anthropogenic activities including industrial development, farming practices and unsustainable use of natural resources has resulted in an unprecedented impact upon the world's biodiversity. The need to conserve, maintain and enhance biodiversity has been identified through a number of international, national and local strategies including Scottish Biodiversity Strategy "It's in Your Hands".

Through its Sustainability Policy Strathclyde University aims to be an exemplar of sustainable practice with its commitment to the implementation of Sustainability and Global Citizenship in accordance with its Excellence Agenda. A number of studies have shown the benefits of the development of the biodiversity green assets within each campus. These benefits include the health and well-being, improved reputation for green issues, effective use of space, improved connectivity with existing green habitat corridors, opportunities to use campus as a green laboratory, development of practical skills base and opportunities to work within partnerships.

To support its Sustainability Policy the University commissioned BSG Ecology to undertake a Preliminary Ecological Appraisal of the John Anderson Campus in August 2015. A desk study and field surveys were undertaken within nine areas of the Campus (Sites A-E). The survey results were used to identify a series of measures to enhance biodiversity within the Campus.

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2 Introduction

- 2.1 BSG Ecology has been commissioned by Strathclyde University to undertake a Preliminary Ecological Appraisal (PEA) of Strathclyde University John Anderson Campus. The campus is located within the centre of Glasgow city as shown in Figure 1 (Appendix A).
- 2.2 The aims of the PEA are as follows:
- To undertake an extended Phase 1 habitat survey of the 9 survey areas within the campus to identify and map the habitats present, providing details of any features of ecological interest associated with the site;
 - To assess the likely presence of protected and notable species; and
 - To identify the legislative and/or policy protection afforded to any habitats present or any species assessed as likely to be associated with the site.
- 2.3 The results of the PEA are used to inform the development of a Biodiversity Enhancement Plan for the site, which is presented in Section 5 of this report.
- 2.4 Strathclyde University is a leading international technological University, located close to the commercial, civic and cultural centre of the city of Glasgow. The University since receiving its charter in 1964, has expanded mainly eastwards from George Street along Cathedral Street, through decades of construction and acquisition of new buildings. The University is embedded within the City and forms part of the cities' "Learning Quarter" along Cathedral Street which includes the City of Glasgow College and Glasgow Caledonian University. Its location is important in contributing to the environment used by a significant population of walkers using the area and helps to shape the changing streetscape of the area. The University aims to be an exemplar of sustainable practice through its commitment to the implementation of Sustainability and Global Citizenship in accordance with its Excellence Agenda.

Benefits of Biodiversity Enhancement Plan to Strathclyde University

- 2.5 Biodiversity refers to the "biological diversity" of all living things on earth. It includes the abundance and diversity of ecosystems, species, genes and their interactions¹. With the ever-increasing use of natural resources and increased pollution of our natural environments, the need to conserve, maintain and enhance existing biodiversity sources is vital, with everyone having an important role to play.
- 2.6 International recognition for the need to conserve biodiversity was recognised in 1992 at the Earth Summit in Rio de Janeiro, with the signing of the "Convention on Biological Biodiversity". The United Kingdom set out its 20 year strategy in its document "Biodiversity: The UK Action Plan" including the underlying principle that "*The conservation of biodiversity requires the care and involvement of individuals and communities as well as Governmental processes*"². In Scotland, the Scottish Biodiversity Strategy "It's in Your Hands" was published in 2004, with the aim "*Conserving biodiversity for the health, enjoyment and wellbeing of the people of Scotland now and in the future*".
- 2.7 The PEA and Biodiversity Enhancement Plan will be used by the University to develop appropriate strategic documentation to enable it to more effectively protect, restore and enhance biodiversity. In

¹ Biodiversity on Campus, An EAUC practical guide

² Biodiversity: The UK Action Plan, DEFRA

particular, it is deemed necessary for the Biodiversity Enhancement Plan to contribute to the delivery across the following key areas:

- Best Practice – Applying best practice to grounds maintenance to maximise benefits for wildlife, without adversely compromising the aesthetic appeal of the estate, and the requirement to provide a safe environment to users.
- Utilisation of Available Space – Seeking opportunities to deliver biodiversity gain, through the use of inventive approaches, to maximise the space available for wildlife in an urban environment. This could include, but not be limited to, the provision of nesting, /roosting, foraging and over-wintering habitat in buildings and landscaping. This may be delivered through the use of wildlife installations, vertical green planting; vegetated roofs, habitat creation and the design of formal landscape planting to maximise biodiversity benefits.
- Connectivity – Identifying opportunities to manage the functional estate to enhance connectivity across urban Glasgow, through provision of stepping-stones and green corridors. Improved connectivity will promote the movement of wildlife between habitat patches for feeding and breeding purposes.
- Reputation – Provides an opportunity for the development for the reputation of Strathclyde University for good environmental practice.
- Promote biodiversity within the curriculum through increasing the opportunities for use of the campus grounds as an “outdoor laboratory”. They will also promote environmental awareness and personal responsibility amongst college users including, students and staff that will be taken into their chosen careers.
- Enhance the biodiversity of Glasgow through increased opportunities to work in partnership with stakeholders. It also provides opportunities for staff and students to work together on projects, which can create a stronger identity, belonging, and commitment to the University.
- Healthy and Well-Being – There are a number of studies that have shown the correlation between the presence of well-being and the improvement in physical and psychological health.
- Volunteering opportunities – Biodiversity on campus provides opportunities for students to gain practical experiences which may be beneficial in their career development. A range of work related skills, practical techniques and administration might all be developed through taking part in campus based biodiversity projects.

2.8 In parallel with the key areas described above for the Biodiversity Enhancement Plan, there is a requirement to integrate the common themes through the Estates Services Sustainability Policy³. Sustainability maintains economic, social and environmental systems at a capacity to endure and meet the needs of humans at a sustainable level for the future. The University's Sustainability Policy recognises the economic, social and environmental responsibilities of the University through its undertakings and outlines its commitment to the principles of sustainable development. It also recognises the important role of the University to stimulate debate and exchange information with communities and related stakeholders regarding sustainability. The University has identified a number of ways to become more sustainable through a range of initiatives including:

- Exceeding relevant legislative requirements and demonstrating best practice;
- Embedding sustainability into all strategies and activities of the University;
- Enhancing mechanisms and capacities for more sustainable practices in the management and maintenance of the University's estates;

³ University of Strathclyde (2010) Estates Services Sustainability Policy, May 2010, ver 2.

- Contributing to the development of and quality of life in Glasgow, Scotland and internationally; and
- Engaging with communities to enhance knowledge of sustainable living and engage with debates over sustainability.

2.9 The policy identifies a number of sustainable development principles which need to be addressed when planning, designing, constructing and managing the built environment. The University has developed a set of performance targets, which act as a framework for achieving a sustainable environment contained within the documents Sustainable Design Quality Standards – Minor Projects and Sustainable Design Quality Standards – Major Projects. The Sustainable Design Quality Standards (SDQS) aim to:

- Enhance Biodiversity –where the University commits to improving natural environments where possible through appropriate planting and water use, avoidance of chemicals in the external landscape; and preventing the use of materials that threaten species or habitats in the development;
- Create Healthy Environments – where the University seeks to enhance living, leisure and work environments through good design;
- Manage the Process - where the University expects all new and refurbished buildings exhibit exemplary sustainable design and should ‘respect biodiversity, and minimise pollution’;
- Support Communities;
- Use Resources Effectively and
- Minimise pollution.

2.10 There is an opportunity, through the delivery of the Biodiversity Enhancement Plan to provide examples of how biodiversity features can be incorporated into built environment and landscaping features to support target habitats and species. These examples would be used by design teams to guide how to incorporate biodiversity enhancements into future developments within the campus as outlined in the University’s ‘Campus Plan 2011’⁴. This should provide design teams with an accessible palette of options to bring the greatest biodiversity benefit to future developments from the outset. The options should be reviewed in accordance with the design principles and guidelines for the on-going development of the public realm on the campus⁵.

2.11 This report provides information on the importance of biodiversity in the local context (i.e. University of Strathclyde) (Sections 2 and 3). It goes on to describe the approach taken to understand the biodiversity interests of the University of Strathclyde functional estate (Section 4). It describes the findings of the desk study, meetings with key personnel, and outcome of the extended Phase 1 habitat surveys (site investigations) at the nine sites that are representative of the functional (urban) estate of John Anderson Campus (Section 5). Section 6 identifies a number of recommendations to increase the biodiversity value of the John Anderson Campus and outlines methods by which these enhancements may be achieved.

⁴ University of Strathclyde (2011) *Campus Plan 2011*

⁵ University of Strathclyde (2011) *Public Realm Design Guide 2011*

3 Benefits of Biodiversity

- 3.1 Biodiversity is the single most important indicator of the state of the environment around us and where we live. Human existence is dependent upon other organisms. Other species provide the oxygen that we breathe, recycle our waste, provide food, clean the water we drink, help to reduce flooding and pollution, provide fuel, food and clothing and produce chemicals used in our medicines. The natural world enriches the quality of our lives, providing positive effects upon human health, wealth and wellbeing and provides an invaluable educational, recreational and tourism resource.
- 3.2 It is essential to conserve biodiversity, since the planet's ecosystems are composed of communities of organisms that are interrelated. The variety of species and variations within any particular species is crucial because it enables organisms to adapt to natural changes in their environment and, for example, to respond to diseases.
- 3.3 Ultimately, the survival of species, including ourselves, depends upon maintaining the biodiversity of life on earth. We have a responsibility to be careful custodians of biodiversity, not only for human related purposes, but for the intrinsic value of biodiversity itself. This responsibility is one of the underpinning philosophies behind sustainable development so that humans safeguard existing biodiversity interests and repair human damage to biodiversity for the benefit of future generations. The benefits that people obtain from the natural world are often referred to as Ecosystem Services, which support and maintain a healthy environment for humans to live in. This includes the provision of food, clean water and air as well as protection from natural hazards such as flooding.
- 3.4 The UK National Ecosystem Assessment (NEA)⁶ clearly established the link between health and wellbeing and ecosystem services, identifying health and wellbeing benefits obtained from ecosystems and cultural ecosystem services. The UK NEA concluded that ecosystems provide three generic health benefits:
- Direct positive effects on both mental and physical health;
 - Indirect positive effects which facilitate nature-based activity and social engagement (by providing locations for contact with nature, physical activity and social engagement), all of which positively influence health, and provide a catalyst for behavioural change in terms of encouraging the adoption of healthier lifestyles (improving life pathways, activity behaviour, consumption of wild foods);
 - A reduction in the threats of pollution and disease vectors to health via a variety of purification and control functions, such as local climate regulation, noise reduction, and scavenging of air pollutants.
- 3.5 Within areas of the University of Strathclyde estate, there are several good examples of how biodiversity is playing an important role. The sensory experience to be had from a walk around the Sculpture Gardens is testament to this. Here the watercourse and range of mature ornamental trees all make a vital contribution in promoting human health and well-being. The Rottenrow Gardens provides a centre point for students and staff to interact with nature, within an urban setting.
- 3.6 Without biodiversity playing its part, Glasgow would be a very different place. The University of Strathclyde estate at John Anderson campus covers a diverse patchwork of land holdings, within an urban setting. This comprises University departments which are spread over approximately 39

⁶ UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment Technical Report. UNEP-WCMC, Cambridge.

buildings – within the Glasgow City area as shown in Figure 2. It is considered that there is significant potential to manage and enhance the biodiversity across the estate, including within the urban and built environment, which can be highly rewarding in respect of engaging staff and students, and raising public awareness, whilst delivering biodiversity enhancements

Guiding Documents

- 3.7 The following Table 1 includes summary descriptions and links to the legislation and policy framework relevant in the development of the University of Strathclyde Biodiversity Enhancement Plan. The overall spirit of this report takes into account these documents, particularly in the setting of aims, and development of projects to enhance biodiversity (refer Section 5).

Table 1 Guiding documents

Policy/Legislation/Guiding Document	Hyperlink
<i>Scottish Planning Policy</i> . The revised and updated Scottish Planning Policy (SPP) was adopted by the Scottish Government in 2014. The SPP sets out planning policies including those that relate to the protection of biodiversity.	http://www.gov.scot/Topics/Built-Environment/planning/Policy
<i>The National Planning Framework (NPF)</i> . Sets the context for development planning in Scotland and provides a framework for the spatial development of Scotland as a whole. It sets out the Government's development priorities over the next 20-30 years and identifies national developments which support the development strategy. Scotland's third National Planning Framework 3 was laid in the Scottish Parliament on June 23, 2014. As well as a framework for the spatial development of Scotland as a whole, it includes 14 national developments, identified to deliver the strategy.	http://www.gov.scot/Topics/Built-Environment/planning
<i>Scotland's Biodiversity: It's in Your Hands (2004)</i> . Sets out a vision for 2030 for the health of Scotland's biodiversity, in response to the European Biodiversity Strategy for 2020 and United Nations 'Aichi' targets.	http://www.gov.scot/Publications/2004/05/19366/37240
<i>2020 Challenge for Scotland's Biodiversity</i> . Focuses on the desired outcomes for 2020 and forms part of the Scottish Government's response to European Biodiversity Strategy for 2020 and United Nations 'Aichi' targets. The two documents together are now designated by the Scottish Government as comprising the <i>Scottish Biodiversity Strategy</i> .	http://www.gov.scot/Publications/2013/06/5538
<i>Nature Conservation (Scotland) Act (2004)</i> . Section 1 of the Nature Conservation Scotland Act 2004 states that 'It is the duty of every public body and office-holder, in exercising any functions, to further the conservation of biodiversity so far as is consistent with the proper exercise of those functions', the so called 'Biodiversity Duty'. In so doing, public bodies must take regard of the Scottish Biodiversity Strategy.	http://www.legislation.gov.uk/asp/2004/6/contents
<i>The Wildlife and Natural Environment (Scotland) Act 2011 (WANE Act)</i> . Makes amendment to the Nature Conservation Scotland Act 2004 and places an additional obligation on public bodies to report compliance with the Biodiversity Duty every three years.	http://www.gov.scot/Topics/Environment/Wildlife-Habitats/biodiversity/duty

Policy/Legislation/Guiding Document	Hyperlink
<p><i>Glasgow City Plan 2</i>. The City Plan forms part of the city's development plan and is used as a guide to inform development across the city up to 2014. The City Plan 2 has the following development and design policies for the environment:</p> <p>EN6 – To protect and enhance Glasgow's habitats and species</p> <p>EN7 – To maintain, protect and enhance national, regional and local sites of landscape, cultural or nature conservation importance</p> <p>EN8 – To protect trees, woodlands and hedgerows from inappropriate development</p>	<p>http://www.glasgow.gov.uk/CHttpHandler.ashx?id=13437&p=0</p>
<p><i>Glasgow Proposed City Development Plan</i>. The overarching strategy for the approach to development in Glasgow until 2026, which includes a vision, spatial strategy and core policies; two of which relates to Biodiversity:</p> <p>CDP6 – Green Belt and Green Networking</p> <p>CDP7 – Natural Environment</p>	<p>http://www.glasgow.gov.uk/CHttpHandler.ashx?id=19258&p=0</p>
<p><i>Strategic Development Plan – Main Issues Report – Background Report. Green Network Priorities</i>. Glasgow and the Clyde Valley Strategic Development Planning Authority. Identifies Green Network priorities and opportunities for the Clydeplan.</p>	<p>http://www.gcvgreennetwork.gov.uk/307-clydeplan-green-network-background-report</p>
<p><i>The Biodiversity Action Plan for Glasgow</i>. The Biodiversity Action Plan (BAP) is a document which sets out a plan to restore key habitats and species. The BAP plan for Glasgow contains details on Glasgow's Biodiversity Action Plan and explains how it is delivered. The habitat/species which are relevant to the site at John Anderson campus include: common frog <i>Rana temporaria</i>, Common toad <i>Bufo bufo</i>, dragonflies <i>Odonata</i> and damselflies <i>Zygoptera</i>, swift and the habitat 'Built up areas and Gardens'.</p>	<p>http://www.glasgow.gov.uk/index.aspx?articleid=6054</p>
<p><i>Biodiversity on Campus: An EAUC Practical Guide</i>. The guide contains advice on biodiversity enhancement and biodiversity initiatives through three sections including Institutional Context, Practical Management and Further Information.</p>	<p>http://www.eauc.org.uk/biodiversity_guide</p>

4 Approach taken to understand the Biodiversity Interests of the University of Strathclyde functional estate at John Anderson Campus

4.1 The Biodiversity Enhancement Plan is being developed to demonstrate what can be achieved by the University of Strathclyde in terms of overarching principles that can be applied elsewhere across the estate. The Biodiversity Enhancement Plan cannot be produced without knowledge of the nature of the existing habitats on the John Anderson campus.

4.2 Accordingly, a site meeting, an extended Phase 1 habitat survey and a desk study of existing information on the biodiversity within and around the campus have taken place across nine discrete sites / clusters of functional estate of John Anderson Campus, namely:

- Area A: Sculpture Gardens south of the John Arbuthnott Building
- Area B: Cathedral Street Gardens, to south of Lord Hope Building
- Area C: around the Lord Todd Village Office
- Area D: to the south of Thomas Campbell Court and to the south of James Blyth Court
- Area E: to the north of Barony Hall
- Area F: Rottenrow Gardens
- Area G: south of the Henry Dyer Building
- Area H: north of the Ramshorn Theatre
- Area I: University Centre – two areas, one adjacent to Cathedral Street, a second at the corner of Martha Street and North Frederick Street.

Desk Study

4.3 A desk study was undertaken to gather existing ecological records and data in relation to the site and the surrounding area, in order to provide an ecological context for the site and inform an assessment of likely effects of development.

4.4 Existing ecological and nature conservation data relevant to the site and within 1 km from its boundaries was collated from the MAGIC (Multi-Agency Geographic Information for the Countryside) online database. Biological records for the site were provided by Glasgow Museums Biological Records Centre. A 1 km radius desk study area is considered to be appropriate given the small size of the site (CIEEM, 2012). The University Estates Sustainability Team, were also consulted for supplementary information that might assist in the assessment of each of the nine sites.

Field Survey

4.5 A field survey was carried out by Greg Chamberlain MCIEEM, using the Phase 1 habitat survey methodology (JNCC, 2010), on the 16 August 2015. The Phase 1 habitat survey of the 9 survey areas are shown on Figure 2. Weather conditions on the day were full sunshine and did not impede the survey.

- 4.6 The survey involved walking over the site, mapping the principal habitat types and compiling detailed descriptions ('Target Notes') of key features. Habitat areas were identified and drawn onto a site plan in the field, and later digitised. The Target Notes record habitat features and provide a list of the predominant vascular plant species present, together with a qualitative assessment of relative abundance, where appropriate. All plant names in this report follow The New Flora of British Isles (Stace, 2010). The relative abundance of plant species within habitats marked with a Target Note is denoted according to the DAFOR system which uses the following qualitative categories: D - dominant; A - abundant; F - frequent; O - occasional; and R - rare. The prefix 'l' is applied to infer 'locally' abundant or frequent.
- 4.7 The Phase 1 habitat survey was extended to include observations on the presence of protected or notable species, or habitats suitable for such species; recorded as incidental information as part of the Target Notes. A full list of the Target Notes is included in Appendix B. Photographs were taken of key features and are presented in Appendix C.

Trees and Buildings

- 4.8 During the survey, all trees and buildings within the site boundary were inspected from the ground, using binoculars. The following features are those that have the potential to support roosting bats: trees - woodpecker holes, rot holes, splits or cracks, dead limbs, ivy cover and/or flaking bark (Section 8.2.5 of Hundt, 2012); buildings – cracks in building infrastructure, areas below soffit boards, loose tiles. Any trees and buildings with potential to support bat roosts, in line with the above, were recorded and descriptions provided in the Target Notes.
- 4.9 An on-site meeting with Jim Moffet, Grounds & Gardens Supervisor, Estates Services University of Strathclyde was undertaken on 18 August 2015. The aims of the site visit was;
- To identify habitat enhancement opportunities or potential to create ecological features to enhance biodiversity interest of the estate
 - To discuss routine grounds maintenance, and explore possibilities for additional integration of biodiversity.

Credentials of the Ecologist

- 4.10 This report and the survey have been completed by Greg Chamberlain, who holds a degree in Combined Sciences, an MSc in Conservation Environmental Management, and is a practising ecologist with over 20 years of applied experience. He is a full member and a Chartered Environmentalist of the chartered Institute of Ecology and Environmental Management (MCIEEM) and as such is bound by a professional code of conduct and is subject to peer review.

5 Results from Field and Desk Surveys

Desk Study

Designated Sites

- 5.1 Information on designated sites as supplied by Glasgow Museums Biological Records Centre is presented below with reference to the distance from the site boundary.

Statutory Sites designated for Nature Conservation

- 5.2 There are no statutory designated areas of nature conservation importance within 1 km of the site.

Non Statutory Sites designated for Nature Conservation

- 5.3 There are two non-statutory sites designated for nature conservation within 1 km of the site, as shown in Figure 1, Appendix A:

- Forth and Clyde Canal Glasgow Branch, Corridor of Wildlife and Landscape Importance (CWLI) - located 921 m north-west of the site.
- Necropolis, Local Site of Importance for Nature – located 219 m east of the site.

Habitats

- 5.4 Glasgow Museums Biological Records Centre returned no records of priority habitat within 1 km of the site.

Protected and Notable Species

- 5.5 Protected species are those that are protected under either national or international legislation, Notable species are those that are not legally protected but are of material consideration for the assessment of planning applications. This can include declining species either nationally or locally or those that are rare within the county or local area. They are often included within local Biodiversity Action Plans, listed as Species of Principal Importance (SPI) under Section 1 of the Nature Conservation Scotland Act 2004 or lists such as the Scottish Biodiversity List and Birds of Conservation Concern (Eaton et al, 2009). Records of protected and notable species within the 9 areas of the Anderson campus, and within 1 km of the campus are found in Appendix D. The relevant legislation and policy relating to these species is detailed in Appendix E.
- 5.6 The desk study recorded no protected and notable species within the 9 survey areas of the John Anderson campus.

Field Survey

- 5.7 The habitats recorded during the extended Phase 1 habitat survey are shown on Figures 3-11, Appendix A. Target Notes (TNs) on the figure can be cross-referenced to the text below, descriptions of Target Notes are provided in Appendix B.

5.8 Glasgow Biodiversity Action Plan Habitat and Species

- 5.9 As part of its commitment made at the Earth Summit in Rio de Janeiro in 1992, the UK Government published a Biodiversity Action Plan in 1994. A Scottish Biodiversity Group was established in 1996

to guide Scottish implementation. Local Biodiversity Action Plans (LBAP) are seen as a crucial method for implementing the UK Biodiversity Action Plan at the local level.

- 5.10 The damselflies common blue *Enallagma cyathigerum* and blue-tailed damselfly *Ischnura elegans* were recorded during the field survey along the artificial water course in Area A and within the tall ruderal habitat adjacent to the pond in Area F. Dragonflies are a group of species which are designated Glasgow LBAP species group.
- 5.11 The common frog (one male and two females) and common toad (three males) were recorded within the swamp and tall ruderal habitat surrounding the pond in Area F. Both common frog and common toad are Glasgow LBAP species.
- 5.12 Habitats within John Anderson campus are intensively managed and natural habitats are limited. One Glasgow LBAP Habitat recorded within the John Anderson campus is the category 'Built up areas and gardens'.

Survey Areas

Area A Sculpture Gardens - south of the Arbuthnott (Roberston Wing) Building

- 5.13 Area A comprises a mix of modern buildings, road infrastructure and hard landscaping (surfaced path/walkways), surrounding a central core of soft landscaping of the Sculpture Garden, and two separate areas of amenity grassland to the north and south. The soft landscaping is mostly limited to low maintenance ornamental shrub beds, individual scattered ornamental trees and frequently cut amenity lawns that are of limited biodiversity value. An artificial watercourse runs through the ornamental shrub beds along the west and northern boundary of the Sculpture Garden.

Habitat

- 5.14 The Sculpture Gardens are bordered by a number of faculty buildings including the Stenhouse Building, the Wolfson Building, the William Duncan Building and to the south by the Department of Architecture Building. The faculty buildings are multi-storey brick and concrete structures, largely with flat roofs with glass frontages (Photograph 1A).
- 5.15 The central section of the Sculpture Gardens comprises an area of amenity grassland with a sward dominated by meadow grass *Poa annua*, red fescue *Festuca rubra*, occasional perennial rye grass *Lolium perenne*, common bent *Agrostis capillaris*, and Yorkshire fog *Holcus lanatus* (Photographs 2A, 3A and 4A) (TN1). The grassland slopes from the south to the north, with the upper sections being damp and often waterlogged, where the sward contains occasional self-heal *Primula vulgaris* and rough-stalked feather-moss *Brachythecium rutabulum*.
- 5.16 Three other areas of amenity grassland are found within Area A: along the slopes directly south of the Arbuthnott (Roberston Wing) building, a small area to the east of Arbuthnott (Hamnet Wing); and an area to the south of the Department of Architecture building (Photograph 5A). The grassland sward is similar in composition to that found within the Sculpture Gardens.
- 5.17 The Sculpture Gardens are bordered by a series of shrub beds containing a range of non-native species including areas dominated by St John's wort *Hypericum beanie*, David viburnum *Viburnum davidii*, William Penn barberry *Berberis gladwynensis*, and Japanese spirea firelight *Spiraea japonica* (Photographs 3A and 4A). The shrub bed located to the eastern border of the area contains occasional variegated purple flowered cotoneaster *Cotoneaster salicifolius* and Portugal laurel *Prunus lusitanica*, azalea *Rhododendron indicum* and kaparga *Rhododendron arboretum* (TN2)
- 5.18 A linear shrub border located to the north of the department of Architecture building contains occasionally occurring heather *Calluna vulgaris* and Cornish heath *Erica vagans*, which are

deteriorating in condition. The shrubs are interspersed with an open canopy of mature Scot's pine *Pinus sylvestris*. (Photograph 1A).

- 5.19 The banks of the artificial watercourse contains a number of frequently occurring herbs and shrubs including bistort *Polygonum bistorta*, giant rhubarb *Gunnera tinctoria*, and cranesbill *Geranium thundersgii*. The northern end of the artificial watercourse is surrounded by frequently occurring marginal shield fern *Dryopteris marginalis* (Photographs 7A-12A).
- 5.20 Several large, mature common alder trees *Alnus glutinosa* shade the northern section of the artificial watercourse, in addition to weeping willow *Salix sepulcralis*, with several Scot's pine located along the east boundary (Photograph 7A) (TN3).
- 5.21 A number of ornamental trees are scattered throughout the amenity grassland areas including *Acer* spp, and *Betula* spp.
- 5.22 The artificial watercourse runs from the south western corner pond (top pond) to the north eastern corner pond of the Sculpture Garden, where upon water is pumped back to the top pond. The watercourse is constructed from concrete and measures c 0.5 m (width) x 0.5 m (depth), with an average flow depth of 0.1 m. The watercourse forms a series of ponds and riffles which contain a limited range of floating and emergent plants including common duckweed *Lemna minor*, white water lily *Nymphaea alba*, spiked milfoil *Myriophyllum spicatum*, water mint *Mentha aquatic*, yellow flag *Iris pseudacorus*, and water horsetail *Equisetum fluviatile* (Photograph 8A and 11A) (TN4).

Species

- 5.23 The faculty buildings within Area A are generally well maintained, with building material well sealed and in a good condition. However, the buildings are likely to provide a number of points where there are small gaps within the fabric of the buildings, which potentially could be used as occasional roosting sites for a small number of bats (Photograph 1A). Therefore the faculty buildings are assessed as being of low potential to support roosting bats.
- 5.24 The majority of the trees within Area A are either mature and in good condition or are young and in poor condition. Therefore there are no trees which show features which would provide suitable roosts for bats including woodpecker holes, broken branches, rot holes, cracks, uplifted areas of bark and dense ivy. The line of Scot's pine trees although showing signs of poor condition including areas of die back, do not present features which are potential suitable roosts for bats (Photograph 1A).
- 5.25 The shrubby borders found throughout Area A contain a range of plant species which are beneficial to terrestrial invertebrates by providing sources of nectar (including Japanese spirea firelight, bistort, heather, St John's wort), and provide a structural habitat. The shrubby borders provide a suitable habitat corridor through Area A and contribute to the overall connectivity throughout the campus and the wider environment.
- 5.26 The limited structural diversity of the vegetation present provides limited opportunities for breeding birds. During the field survey blue tit *Cyanistes caeruleus* were observed feeding on insects, with great tit *Parus major* house sparrow *Passer domesticus* and dunnock *Prunella modularis* feeding on seeds within the ground cover. The shrubby borders contain fruit bearing species including cotoneaster providing a suitable food source for berry eating bird species.
- 5.27 The artificial watercourse provides a suitable environment for a range of aquatic species. During the field survey a number of species of damselflies Zygoptera were recorded including common blue *Enallagma cyathigerum* and blue-tailed damselfly *Ischnura elegans*. The coverage of marginal, emergent and submerged aquatic plants evidently provides sufficient cover for aquatic invertebrates (Photographs 9A-11A). The terrestrial and emerging aquatic invertebrates will provide suitable feeding opportunities for species of bats and insectivorous birds.

Area B Cathedral Street Gardens

5.28 Area B is positioned to the south of the Estate Services and Lord Hope Building and bordered by the Curran Building (Anderson Library) to the east and Cathedral Road to the south. The central section of the site forms Cathedral Street Gardens, an area of soft landscaping including areas of amenity grassland, shrub beds, and scattered trees. Areas of hard landscaping include a series of pathways running from Cathedral Street to the faculty buildings and a number of raised container beds (Photograph 13B).

Habitats

5.29 The faculty buildings surrounding Area B are modern, multi-storey brick structures, with a mixture of pitch and flat roofs (Photograph 15B).

5.30 The site is mainly laid down as amenity grassland, with a sward dominated by meadow grass, red fescue and occasional perennial ryegrass, white clover *Trifolium repens* and creeping buttercup *Ranunculus repens* (Photographs 14B and 24B). The amenity grassland is cut regularly during the growing season and the sward is retained short (TN5).

5.31 The north western corner of the site includes an area of mainly bare ground (0.2 acres) with occasional young shrub *Buddleja davidii* found along the western boundary. This area also contains a small area of ephemeral/short perennial habitat including occasional greater plantain *Plantago major*, common ragwort *Senecio jacobaea*, colt's foot *Tussilago farfara* and curled dock *Rumex crispus* (Photograph 19B) (TN7).

5.32 The southern section of the site contains a series of access pathways which are bordered by extensive areas of managed, mature non-native shrubs (Photographs 15B-18B). The shrub borders are dominated by William Penn barberry, cotoneaster, Portugal laurel and rhododendron kaparaga. The shrub borders along Cathedral Street, contain mature trees including mainly sycamore *Acer pseudoplatanus*, with several whitebeam *Sorbus aria*, common lime *Tilia x europaea* and cherry *Prunus* spp..(Photograph 16B). Within the central section of the site, the shrub border contains a line of mature whitebeam and silver birch *Betula pendula* (Photograph 14B) (TN6).

5.33 The western boundary of the Lord Hope Building contains a series of shrub borders which include mature Portugal laurel, cotoneaster and red osier dogwood *Cornus sericea* (Photograph 22B).

5.34 The eastern section of the site contains a series of raised container beds which have been planted with a range of non-native shrubs and lavender *Lavandula angustifolia* (Photograph 21B).

5.35 Within the north eastern section of the site, a recent new development has resulted in the planting of a short length (5 m) of species poor hedgerow of common beech *Fagus sylvatica* (Photograph 23B).

Species

5.36 The faculty buildings within Area B are well maintained. However the Estate Services and Lord Hope Building are of brick construction and these buildings are likely to contain a number of features including small gaps, loose tiles, gaps within the soffit boards (for example the pine end of Estate Building), which potentially could be used as an occasional roosting sites for a small number of bats (Photograph 19B). Therefore the faculty buildings are assessed as being of low potential to support roosting bats.

5.37 The trees within the site are semi/mature in age and structure, and have been managed and maintained as part of the Estate management programme (Photograph 20B). All trees within the site are in good condition and did not provide features suitable for roosting bats.

- 5.38 The age and structure of the trees present provide suitable nesting opportunities for birds inhabiting urban environments. The shrubby borders and mature trees along the southern and western borders of the site are likely to reduce the negative impact of artificial lighting upon foraging bats and birds using the central section of the site.
- 5.39 The majority of the shrubby borders show limited range of species and are dominated by a small number of shrub species and provide limited nectar sources for terrestrial invertebrates. The raised beds to the east of the site present a greater range of plant species providing sources of nectar including lavender.
- 5.40 The shrub borders are mature and provide good ground cover for nesting birds including dunnock and wren *Troglodytes troglodytes*. During the field survey, two female blackbirds *Turdus merula* were recorded foraging in the undergrowth of shrubby borders in the west and southern sections of the site. The shrubby borders contain fruit bearing species including cotoneaster and William Penn barberry which provide sources of food for bird species including starling, a species recorded during field survey.
- 5.41 The area of bare ground and associated areas of ephemeral/short ruderals contain several plants which are food sources to terrestrial invertebrates including common ragwort and buddleia (Photograph 19B).
- 5.42 Area B provides limited biodiversity value to the Andersen Campus but contributes to the connectivity within the campus itself and forms a connecting unit to habitats located to the north of the site including Sighthill.

Area C around the Lord Todd Village Office

- 5.43 Area C forms the largest site within the campus and includes the Lord Todd Village Office. The area includes a number of faculty buildings of varying age and construction including Birbeck Court, Garnett Hall, Forbes Hall, Murry Hall and James Goold Hall. The area comprises a mixture of soft landscaping of mainly amenity grassland, shrub borders and ornamental scattered trees. The hard standing includes a number of pathways, road infrastructure, and car parking. The soft landscaping within the area is intensively managed including manicured lawns, trimmed shrub borders and trees, providing the area with a limited biodiversity value.

Habitats

- 5.44 The major habitat throughout the area is amenity grassland (Photographs 27C, 28C, 29C and 32C). The habitat is intensively managed and the sward is maintained at a low height. The amenity grassland is located throughout the site and forms generally manicured lawns. The composition of the sward is of limited diversity and dominated by meadow grass and red fescue with occasional perennial ryegrass.
- 5.45 Shrub borders are found throughout the site and often delineate internal compartments within the site including north eastern boundary which comprises mainly Portugal laurel (Photograph 27C). In these areas the shrub borders are intensively managed. The shrub borders are often associated with faculty buildings forming a protective shrub buffer and are dominated by William Penn barberry, Florida variegate *Weigela florida*, willow leaved cotoneaster *Cotoneaster salicifolius*, oleaster *Elaeagnus macrophylla* and red osier dogwood. The formal shrub beds contain Aaron's beard *Hypericum calycinum*, viburnum, Oregon grape *Mahonia media*, azalea, Marlborough rock daisy *Pachystegia insignis*, St John's wort, and Aaron's beard (Photographs 25C, 29C, 30C and 34C).
- 5.46 Often ivy *Hedera helix* is present growing throughout the shrub borders, and occasionally has grown up forming green walls as recorded on the eastern side of Murry Hall and Birbeck Court (Photograph 36C) (TN8).

5.47 Ornamental trees are located throughout the site and vary in species. The age and structure of the trees varies although most are young. The outer boundaries of the site contain young trees including cherry, *Acer spp.*, mountain ash *Sorbus aucuparia*, common lime and sycamore (Photograph 35C). Mature trees are often associated with older areas of the site including hawthorn *Crataegus monogyna*, and cherry spp. located to the east of Birbeck Court, silver birch to the west of Birbeck Court and a mix of silver birch and Scots pine to the north of Forbes Hall (Photographs 32C and 33C), and a single sycamore in the north-west corner of the site.

Species

5.48 The faculty buildings within Area C range in age and construction. The older buildings are constructed from concrete with the more modern buildings being brick built (Photographs 29C). Although all buildings are in good condition, most buildings provide potential suitable features for roosting bats, particularly Birbeck Court which have extensive soffit boards and tiled pitched roofs (Photograph 32C). The faculty buildings within the area are assessed as being of low potential to provide potential roosts for bats.

5.49 All trees within the site are managed and maintained and do not provide features suitable for roosting bats.

5.50 The mature trees within the area are of sufficient age and structure to provide nesting opportunities for generalist birds which are common within urban environments (Photograph 33C).

5.51 The extensive coverage of shrubby borders within the area provides a range of plant species which are sources of nectar for terrestrial invertebrates (Photograph 31C). The formal beds within the central section of the area are planted with annual species which will increase foraging opportunities for terrestrial invertebrates during the spring and summer periods.

5.52 The green wall areas recorded at Murry Hall and Birbeck Court will offer opportunities for foraging terrestrial invertebrates and where mature ivy exists, opportunities for roosting bats (Photographs 28C and 36C).

5.53 The intensively managed habitats within Area C have a limited benefit to the biodiversity of the site and campus. Area C forms part of the connecting habitat corridor through the campus linking with Area E to the east.

Area D to the south of Thomas Campbell Court and to the south of James Blyth Court

5.54 Area D comprises an area of soft landscaping of mainly amenity grassland interspersed with hard landscaping features including pathways/access road infrastructure and car park. The topography of the area consists mainly of sloping grasslands with a southern aspect.

Habitats

5.55 Area D comprises two areas of mainly amenity grassland separated by the college buildings Thomas Campbell Court and James Blyth Court. The sward is dominated by meadow grass and red fescue with occasional Yorkshire fog creeping bent. The grassland is intensively managed with a short sward which has a low biodiversity value (Photographs 37D and 39D).

5.56 The western boundary of the site comprises small blocks of shrub beds including cotoneaster, dogwood, William Penn barberry and Portugal laurel (Photograph 38D). The car park located to the south of the site is bordered by mainly cotoneaster and dogwood, with several scattered trees of mountain ash. The blocks of shrubs are regularly maintained and provided a regimented structure (Photographs 39D and 40D).

5.57 Along the eastern boundary of the site is located a section of mainly introduced shrubs including dominant buddleia and dogwood, occasional Portugal laurel and raspberry. These non-native

species are interspersed with native shrub of guelder rose *Viburnum opulus*, elder *Sambucus nigra* and dog rose *Rosa canina* and areas of tall ruderal species including rosebay willow herb (Photograph 41D and 42D). This area presents a range of habitats which provides a higher biodiversity value compared with other sections within the area (TN9).

Species

- 5.58 The college buildings within Area D are well maintained and are of mainly brick construction with glass frontages. However these buildings are likely to contain a number of features including small gaps, loose roof tiles, gaps within the soffit boards, which potentially could be used as an occasional roosting site for a small number of bats (Photograph 37D). The college buildings are therefore assessed as being of low potential to support roosting bats.
- 5.59 The trees located within Area D are mainly young and present structures which provide potential suitable features for roosting bats (Photograph 41D).
- 5.60 The trees present (mainly mountain ash) are semi/mature and have a structure which provides suitable features for nesting birds frequently found in urban environments and provide foraging opportunities upon tree species bearing berries (Photograph 38D).
- 5.61 The shrub borders contain a number of fruit bearing species (including cotoneaster) which provide suitable foraging opportunities to berry feeding bird species including blackbird recorded during field survey.
- 5.62 The matrix of habitats located within the eastern section of the site provides a range of species which are good sources of nectar for terrestrial invertebrates. The field survey recorded a number of common butterflies within the area including small tortoiseshell *Aglais urticae* feeding on common nettle *Urtica dioica*, ringlet *Aphantopus hyperantus* on ragwort (Photograph 42D).

Area E to the north of Barony Hall

- 5.63 Area E is located to the east of the Anderson campus at the junction of Cathedral Street and Collins Street, and comprises mainly areas of hard landscaping including a large car park, in addition to pathways. The soft landscaping areas include a section of amenity grassland, bordered by linear sections of shrub interspersed with semi mature trees (Photograph 57E). The intensively managed habitats within Area E have a limited benefit to the biodiversity of the site and campus.

Habitats

- 5.64 The area of amenity grassland is intensively managed with the sward cut short and provides limited biodiversity value. The sward is dominated by meadow grass and red fescue with occasional rye grass, creeping bent, and Yorkshire fog (Photograph 61E).
- 5.65 The trees are mainly semi/mature and include sycamore, *Acer spp.* and poplar *Populus spp.* All species are well maintained and in good condition (58E - 60E).
- 5.66 The linear shrub borders are dominated by Portugal laurel with a ground cover of ivy sulphur heart *Hedera colchia*. In a number of areas the shrub comprises cotoneaster with occasional rose bay willow herb (Photograph 60E).

Species

- 5.67 The trees are mainly semi/mature and include sycamore, *Acer spp.* and poplar *Populus spp.* (Photograph 62E).
- 5.68 The age and structure of the trees together with maintenance means that the trees do not present features which are suitable potential sites for roosting bats.

- 5.69 The shrubs provide potential nesting sites for a number of bird species including wren, with ground ivy, and cotoneaster provide foraging opportunities for berry eating bird species.

Area F Rottenrow Gardens

- 5.70 Area F borders Area G (to the north) and Area A (to the east). The site comprises a mixture of soft landscaping including areas of amenity grassland, extensive areas of shrub, broadleaved plantation, scattered individual trees and an area of wetland surrounding a small pond. The site follows a steep gradient falling along the north to south axis. The area contains extensive areas of hard landscaping including pathways, steps, seating areas and retaining walls, some of which are remnant walls from previous buildings.

Habitat

- 5.71 The amenity grassland habitat comprises 5 areas mainly to the west and south of the site. The amenity grassland is intensively managed and the sward is retained to a low height (2.5 cm – 5 cm). The composition of the sward is dominated by red fescue and meadow grass, with occasional perennial ryegrass and creeping bent (Photograph 75F).
- 5.72 Within the southern corner and lowest point of the site, a small pond is located surrounded by an extensive area of swamp habitat and inundated vegetation to the north. The open water area has reduced in size due to successional development, resulting in an existing area of 3 m x 2 m containing amphibious bistort and common duck weed. The deep water is dominated by common bulrush *Typha latifolia*, with frequent branched burr reed *Sparganium erectum* (Photograph 76F). The shallow water margins which are found to the south and western borders of the pond include marsh marigold *Caltha palustris*, water plantain *Alisma plantago-aquatica* and water forget-me-not *Myosotis scorpiodes*. In swamp areas occasional ragged robin *Lychins flos-cuculi*, purple loosestrife *Lythrum salicaria* and water mint and meadow sweet *Filipendula ulmaria* are occasionally found (TN10).
- 5.73 Along the drier areas of the pond in the west and east, tall ruderal habitat dominated by rose bay willow herb are found (Photograph 78F).
- 5.74 Along the southern border of the pond and adjacent to the amenity grassland, a small section of wild flower grassland is present (3m x 4 m) which is a remnant from previous conservation enhancement of the site. The species present include frequent yarrow *Archillea millefolium*, common knapweed *Centaurea nigra*, oxeye daisy *Leucanthemum vulgare*, field scabious *Knautia arvensis*, selfheal *Prunella vulgaris*, and birdsfoot trefoil *Lotus corniculatus* (Photograph 80F).
- 5.75 To the north of the pond is located a series of linear plantings of semi mature ornamental fruit trees which border adjacent pathways. The ground cover is dominated by ivy (sulphur heart) which extends beyond the eastern edge of the pond (Photographs 63F, 72F and 77F).
- 5.76 A number of mature trees are located along the central southern boundary of the site and include silver birch, Scots pine, sycamore and *Prunus* spp.. (Photographs 73F and 74F).
- 5.77 Two broadleaved plantations are located within the site, one to the north eastern corner dominated by multi-stemmed paper birch *Betula papyrifera*. The plantation forms an almost continuous canopy which limits vegetative layers to a ground cover dominated by ivy (Photographs 65F, 70F and 71F) (TN13). The second broadleaved plantation comprises a block of sekka willow *Salix udensis*. Regular coppicing of the willow coup has resulted in a closed canopy (Photograph 69F) (TN11).
- 5.78 The shrub borders to the east and north of the site comprise a range of species including willow leaved cotoneaster, variegated purple-flowered cotoneaster, William Penn barberry, Rubella *Skimmia japonica*, Portugal laurel (Photograph 73F). The raised containers located within the northern section of the site contain pampas grass *Cortaderia selloan* and Oregon-grape (Photograph 68F).

- 5.79 Borders within the stepped area to the north-west, contain spike lavender and *Heuchera hybrid* (Photograph 70F).
- 5.80 Mature ivy forms areas of green walls along existing buildings to the north eastern boundary of site with honeysuckle forming an extensive green wall along the north eastern boundary of site (Photographs 66F and 67F) (TN12).

Species

- 5.81 The northern boundary of the site retains the outer walls of previous buildings. The walls have numerous openings and gaps within the mortar and in two areas the walls are covered with mature ivy (Photograph 66F) together with a green wall covered in honeysuckle (Photograph 67F). The extensive retaining wall located in the north of the site, which is constructed from gabion baskets, provides a number of openings and gaps (Photograph 68F). These features provide suitable opportunities for roosting bats.
- 5.82 The wetland areas within the south of the site and the range of habitats found within the Area F, provide an area of moderate value for foraging bats.
- 5.83 Although the site contains a number of mature trees, they do not provide any features which are suitable for roosting bats although they provide a range of options for nesting birds.
- 5.84 The shrubs found throughout the site include a number which are fruit bearing; these will benefit those bird species which forage for fruit. Opportunities for food are also provided by fruit bearing trees located within linear orchard.
- 5.85 Habitats beneficial to terrestrial invertebrates are found throughout the site and include green walls in the north of the site (both ivy and honeysuckle), all south facing walls, and areas surrounding pond.
- 5.86 The pond provides a suitable habitat for a range of aquatic invertebrates although the extent of the pond is decreasing with time.
- 5.87 Area F provides a range of habitats which provide foraging and roosting opportunities for a limited range of species and has low/moderate biodiversity value.

Area G south of the Henry Dyer building

- 5.88 Area G comprises a mixture of small areas of soft landscaping to the south of Henry Dyer building, in addition to hard landscaping areas including pathways and road infrastructure. The soft landscaping areas include small sections of amenity grassland which are mainly manicured lawns, discrete areas of non-native shrubs, with scattered individual trees. The intensively managed habitats within Area G have a limited benefit to the biodiversity of the site and campus.

Habitat

- 5.89 To the west of the Henry Dyer building is located a small area of mainly amenity grassland which is dominated by red fescue and meadow grass, with occasional creeping bent and perennial rye grass recorded at the edges of the grassland (Photograph 81G). Within the short sward, occasional ragwort, common dandelion *Taraxacum officinale*, lesser trefoil *Trifolium dubium* and greater plantain are present. Two further areas of amenity grassland are located to the north of Rottenrow Street and to the south of Strathclyde Business School building and west of Sir William Duncan building (Photograph 83G). Both sections of amenity grassland are dominated by red fescue and meadow grass and have limited biodiversity value.
- 5.90 The area contains two areas of shrubby borders including a small area (2 m x 3 m) to the west of Henry Dyer containing cotoneaster and Florida variegate (Photograph 82G). The second area

forms a linear section to the north of Rottenrow Street containing William Penn barberry and Portugal laurel. A trellis located on the western boundary of the Henry Dyer building forms a small green wall (1 m x 2 m) partially covered with semi mature honeysuckle (Photograph 81G).

- 5.91 Scattered trees are located throughout the site including a young whitebeam to the west of Henry Dyer building, mature silver birch adjacent to Rottenrow street, two young *Acer* spp. within tall ruderal area, and a line of mature sycamore in the centre of the site (Photographs 81G and 83G).
- 5.92 An area of tall ruderal habitat is located to the north of Rottenrow street dominated by common nettle, rosebay willow herb and creeping thistle, with occasional lesser burdock *Arctium minus* (Photograph 84G) (TN14).
- 5.93 To the south of the Strathclyde Business School building, an area of ephemeral/ruderal habitat is found dominated fat-hen *Chenopodium album* and occasional coltsfoot *Tussilago farfara* (Photograph 85G).

Species

- 5.94 The Henry Dyer building is well maintained and are of mainly brick construction with glass frontages (Photograph 81G). The buildings are likely to provide features including small gaps in motar, which potentially could be used as an occasional roosting site for a small number of bats. The college buildings are therefore assessed as being of low potential to support roosting bats.
- 5.95 The trees present within the area are either semi mature including *Acer* spp. or mature sycamore trees. The age and structure of the trees together with maintenance techniques means that the trees do not present features which are suitable potential sites for roosting bats.
- 5.96 The line of mature sycamore trees provide a structural diversity which provides suitable opportunities for nesting birds common within the urban environment (Photograph 83G)..
- 5.97 The two areas containing shrubs provide limited opportunity for nesting birds as they are located in areas of high disturbance. The small area of cotoneaster (to the west and south of the Henry Dyer building) provides foraging opportunities for berry eating bird species.
- 5.98 The areas of tall ruderal habitat, ephemeral habitat and small area of green wall comprising common honeysuckle comprises a number of plant species that provide sources of nectar for terrestrial invertebrates, and foraging opportunities for seed eating birds (Photograph 84G).

Area H north of the Ramshorn Theatre

- 5.99 Area H is a discrete section of the Andersen campus located to the south of the core area of faculty buildings and is located between Montrose Street and Albion Street. The area contains the college building Ramshorn Theatre, with hard landscaping comprising a series of pathways through a graveyard. The soft landscaping areas include amenity grassland, shrub hedgerows and mature trees (Photograph 87H).

Habitat

- 5.100 The amenity grassland is intensively managed with the sward height maintained at a low height. The composition of the sward is dominated by meadow grass and red fescue with occasional perennial ryegrass and creeping bent along the margins of the grassland areas (Photograph 88H).
- 5.101 The area contains a number of mature trees including ash, white beam and *Prunus* spp. (Photographs 87H, 89H and 90H) (TN15).
- 5.102 Within the central walled garden of the site, the shrub borders are dominated by cotoneaster and ground cover greater periwinkle *Vinca major* (Photograph 89H).

Species

- 5.103 The Ramshorn Theatre building is stone built and a former church and is likely to provide a number of features (including gaps in walls and wooden joists, slipped tiles and soffit boards) potentially could be used as occasional roosting sites for a small number of bats (Photograph 87H). Therefore the faculty buildings are assessed as being of high potential to support roosting bats.
- 5.104 Although the trees located within the area are mature and provide a complex structural diversity, no features were recorded that provide potential roosting sites for bats (Photograph 88H).
- 5.105 The mature trees located within the site provide suitable opportunities for nesting birds common within the urban environment.
- 5.106 The shrub borders are well maintained and provide limited opportunities for nesting birds.
- 5.107 The composition of the grassland sward and its maintenance provides an area of low biodiversity value.

Area I University Centre

- 5.108 The University Centre is located on the western boundary of the campus and is situated on the corner of North Frederick Street and Cathedral Street. Area I is effectively split into two compartments of soft landscaping by the central modern building of the University Centre. The larger area of the site comprises; car parking, hard landscaping including surfaced paths and walkways, soft landscaping including planted borders, scattered trees and amenity lawns (Photograph 94I). The smaller section, located to the south western corner of Area I consists of a small area of soft landscaping and a maintenance pathway of 20 m length x 2 m width (Photograph 99I).

Habitats

- 5.109 Within the larger compartment of Area I, shrub borders form the main habitat comprising a range of species including Portugal laurel with a ground cover of ivy sulphur heart *Hedera colchia*. In a number of areas the shrub comprises contoneaster which are well maintained, with the raised beds containing common fuschia *Fuchsia magellanica* (Photograph 95I and 97I).
- 5.110 The areas of shrub are bordered by small areas of amenity grassland (10 m x 7 m) which are intensively managed forming manicured lawns (Photograph 98I). The composition of the sward is of limited diversity and dominated by meadow grass and red fescue within the smaller section of Area I, with occasional perennial ryegrass (Photograph 105I).
- 5.111 The trees present within the larger section of Area I are semi/mature in age and include *Acer* spp., silver birch and field maple. All trees are in good condition (Photograph 93I).
- 5.112 The smaller compartment of Area I contains remnant amenity grassland that has deteriorated from lack of maintenance and has developed into a small area of ephemeral/short perennial habitat dominated by common nettle, rose bay willow herb, with occasional creeping buttercup, white clover and ragwort (Photograph 103I).
- 5.113 Scattered scrub comprises young hawthorn, elder and guelder rose, which are associated with a small area(3m x 4 m) of dogwood (Photograph 100I).
- 5.114 Several mature trees of whitebeam and *Prunus* spp. are located close to the southern boundary of the University Centre (Photograph 103I).

Species

- 5.115 The University Centre building is well maintained, and is of mainly brick construction with glass frontages. The University Centre building is likely to provide features including small gaps in mortar, which potentially could be used as an occasional roosting site for a small number of bats (Photograph 104I). The college buildings are therefore assessed as being of low potential to support roosting bats.
- 5.116 The trees present within the area are either semi mature including *Acer* spp.. The age and structure of the trees together with maintenance techniques means that the trees do not present features which are suitable potential sites for roosting bats (Photograph 94I).
- 5.117 The semi mature trees located within the larger compartment, and the mature trees (mainly *Prunus* spp.) within the smaller compartment provide a structural diversity which provides suitable opportunities for nesting birds common within the urban environment.
- 5.118 The two areas containing shrubs provide limited opportunity for nesting birds as they are located in areas of high disturbance. The shrub borders of mainly cotoneaster provide foraging opportunities for berry eating bird species (Photograph 98I).
- 5.119 The area of ephemeral/short ruderal habitat comprises a number of plant species that provide sources of nectar for terrestrial invertebrates, and foraging opportunities for seed eating birds (TN16).

6 Biodiversity Enhancement Plan

- 6.1 It is recommended that a Biodiversity Enhancement Implementation Plan is developed to include the following biodiversity enhancement measures and to ensure the enhancements are strategically and appropriately implemented and deliverable. The recommended enhancement measures for each Area of the John Andersen campus are shown in Figures 12-20.
- 6.2 The specific recommendations for biodiversity enhancement for each area (A-I) are recorded in Figures 12-20. For example the recommendation for reseeding within existing amenity grassland adjacent and to the north of the pathway to the south of the Abuthnott building (Robertson Wing), is recorded on Figure 12 as A1, with a description of the recommendation in Section 6.12.
- 6.3 Examples of biodiversity enhancement measures are shown in Appendix F.
- 6.4 The Biodiversity Enhancement Implementation Plan should include aims and objectives, extent of existing habitats, areas for biodiversity enhancement, management strategies for biodiversity development, and monitoring strategies to determine effectiveness of measures.
- 6.5 Enhancement of biodiversity across the campus should be considered as a staged process; initial stages should look to link existing green areas across the campus and should look to alter the composition of existing planting in favour of native species. Further stages should look to create new high quality habitats and maximize the onsite opportunities for biodiversity including nesting/roosting boxes, green roofs and green walls.

Amenity Grassland and herbaceous borders

Summary

- 6.6 Throughout all areas (A-I) of the John Anderson Campus, the amenity grassland habitat comprises intensively managed and regularly mown grasslands of mainly manicured lawns. Most areas of amenity grassland are not subject to significant impact from disturbance and trampling (due to the extensive network of pathways and general hard landscaping). Existing species diversity is low and is dominated by meadow grass and red fescue. The amenity grassland has limited biodiversity value due to the current intensive management regimes resulting in restricted vegetation structural diversity.
- 6.7 Ornamental flower beds and raised containers are found in Survey areas A, B, C, F, and I.

Existing Management

- During the growing season (February to November), the amenity grassland areas are cut on a five to ten day cutting regime. The grass is mainly cylinder cut with steeply sloping areas cut using a rotary mower. Grass sward is maintained between 2.5 cm and 5cm.
- No fertilizers are applied to the grassland sward.
- Non-residual Glyphosate weed killer and hoeing techniques are applied to maintain weed levels.
- Raised container beds and ornamental beds are planted in April/May and September/October every year.

Recommendations for Biodiversity Enhancement

Recommendation 1: Develop a plan for the creation and maintenance of wildflower areas

- 6.8 A plan should be drafted and adopted to show the location of all sections which are identified for the diversification of grassland flowers within grassland areas across the campus. This could include the creation of traditional wild flower meadows that are allowed to grow long through the summer months or the addition of additional wildflowers to lawns that are resilient to regular mowing to create species-rich lawns. The plan will also include maintenance regimes and include monitoring of the extent, species diversity and condition of wildflower areas created. The plan should be incorporated into the Biodiversity Enhancement Implementation Plan.

Recommendation 2: Creation of wildflower areas in existing amenity grassland

- 6.9 Amenity grassland can be enhanced through deep scarification and over sowing of wild flower seeds or through the removal of existing sward and reseeded. The species composition for new wild flower areas is dependent upon the nutrient level of the soils, and should be of native origin and preferably of local provenance. In areas where disturbance is likely to be low a general wildflower mix (e.g. Emorsgate EM2 – Standard General Purpose Meadow Mixture), should improve the diversity of the grasslands within the campus. The species composition of the mix is listed in Table 2.

Table 2. Standard general purpose meadow mixture (EM2)

Latin name	Common Name
<i>Achillea millefolium</i>	Yarrow
<i>Centaurea nigra</i>	Common Knapweed
<i>Daucus carota</i>	Wild Carrot
<i>Galium verum</i>	Lady's Bedstraw
<i>Knautia arvensis</i>	Field Scabious
<i>Leucanthemum vulgare</i>	Oxeye Daisy
<i>Lotus corniculatus</i>	Birdsfoot Trefoil
<i>Plantago lanceolate</i>	Ribwort Plantain
<i>Plantago media</i>	Hoary Plantain
<i>Primula veris</i>	Cowslip
<i>Prunella vulgaris</i>	Selfheal
<i>Ranunculus acris</i>	Meadow Buttercup
<i>Rhinanthus minor</i>	Yellow Rattle
<i>Rumex acetosa</i>	Common Sorrel
<i>Trifolium pratense</i>	Wild Red Clover
<i>Agrostis capillaris</i>	Common Bent
<i>Cynosurus cristatus</i>	Crested Dogstail
<i>Festuca rubra</i>	Slender-creeping Red-fescue
<i>Phleum bertolonii</i>	Smaller Cat's-tail

- 6.10 Sowing should take place in autumn, following the removal of existing sward, where required. Following establishment, the most productive sward development is achieved through traditional meadow management based around one summer hay cut in combination with autumn and possibly spring mowing.
- 6.11 The biodiversity value of the amenity grassland can also be improved through the planting of wildflower bulbs and plugs. The bulbs and plugs of nectar rich flowering plants should be embedded into amenity grassland which will increase the biodiversity value of the sward. The planting of single species may provide significant ecological benefits e.g. cowslip, providing early sources of nectar for terrestrial invertebrates. Table 3 lists wildflower species which can be planted in plug and bulb forms.

Table 3. Wildflower species, bulb and plug

Suitable Bulbs	
Latin Name	Common Name
<i>Primula vulgaris</i>	Primrose
<i>Ranunculus ficaria</i>	Lesser celandine
<i>Narcissus pseudonarcissus</i>	Wild daffodil
<i>Primula veris</i>	Cowslip
Suitable Plugs	
<i>Lotus corniculatus</i>	Birdsfoot trefoil
<i>Bellis perennis</i>	Daisy
<i>Hypochoeris radicata</i>	Common cats ear
<i>Plantago lanceolate</i>	Ribwort plantain
<i>Prunella vulgaris</i>	Selfheal
<i>Archillea millefolium</i>	Yarrow
<i>Galium verum</i>	Lady's bedstraw

- 6.12 Opportunities for the implementation for the creation of wild flower meadows through reseeded include:
- Area A1 – within existing amenity grassland adjacent and to the north of the pathway to the south of the Abuthnott building (Robertson Wing), with the aim of creating a colourful species-rich summer meadow.
 - Area A2– along southern section of existing amenity grassland, with the aim of creating a colourful species-rich summer meadow.
 - Area A3 – throughout the amenity grassland located to the south of the department of Architecture, with the aim of creating a colourful species-rich summer meadow.
 - Area B1 – throughout the area of existing amenity grassland at south eastern corner of site, with the aim of creating a colourful species-rich summer meadow.
 - Area C1 – along shrub borders and scattered trees in the existing amenity grassland in the south western corner of site, with the aim of creating a colourful species-rich summer meadow.

- Area D1- throughout the amenity grassland to the south of Thomas Campbell Court, with the aim of creating a colourful species-rich summer meadow.
- Area D2 - throughout the amenity grassland to the south of James Blyth Court, with the aim of creating a colourful species-rich summer meadow.
- Area E1 and E2 - along the margins of the shrub borders, with the aim of creating a colourful species-rich summer meadow.
- Area F1 – throughout the amenity grassland within the south western section of site, with the aim of creating a colourful species-rich summer meadow.
- Area F2 – area along the bank to the north east of the wetland area, with the aim of creating a colourful species-rich summer meadow.
- Area F3 – area to the south of willow coup, with the aim of creating a colourful species-rich summer meadow.
- Area F4 – area to the west and south of the existing pond, with the aim of creating a colourful species-rich summer meadow.
- Area G1 – area to the south of Strathclyde Business School building, with the aim of creating a colourful species-rich summer meadow.
- Area G2 – section to the east of access road, with the aim of creating a colourful species-rich summer meadow.
- Area I1 – reseeded area within small compartment, with the aim of creating a colourful species-rich summer meadow.

Opportunities for the implementation of areas of wild flower meadows through the planting of plugs and/or bulbs which will continue to be mown, include:

- Area A4 – in area to the upper central section of wet areas of existing amenity grassland of bulbs and plugs of species which are suitable for wet habitats.
- Area A5 – in the small area of existing amenity grassland to the east of Abuthnott building (Robertson Wing).
- Area B2 – planting of bulbs/plugs.
- Area C2 and C3 – planting of bulbs/plugs in the northern section of area C.
- Area D3 – planting of bulbs and/or plugs along area adjacent to James Blyth Court.
- Area F5 – area to the west of central square.

Recommendation 3: Less intensive management of grasslands

- 6.13 Where there are amenity grassland borders, shrub borders, and areas of scattered trees, the mowing regime should be reduced to create buffer zones. The biodiversity value of the sward can be further developed through deep scarification and the over sowing with wildflower seed, planting of wildflower plugs and the planting of bulbs. These areas should be annually cut at the end of the growing season. Species-rich swards can be readily developed without adversely affecting the

managed character of the landscapes, which in many areas will need a high level of landscape maintenance. This requires careful development of mowing regimes and edge management in agreement with the estates management team.

Opportunities for the implementation of areas of wild flower meadows through the change in mowing regime include:

- Area A6 – reduction in mowing adjacent to shrub borders.
- Area B3 – reduction in mowing along area to the south of Lord Hope building.
- Area E3 – reduction in mowing in area adjacent to shrub border along eastern boundary of site.
- Area D4 – reduction in mowing in area to the north of car park.
- Area G3 – reduction in mowing within the central section of amenity grassland.
- Area H1-H4 – reduction in mowing along outer boundaries of amenity grassland.

Built Environment

Summary

- 6.14 The John Andersen campus contains a significant number of buildings within the centre of Glasgow City. The biodiversity of the buildings within the 9 Areas of the John Andersen campus may be enhanced through a number of measures including : wildlife installations, construction of artificial habitats (including wood piles), the creation of green roofs and walls and installation of rain gardens. These enhancements can be retrofitted onto existing buildings, although in future the potential for biodiversity enhancements should form part of the design and planning process for future developments.

Existing Management

- 6.15 Currently enhancement of the built environment for biodiversity is limited to:
- Localised development of green walls (mainly ivy and other native climbers such as honeysuckle).
 - Existing green roof (Area A).
 - Bird boxes in areas throughout the campus.

Recommendations for Biodiversity Enhancement

Recommendation 1: Develop a plan for the installation and maintenance of wildlife installations

- 6.16 A plan should be drafted and adopted to show the location of all artificial refugia, namely bird and bat boxes, across the campus and to plan maintenance. The plan should be incorporated into the Biodiversity Enhancement Implementation Plan. Bat boxes must be cleaned on an annual basis to ensure that other species do not colonise them. Most bird boxes should also be cleaned once a year, a couple of weeks after any nestlings have fledged (October – November); warm soapy water should be used to clean the box after any old nests have been removed. The maintenance plan

should include the checking of all box fixtures to ensure that they are securely attached to their tree or wall.

Recommendation 2: Install additional bird boxes and bat boxes and undertake monitoring

- 6.17 Many bird and bat species rely on the availability of suitable nesting opportunities within buildings however, modern construction and building maintenance often excludes these spaces. Wildlife installations provide additional nesting/roosting locations and are easily fitted onto existing buildings and trees or built into the fabric of new buildings. Bat boxes are known to be used by 11 of the UK's resident bat species whilst bird boxes are used by more than 60 species of birds. Most modern designed bat boxes are produced from woodcrete, a formulation of wood sawdust, concrete and clay. Woodcrete provides a stable temperature, allows natural respiration and is very long lasting; it also has the highest rates of occupation of all box types.
- 6.18 Most bird and bat boxes have specific installation requirements, the following should be taken into consideration prior to the installation of any new boxes:
- Where wooden boxes are used, paint or preservatives which may discourage or kill bats must not be used
 - Boxes should be placed a minimum of 3.5 metres above ground however a box placed 4.5 – 6 metres high will potentially attract more species.
 - Boxes are more likely to be used if sited near to a food source such as gardens, fields, water or woodlands or near to feeders and bird tables.
 - Boxes should not be placed in exposed positions on trees or buildings. The entrance should face south-west to south-east.
 - If a box is not used after two years, the box may be relocated to an alternative situation.
 - Once discovered, a bat roost is protected by law and must not be disturbed.
- 6.19 Bird and bat boxes may be built into existing or integrated into the design of new buildings within the campus. Opportunities for the installation of boxes across the campus include:
- The installation of internal bird boxes at soffits/eaves level for the common swift, house sparrow and starling.
 - Creation of purpose built ledges for swallows, and the installation of pre-cast nest cups for swallows and house martins. Opportunities for the installation of structures will arise as part of the building development at John Andersen campus.
 - Installation of appropriate nest boxes for range of birds found within urban environments. Mature trees are found throughout each Area in the John Andersen campus upon which bird boxes may be attached including;

Areas: A7, A8, B4, B5, C4-C7, F6, F7, G4, H5-H7, I2-I4
 - Creation of space in walls or behind cladding for crevice dwelling bats, installation of access points for roof-void dwelling bats, or the installation of bat boxes. Mature trees are found in each Area within the John Andersen campus upon which bat boxes may be attached including;

Area: A9, A10, B6, B7, C8-C10, F8, F9, H8, I5

- 6.20 Monitoring of boxes should be undertaken on an annual basis during the breeding season (birds March – August, Bats May – August). A dusk emergence survey should be undertaken for bats by an appropriately trained member of staff.

Recommendation 3: Mitigate for the impact of lighting on bats and birds

- 6.21 High levels of lighting can have negative implications for certain species of bats and birds by disturbing roosts, affecting the emergence times of bats and birds and affecting their feeding behaviour. Bat roosts and access points should not be directly illuminated and any essential nearby lighting should be designed to prevent the illumination of roosts. Wherever possible, low or high pressure sodium lamps should be used instead of mercury or metal halide lights; hoods and shields should be used to reduce light spill and if possible, low level lighting should be used. Lighting times should also be restricted to provide periods of dark or lower level lighting, and lighting in areas of particular ecological sensitivity.

Recommendation 4: Construct artificial habitats

- 6.22 Invertebrates form the basis of most ecosystems and diversity should be enhanced as much as possible. Invertebrate boxes or habitat towers can be built to any size and provide overwintering sites for many species such as solitary wasps, ladybirds, lacewings, bumblebees and red mason bees, which are essential in their pollination and pest control roles within many ecosystems.
- 6.23 It is recommended that a variety of artificial habitats for invertebrates are created across the campus. They can be located within shrub beds, hung on trees or placed near areas of high flowering plant diversity. Biodiversity could be further enhanced by the implementation of an urban beehive which would provide additional pollinators across the university and improve the diversity of flowering plants.
- 6.24 Areas for construction of artificial habitats include: B8,C11, D5, F10, F11

Recommendation 5: Construct woodpiles

- 6.25 Dead and decaying wood are of great value to wildlife, especially insects, fungi, mosses and lichens, and in turn help to provide a food source for birds and other small mammals. Woody cuttings and larger pieces of wood should be used to create woodpiles, which are best located in direct contact with the ground in a shaded area.
- 6.26 Areas for construction of woodpiles include: F12

Recommendation 6: Include the design of green roofs in new developments (and consider retrofitting onto existing buildings)

- 6.27 Green roofs can provide some form of mitigation for the loss of biodiversity where habitat has been lost at ground level through development. There are two types of green roof: intensive and extensive (livingroofs.org). An intensive green roof is generally designed as a formal park or garden at rooftop level; they require a deep layer of soil for the planting of shrubs and trees, significant maintenance, and are quite costly to install. Extensive green roofs have a thin soil and usually consist of low growing succulents e.g. Sedum sp. or low growing drought tolerant succulent species. Extensive green roofs using substrate material (gravel), laid down on a flat roof tend to be well drained and low nutrient in character; they can offer significant value in terms of biodiversity as they allow other plant species to colonise naturally.
- 6.28 Green roofs are not straight substitutes for wildlife habitats at ground level as many animals cannot get to the rooftop and growing conditions are not suitable for all plants, however they do provide green links across the built environment and support a range of different species – well designed green roofs can even provide a habitat for ground nesting birds. Invertebrates such as bees and

butterflies will be attracted to nectar sources on a green roof and the soil will provide a habitat for spiders, earthworms, beetles and ants.

- 6.29 Within the wider development of the University campus the opportunities to incorporate green roofs should be given due consideration. They can be installed on most roof types, and can also be retrofitted onto existing roofs providing the building is able to structurally support the saturated weight of a green roof. Alongside the biodiversity benefits, green roofs are visually attractive and provide heat and noise insulation, and are often included in sustainable drainage systems design because they intercept rainfall and reduce run-off rates.
- 6.30 The long term monitoring and further enrichment of green roofs across the campus in terms of their biodiversity interest, may provide both under graduate and post graduate students with research opportunities.

Recommendation 7: Create and enhance green walls on buildings

- 6.31 Green walls are walls with vegetation growing on them, enhancing otherwise featureless areas of bare wall. They may be natural, such as brick or stone built walls which have been naturally colonized by lichens, mosses, ferns and flowering plants or they can be large scale engineered green walls. The process of allowing and encouraging plants to grow on and up walls allows the natural environment to be extended into urban areas. Green walls can mimic natural rock faces of cliff and rock slopes and provide resting and feeding places for birds, invertebrates and even small mammals. Climbers provide nesting habitat for birds such as wrens, blackbirds, song thrushes and house sparrows. Plant species such as ivy, climbing roses and honeysuckles are all important fruit resources for birds; climbing plants like Virginia creeper and ivy also form important habitats for invertebrates. Green walls are also beneficial in reducing energy consumption through providing shading during the summer and insulation during the winter, and can also form part of a Sustainable Urban Drainage System. The combination of green walls with green roofs provides a route for wildlife between habitats at ground and roof level. Green walls that comprise climbers and light weight support structures such as wires and trellis are relatively cheap to develop and maintain.
- 6.32 Engineered green walls, or 'vertical gardening', provide an opportunity for impressive visual impact whilst providing a living vertical habitat with biodiversity value. They may be either designed as a large structure attached to a wall containing a variety of planted species and an irrigation system which provides the plants with water and nutrients, or as a hanging wall at the top of a building where plants are allowed to hang down from suspended planters, entailing no direct contact between the plants and the wall. Whilst providing impressive displays many engineered green walls comprise mainly non-native plants and can be expensive to maintain and as such their inclusion needs careful consideration. For example a number of green walls have been constructed primarily as sound barriers to protect human health and the incorporation of vegetation has been a relatively minimal additional cost.
- 6.33 On a smaller scale, green walls can also be created on existing buildings by growing climbing plants against a section of trellis work to train the plant, examples across the campus are observed in Areas C, F and G. Climbing plants are likely to require pruning to ensure that they do not have an adverse effect on the condition of windows and guttering. Fruit trees such as apples and pears can also be used to form a green wall by training them as espaliers.
- 6.34 Areas for construction of green walls include: B9, B10, C12, F13, F14, G5, I6

Recommendation 8: Install rain gardens

- 6.35 Rain gardens mimic natural drainage in urban areas by increasing water retention, reducing the volume of rainwater running into drains and treating low level pollution. A rain garden is a simple intervention designed to receive rainwater which has come from a downpipe or a large domestic paved area. The rainwater enters the soil and drains away into the ground or is taken up by the

plants and returns to the atmosphere via evapotranspiration. During particularly heavy rainfall, any excess water is redirected to existing drains.

- 6.36 Rain gardens, in their simplest form may be a planter placed under a building downpipe composed of a gravel bed, a soil layer, densely planted with a diverse range of species and fitted with an overflow pipe directed to the existing surface water drain. The University could consider placing rain garden planters under downpipes across the Campus therefore further increasing green space around the campus. Table 4 below provides a list of plants which may be incorporated into the planting regime of water gardens, and their benefits to wildlife.

Table 4 Plants suitable for rain gardens

Common name	Scientific name	Habit	Sunlight and Aspect	Origin
Guelder rose	<i>Viburnum opulus</i>	Perennial shrub	Any	Native. Flowers attract insects and berries are eaten by birds.
Dogwood	<i>Cornus sanguinea</i>	Perennial shrub	Any	Native. Leaves are larval food for vase bearer moth and berries eaten by birds. Often planted for attractive winter stems.
Culvers root	<i>Veronicastrum virginicum</i>	Herbaceous perennial	Full sun or partial shade	Non-native. Tall with long terminal blue flower spikes. On the RHS 'plants for pollinators' list.
Aster	<i>Aster spp.</i>	Herbaceous perennial	Full sun or partial shade	Non-native. Often late flowering. Clump forming. Several species on the RHS 'plants for pollinators' list.
Black eyed susan	<i>Rudbeckia birta</i>	Herbaceous annual or biennial	Full sun or partial shade	Non-native. Spectacular yellow and black flowers. On RHS 'plants for pollinators' list.
Stinking hellebore	<i>Helleborus foetidus</i>	Herbaceous perennial	Full sun or partial shade	Native. Winter flowers.
Montbretia	<i>Crocsmia spp.</i>	Deciduous rhizomatous perennial	Partial shade	Naturalised. Red flowers. Thrives in most conditions.
Bugle	<i>Ajuga reptans</i>	Rhizomatous perennial	Partial shade	Native. Low growing and will form a mat.
Columbine	<i>Aquilegia spp.</i>	Herbaceous perennial	Full sun or partial shade	Non-native. Clump forming with tall flower spikes. On RHS 'plants for pollinators' list.
Inula	<i>Inula hookeri</i>	Herbaceous perennial	Partial shade	Tall clump forming with yellow flowers. On RHS 'plants for pollinators' list.
Hemp agrimony	<i>Eupatorium cannabinum</i>	Herbaceous perennial	Full sun or partial shade	Native. Sub-shrubs with pink flowers.
Bellflower	<i>Campanula glomerata</i>	Herbaceous perennial	Full sun or partial shade	Native. Clumps bearing violet-blue bell shaped flowers.
Sneezeweed	<i>Helenium sp.</i>	Herbaceous perennial	Full sun	Non-native. Clump forming with red flowers. On RHS 'plants for pollinators' list.

Common name	Scientific name	Habit	Sunlight and Aspect	Origin
Lesser periwinkle	<i>Vinca minor</i>	Perennial sub-shrub	Any	Non-native. Ground cover with blue flowers.
Elephants ear	<i>Bergenia sp.</i>	Rhizomatous perennial	Full sun or partial shade	Non-native. Large leaves and pink flowers.
Plantain lilies	<i>Hosta spp.</i>	Herbaceous perennial	Part shade	Non-native. Attractive light coloured flowers.
Yellow flag	<i>Iris pseudocorus</i>	Rhizomatous perennial	Full sun or partial shade	Native. Likely to prefer wetter areas near inlet.
Siberian flag	<i>Iris sibirica</i>	Rhizomatous perennial	Full sun or partial shade	Non-native. Blue flowers. Prefers moist but well drained soil.
Garlic and onions	<i>Allium spp.</i>	Bulbous perennials	Full sun	Non-native. On RHS 'plants for pollinators' list.
Soft rush	<i>Juncus effusus</i>	Evergreen perennial	Full sun or partial shade	Native. Form tussocks – likely to prefer wetter areas.
Pendulous sedge	<i>Carex pendula</i>	Rhizomatous perennial	Full sun or partial shade	Native. Nodding flower spikes. Likely to prefer wetter areas near inlet.
Zebra grass	<i>Miscanthus sinensis</i>	Perennial, deciduous grass	Full sun	Non-native. Tussock forming ornamental grass with silky flowers.
Switch grass	<i>Panicum virgatum</i>	Deciduous perennial grass	Full sun	Non-native. Tussock forming ornamental grass.
Royal fern	<i>Osmunda regalis</i>	Deciduous fern	Any	Native. Large clump-forming plants.
Male fern	<i>Dryopteris felix-mas</i>	Deciduous or evergreen fern	Partial shade or full shade	Native. Large shuttlecock-like form.
Broad buckler fern	<i>Dryopteris dilatata</i>	Deciduous or evergreen fern	Partial shade or full shade	Native. Large shuttlecock-like form.

Extracted from Rain Garden Guide (www.raingardens.info)

Scattered Trees and Shrub

Summary

- 6.37 All areas of the John Andersen campus contain scattered trees which have a limited range in species (mostly *Acer* spp.), are non-native, and are of semi/mature in age. Similarly each area of the campus comprises significant shrub borders of mainly non-native species. However the presence of both trees and shrub borders increases the permeability of the Andersen campus to the movement of wildlife within the campus and to areas outside to the north (Sighthill) and east (Necropolis). The enhancement of existing habitat corridors and habitat 'stepping stones', can be undertaken through strategic planting of additional trees and shrub borders throughout the campus. The design of new planting schemes (both trees and shrubs) should aim where possible to increase connectivity with existing plantings. Planting regimes should also aim to mainly use native species which are known to increase the biodiversity value of an area.

Existing Management

- The trees on campus are subject to a regular assessment of condition which are used to inform tree management decisions.
- The trained grounds staff of the Estate Services inspect trees to identify to prioritise works including pruning, felling and replacement felling as deemed necessary.

Recommendations for Biodiversity Enhancement**Recommendation 1: Develop a plan for the planting and maintenance of individual trees/shrubs and coups of trees and areas of shrub borders**

- 6.38 A plan should be drafted and adopted to show the location of all existing trees and shrubs, newly planted trees and/or coups of trees, and areas of newly planted shrub. The document should incorporate a maintenance plan for these habitats across the campus. The maintenance plan should include monitoring of the extent, species diversity and condition of individual trees/shrub and coups of trees and areas of shrubbery.

Recommendation 2: Increased planting of trees and shrub areas to promote connectivity and structural diversity between and within existing habitats

- 6.39 It is recommended that the new planting should be guided by the aim to develop a network of habitat corridors through the Andersen campus thus creating increased permeability. The potential corridors should be formed from existing areas of scattered trees and shrub borders which will be strategically planted with additional trees and shrubs to enhance and strengthen these habitat corridors. Where possible the width of habitat corridors should be increased or buffered through the addition of contiguous strips of habitat including wildflower margins adjacent to shrub borders and along areas of scattered trees. The edges of existing shrub borders should be scalloped, and newly planted shrub borders designed with increased sinuosity thus increasing habitat variation. It is recommended that native species of trees and scrubs are used in preference to ornamental non-native species due to their inherent benefit to biodiversity. It has been shown that native tree and scrub species provide significant benefit (by providing sources of nectar, shelter, commuting routes) to a range of invertebrate species (numbers in brackets), including hazel (107), hawthorn *Crataegus monogyna* (230), bird cherry *Prunus avium* (157), elder (19), oak *Quercus robur* (423), ash (68) and Scot's pine (172).
- 6.40 Within urban settings there is a need to balance the aesthetic requirements of amenity plantings with those species that benefit wildlife. Strategic planting even within formal areas can provide benefit to wildlife by providing vegetated structural diversity and flora species diversity.
- 6.41 Areas for planting of new areas of native shrub/trees include: A11, B11, C13, C14, D7, E4, E5, F14-F17, G6, I8, I9

Recommendation 3: Management of Mature Trees

- 6.42 It is recommended that where public safety allows, scattered trees should be allowed to be allowed to mature. Regular arboricultural surveys should be used to determine management and maintenance including pruning. Where possible dead trees should be remain on site, to provide potential habitat for roosting bats, nesting birds and invertebrates.

Recommendation 4: Tree protection during campus development

- 6.43 During construction work on Andersen campus, all trees should be protected following best practice guidance as identified in 'British Standards 5837:2005 Trees in relation to construction' document. All trees should be protected through the adoption of a protected zone placed around the trees, its distance determined by the extent of the crown and the height of the tree.

Wetland

Summary

- 6.44 Waterbodies such as ponds are an important resource for local biodiversity, irrespective of its size. Wetlands on campus include a pond in Area F and an artificial man made channel in Area A. The extent of the wetted section of the pond has reduced in time, as successional habitats have developed including swamp and inundation vegetation. The development of marginal wetland habitats throughout the boundary of the pond has reduced the aesthetic appeal of the feature to students and staff.
- 6.45 The artificial watercourse running through Area A is currently of low/moderate biodiversity value due to its form and construction. The channel appears to have been constructed from concrete and stone sections, forming several pools interspersed between uniform sections of square channels, which limits wetland habitat development.

Existing Management

- 6.46 The artificial water course on campus is cleaned periodically to remove surface debris, particularly from leaf fall. A pump creates a continual flow throughout the system and oxygen levels are sufficient to support aquatic life. A riparian strip of mainly non-native shrubs and trees borders the watercourse.
- 6.47 The pond has developed through natural processes over the last several years and has not been managed intensively. The area of swamp habitat has developed accordingly with the drier areas developing into tall ruderal habitat.

Recommendations for Biodiversity Enhancement

Recommendation 1: Develop and adopt a wetland management plan

- 6.48 A plan should be drafted and adopted to show the location of all habitats associated with the pond in Area F and artificial watercourse in Area A. Any developments should be included within the plan in addition to maintenance regimes, monitoring of the extent, species diversity and condition of newly created areas of habitat. The plan should be incorporated into the Biodiversity Enhancement Implementation Plan.

Recommendation 2: Restore and extend pond

- 6.49 The existing pond would benefit from the clearance of a significant amount of the vegetation and from silt removal to create larger areas of open water. The vegetation should be cleared with care to ensure that some vegetation is left, creating a larger area of open water with marginal vegetation around the fringes. It is recommended that native species, of local provenance, are planted in the place of some of the removed vegetation to increase the ecological value of the pond. Most pond fauna will utilize the full range of vegetation structure within a waterbody, therefore it is important to ensure that the pond contains plants from a number of different plant groups. Typical plant groups that provide biodiversity value are:
- Marginal plants: Plants with their roots and lower stems in the water, but with the majority of their leaves and flowers above the water level. Usually grow in a range of water depths and are valuable for their attractive flowers which are a good source of nectar. They provide shelter for amphibians and allow emerging fauna to exit from the pond.
 - Oxygenating plants: Plants that are mainly submerged which are crucial for a balanced pond. They raise oxygen levels within the pond whilst keeping algae levels low; they may also provide cover and foraging opportunities for amphibians and other pond life.

- Bog plants: Found in areas which are always very damp, but are not permanently waterlogged.
- Floating plants: Plants which are rooted on the bottom of the pond, but their leaves float on the surface. They provide shade for pond life and will help inhibit algae and duckweed through competition for nutrients and light.

Recommendation 3: Monitor the water quality of the pond

- 6.50 The quality of water in a wetland affects its nature conservation value and in terms of ponds, the best wildlife ponds have clean water with low levels of pollutants. It is recommended that water quality testing of the pond is undertaken at least twice a year, once in spring and once at the end of summer, to ensure that oxygen levels are sufficiently high and that ammonia and nutrient levels are low. An action plan should be developed and followed in the event of poor water quality results to restore the pond to high conservation value. It is also recommended that rubbish inspections take place on a regular basis and any necessary rubbish removal instigated.

Recommendation 4: Construct a boardwalk around existing pond

- 6.51 The pond is currently under-utilised as an amenity resource therefore its value is low. It is recommended that a boardwalk or similar is constructed around the pond to increase access from existing access routes in the south to areas in the north.

Recommendation 5: Incorporate wetland design into any new development across the campus

- 6.52 Wetlands are an important part of sustainable urban drainage systems (SUDS), by intercepting rainfall and reducing runoff rates. Within Scotland, it is a legal requirement for almost all new developments to incorporate some form of SUDS into their design however, SUDS also provide significant opportunity for biodiversity enhancement through the creation of wetted areas which may be vegetated with native species, providing significant additional habitat for wetland fauna. It is recommended that ponds, wetlands and swales are all considered in future development as part of the University's ongoing Biodiversity Enhancement Strategy.

Recommendation 6: Naturalise the channel running through Area A

- 6.53 The biodiversity value of the channel in Area A could be significantly improved by reengineering the flow pattern to slow the flow and increase the number of ponds and their size within the artificial watercourse.

Conclusion

- 6.54 The 9 Areas within John Andersen campus generally comprise intensively managed amenity grasslands, semi/mature ornamental trees and extensive shrub borders. The preliminary ecological appraisal of the 9 Areas showed that the Areas B, C, D, E, G, H and I are of low biodiversity value, with Areas A and F being of moderate value. A number of enhancement measures have been identified including creation of wild flower areas, new shrub borders, planting of additional trees, the installation of wildlife installations and development of watercourses. The implementation of the recommendations contained within this report will increase the biodiversity value within each Area of the John Andersen Campus. It will strengthen the habitat corridors and improve permeability to wildlife throughout the campus and connectivity to important sites for nature conservation to the north (Sighthill) and to the east (Necropolis) of the campus.

Table 5 Summary of recommendations for biodiversity enhancement

Habitat	Recommendation	Prescription	Areas	Levels of Funding for implementation		
				Low	Medium	High
Amenity Grassland and herbaceous borders	1.Develop a plan for the creation and maintenance of wildflower areas		Throughout Estate		X	
	2.Creation of wildflower areas in existing amenity grassland - reseeded	Reseeding	A1, A2, A3, B1, C1, D1, D2, E1, E2, F1, F2, F3, F4, G1, G2, I1	X		
		Bulbs	A4, A5, B2, C2, C3, D3, F5	X		
	3.Less intensive management of grasslands	Reduced mowing regime	A6, B3, E3, D4, G3 H1, H2, H3, H4	X		
Built Environment	1.Develop a plan for the installation and maintenance of wildlife installations		Throughout Estate		X	
	2. Install additional bird boxes and bat boxes and undertake monitoring	The installation of internal bird boxes at soffits/eaves level for the common swift, house sparrow and starling	On new buildings and existing buildings where appropriate			X
		Creation of purpose	On new		X	

		built ledges for swallows, and the installation of pre-cast nest cups for swallows and house martins.	buildings			
		Installation of appropriate nest boxes for range of birds found within urban environments. Mature trees are found throughout each Area in the John Andersen campus upon which bird boxes may be attached	A7, A8, B4, B5, C4, C5, C6, C7, F6, F7, G4, H5, H6, H7, I2, I3, I4		X	
		Creation of space in walls or behind cladding for crevice dwelling bats, installation of access points for roof-void dwelling bats	On new buildings and existing buildings where appropriate			X
		Mature trees are found in each Area within the John Andersen campus upon which bat boxes may be attached	A9, A10, B6, B7, C8-C10, F8, F9, H8, I5		X	
		Monitoring of bird boxes	A7, A8, B4, B5, C4, C5, C6, C7, F6, F7, G4, H5, H6, H7, I2, I3, I4		X	
		Monitoring of bat	A9, A10, B6,		X	

		boxes	B7, C8-C10, F8, F9, H8,			
	3.Mitigate for the impact of lighting on bats and birds	Use of low light levels	On new buildings			X
	4.Construct artificial habitats	Construction of artificial habitats for invertebrates	B8, C11, D5, F10, F11		X	
	5.Construct woodpiles	Woody cuttings and larger pieces of wood should be used to create woodpiles, which are best located in direct contact with the ground in a shaded area	F12	X		
	6.Include the design of green roofs in new developments (and consider retrofitting onto existing buildings)		On new buildings			X
	7.Create and enhance green walls on buildings		B9, B10, C12, F13,F14, G5, I6 and new buildings			X
	8.Install rain gardens		Throughout the Estate where appropriate			X
Scattered Trees and Shrubs	1.Develop a plan for the planting and maintenance of individual trees/shrubs and coups of trees and areas of shrub borders		Throughout the Estate		X	
	2.Increased planting of trees and shrub areas to		A11, B11, C13, C14,		X	

	promote connectivity and structural diversity between and within existing habitats		D7, E4, E5, F14-F17, G6, I8, I9			
	3.Management of Mature Trees		Throughout Estate		X	
	4.Tree protection during campus development	During construction work on Andersen campus, all trees should be protected following best practice guidance	In areas of new development within the Estate	X		
Wetland	1.Develop and adopt a wetland management plan		A, F		X	
	2. Restore and extend pond		A, F		X	
	3.Monitor the water quality of the pond		A, F		X	
	4.Construct a boardwalk around existing pond		F			X
	5.Naturalise the channel running through Area A		A			X

7 References

Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R.D., Aebischer, N.J., Gibbons, D.W., Evans, A. & Gregory, R.D. (2009). Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 102: 296–341.

Glasgow and the Clyde Valley Strategic Development Planning Authority. (2015) Strategic Development Plan – Main Issues Report – Background Report. Green Network Priorities.

Chartered Institute of Ecology and Environmental Management (2012). Guidelines for Preliminary Ecological Appraisal. CIEEM, Winchester

Environmental Association of Universities and Colleges (2009) Biodiversity on Campus: An EAUC Practical Guide.

JNCC (2010). Handbook for Phase 1 habitat survey. A technique for environmental audit. Joint Nature Conservancy Council. Peterborough

Scottish Government (2005) Scotland's Biodiversity: It's in Your Hands - A strategy for the conservation and enhancement of biodiversity in Scotland

Scottish Government (2013) 2020 Challenge for Scotland's Biodiversity - A Strategy for the conservation and enhancement of biodiversity in Scotland ISBN: 9781782565864

Scottish Government (2014) Scottish Planning Policy ISBN: 9781784125677

Stace, CA (2010). *New Flora of the British Isles*, Third Edition. Cambridge University Press, Cambridge.

United Kingdom National Ecosystem Assessment (2011) The UK National Ecosystem Assessment Technical Report. UNEP-WCMC, Cambridge.

University of Strathclyde (2010) Estates Services Sustainability Policy, May 2010, ver 2.

University of Strathclyde (2010) Estates Services Sustainable Design Quality Standards, November 2010 ver.4

University of Strathclyde (2011) Estates Services Sustainable Design Quality Standards – Minor Projects, December 2010

University of Strathclyde (2010) Estates Services Sustainable Design Quality Standards – Major Projects, November 2010

University of Strathclyde (2011) Campus Plan 2011

University of Strathclyde (2011) Public Realm Design Guide 2011

Appendix A Figures

Figure 1. Position of John Anderson Campus within Glasgow city and wider environment.

Figure 2 Survey Areas within the John Andersen Campus

Figure 3 Results of extended Phase 1 habitat survey Area A

Figure 4 Results of extended Phase 1 habitat survey Area B

Figure 5 Results of extended Phase 1 habitat survey Area C

Figure 6 Results of extended Phase 1 habitat survey Area D

Figure 7 Results of extended Phase 1 habitat survey Area E

Figure 8 Results of extended Phase 1 habitat survey Area F

Figure 9 Results of extended Phase 1 habitat survey Area G

Figure 10 Results of extended Phase 1 habitat survey Area H

Figure 11 Results of extended Phase 1 habitat survey Area I

Figure 12 Enhancements for Biodiversity in survey Area A

Figure 13 Enhancements for Biodiversity in survey Area B

Figure 14 Enhancements for Biodiversity in survey Area C

Figure 15 Enhancements for Biodiversity in survey Area D

Figure 16 Enhancements for Biodiversity in survey Area E

Figure 17 Enhancements for Biodiversity in survey Area F

Figure 18 Enhancements for Biodiversity in survey Area G

Figure 19 Enhancements for Biodiversity in survey Area H

Figure 20 Enhancements for Biodiversity in survey Area I

Appendix B Target Notes

Target Note 1

Composition of intensively managed amenity grassland in Area A. The grassland is regularly mown during the growing season, and no herbicides or fertilisers are applied to the sward. The composition and structure of the sward provides low value to biodiversity.

Common Name	Species	DAFOR Abundance Score
Red fescue	<i>Festuca rubra</i>	D
Meadow grass	<i>Poa pratensis</i>	D
Perennial rye grass	<i>Lolium perenne</i>	F
Yorkshire fog	<i>Holcus lanatus</i>	O
Common bent	<i>Agrostis capillaris</i>	R
White clover	<i>Trifolium repens</i>	O
Common mouse ear	<i>Cerastium fontanum</i>	O

Target Note 2

The shrub borders within the Sculpture Gardens are intensively managed and comprise mainly semi mature non-native species. The range of species and age provides a vegetated structural diversity for the area which provides suitable breeding opportunities for nesting birds. Several species are fruit bearing including cotoneaster, which provide feeding opportunities for a number of bird species including blackbird.

Common Name	Species	DAFOR Abundance Score
St John's wort	<i>Hypericum beanie</i>	D
David viburnum	<i>Viburnum davidii</i>	D
William Penn barberry	<i>Berberis gladwynesis</i>	D
Japanese spirea firelight	<i>Spiraea japonica</i>	D
Purple flowered cotoneaster	<i>Cotoneaster salicifolius</i>	O
Portugal laurel	<i>Prunus lusitonica</i>	O
Azalea	<i>Rhododendron indicum</i>	O

Target Note 3

Several large, mature common alder trees *Alnus glutinosa* shade the northern section of the artificial watercourse, in addition to weeping willow *Salix babylonica*, with several Scot's pine located along the east boundary. The age and structure of the trees provide suitable habitat for nesting birds, and provide suitable areas for the installation of bat boxes as biodiversity enhancement measure.

Target Note 4

The artificial watercourse is constructed from concrete and stone slabs, forming a series of ponds and riffles. Floating and emergent vegetation is limited to common duckweed *lemna minor*, white water lily *nymphaea alba*, spiked milfoil *myriophyllum spicatum*, water mint *Mentha aquatic*, yellow flag *Iris pseudacorus*, and water horsetail *Equisetum arvense*. The shrub beds which border the watercourse strength the habitat

corridor within Area A and allows Glasgow LBAP species (blue tailed and common blue damselflies) to utilise this habitat.

Target Note 5

Intensively managed grassland sward dominated by meadow grass and red fescue with occasional perennial ryegrass *Lolium perenne* occasionally found along the borders of shrub beds.

Target Note 6

The southern border of Area B contains several mature including mainly sycamore *Acer pseudoplatanus*, with several whitebeam *Sorbus aria*, common lime *Tilia europaea* and cherry *Prunus* spp.. They form a number of the oldest trees within any area of the John Andersen campus. Their age and form provide opportunities for nesting birds while reducing the negative impact of street lighting into the site from Cathedral Street.

Target Note 7

An area of mainly bare ground (0.2 acres) with occasional young shrub *Buddleja davidii* and a small area of ephemeral/short perennial habitat including occasional greater plantain *Plantago major*, common ragwort *Senecio jacobaea*, colt's foot *Tussilago farfara* and curled dock *Rumex crispus*. These species provide suitable nectar sources for a range of terrestrial invertebrates.

Target Note 8

Area of natural green wall formed from growth of *Hedera helix* is on the eastern side of Murry Hall. The habitat will provide suitable nectar sources for terrestrial invertebrates and once mature potential nesting sites for birds and transitory bat roosts.

Target Note 9

The area comprises mainly non-native shrubs including dominant buddleia and dogwood, occasional Portugal laurel and raspberry and native shrub of guelder rose *Viburnum opulus*, elder *Sambucus nigra* and dog rose *Rosa canina*. Areas of tall ruderal habitat, has developed within the shrub areas and along the borders providing a mixture of habitats and species of moderate biodiversity value.

Target Note 10

A man-made pond is located to the south-west corner of the site at one its lowest topographical points. The area has historically remained a wet grassland, probably due to natural drainage throughout the site. Several years ago, the pond was constructed through the excavation of top and sub soils forming a structure with deeper central section and graduated margins. The open water area has reduced in extent as successional habitat has developed.

Target Note 11

An area of sekka willow *Salix udensis* which has undergone regular coppicing resulting in a closed canopy with negligible lower vegetative layers.

Target Note 12

The northern boundary of the site retains remnant structures of buildings the majority of which have been removed from the site. The structures include walls, columns and arches. Mature ivy has developed along two columns to the west forming areas of green wall. A second wall to the east is extensively covered by honeysuckle. These natural green walls provide foraging opportunities for terrestrial invertebrates, nesting birds and potential sites for roosting bats.

Target Note 13

An area of broadleaved plantation located to the east of the site. The plantation is dominated by multi stemmed paper birch *Betula papyrifera* and ground cover of ivy.

Target Note 14

Area dominated by common nettle, rosebay willow herb and creeping thistle, with occasional lesser burdock *Arctium minus*, which provide sources of nectar for terrestrial invertebrates and food sources for seeding eating birds.

Target Note 15

Mature ash tree on the eastern boundary of Ramshorn Theatre. Where public safety allows, the tree should be allowed to develop naturally with minimum management.

Target Note 16

An area of ephemeral/short perennial vegetation with abundant creeping nettle, broadleaved dock, common sorrel, common mouse ear *Cerastium fontanum*, pineapple plant, which provide food sources for terrestrial invertebrates.

Appendix C Photographs

Appendix D Desk Study

Records of Protected and Notable species recorded within 1 km of the John Andersen campus.

Common Name	Species	Location	Designation
Common Toad	<i>Bufo bufo</i>	Sighthill Park	Glasgow LBAP, Bern-A3, WACA-Sch5_sect9.5a, WACA-Sch5_sect9.5b
Common Frog	<i>Rana temporaria</i>	Sighthill Park	Glasgow LBAP, Bern-A3, HabDir-A5, WACA-Sch5_sect9.5a, WACA-Sch5_sect9.5b
Spotted Flycatcher	<i>Muscicapa striata</i>	Cathedral Square	Bern-A2, Bird-Red, CMS_A2, SBL
Pipistrelle	<i>Pipistrellus pipistrellus</i>	St Andrews in the Square	Bern-A2, Bern-A3, CMS_A2, CMS_EUROBATS-A1, HabDir-A4, HabReg-Sch2, SBL, WACA-Sch5_sect9.4b, WACA-Sch5_sect9.5a, WACA-Sch5_sect9.5b, WACA-Sch5Sect9.4c
Roe Deer	<i>Capreolus capreolus</i>	Sighthill Park	Bern-A3, SBL
Pipistrelle Bat species	<i>Pipistrellus</i>	The Necropolis	CMS_A2, HabReg-Sch2, WACA-Sch5_sect9.4b, WACA-Sch5_sect9.5a, WACA-Sch5_sect9.5b, WACA-Sch5 Sect9.4c
Goldfinch	<i>Carduelis carduelis</i>	St Mungo's Museum	Bern-A2
Goldfinch	<i>Carduelis carduelis</i>	The Necropolis	Bern-A2
Greenfinch	<i>Carduelis chloris</i>	The Necropolis	Bern-A2
Blue Tit	<i>Cyanistes caeruleus</i>	Cathedral Square	Bern-A2
Blue Tit	<i>Cyanistes caeruleus</i>	The Necropolis	Bern-A2
Pied Wagtail	<i>Motacilla alba</i>	The Necropolis	Bern-A2
Pied Wagtail	<i>Motacilla alba</i>	The Necropolis	Bern-A2
Great Tit	<i>Parus major</i>	The Necropolis	Bern-A2
Wren	<i>Troglodytes troglodytes</i>	Sighthill Park	Bern-A2
Swallow	<i>Hirundo rustica</i>	The Necropolis	Bern-A2, Bird-Amber

Common Name	Species	Location	Designation
Grey Wagtail	<i>Motacilla cinerea</i>	Ingram St	Bern-A2, Bird-Amber
Dunnoek	<i>Prunella modularis</i>	The Necropolis	Bern-A2, Bird-Amber
Dunnoek	<i>Prunella modularis</i>	The Necropolis	Bern-A2, Bird-Amber
Kestrel	<i>Falco tinnunculus</i>	The Necropolis	Bern-A2, Bird-Amber, CMS_A2, ECCITES-A, SBL
Peregrine	<i>Falco peregrinus</i>	George Square	Bern-A2, BirdsDir-A1, CMS_A2, ECCITES-A, SBL, BirdsDir-A1
Robin	<i>Erithacus rubecula</i>	The Necropolis	Bern-A2, SBL
Siskin	<i>Spinus spinus</i>	George Square	Bern-A2, SBL
Willow Warbler	<i>Phylloscopus trochilus</i>	carpark opposite Glasgow Green depot	Bird-Amber
Mallard	<i>Anas platyrhynchos</i>	King St car Park	Bird-Amber, BirdsDir-A2.1, CMS_A2, CMS_AEWA-A2
Woodcock	<i>Scolopax rusticola</i>	High Street, Glasgow	Bird-Amber, BirdsDir-A2.1, CMS_A2, CMS_AEWA-A2, SBL
Mistle Thrush	<i>Turdus viscivorus</i>	The Necropolis	Bird-Amber, BirdsDir-A2.2
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	NS56X (NS5864T) City Centre Tradeston Gorbals	Bird-Amber, BirdsDir-A2.2, CMS_AEWA-A2, SBL
Swift	<i>Apus apus</i>	High Street/George Street	Glasgow LBAP Bird-Amber, SBL
Bullfinch	<i>Pyrrhula pyrrhula</i>	The Necropolis	Bird-Amber, SBL
Starling	<i>Sturnus vulgaris</i>	The Necropolis	Bird-Red, BirdsDir-A2.2
Song Thrush	<i>Turdus philomelos</i>	The Necropolis	Bird-Red, BirdsDir-A2.2, SBL
Woodpigeon	<i>Columba palumbus</i>	The Necropolis	BirdsDir-A2.1

Common Name	Species	Location	Designation
Feral Pigeon	<i>Columba livia</i>	The Necropolis; near meadow c5	BirdsDir-A2.1, ECCITES-A
Carrion Crow	<i>Corvus corone</i>	The Necropolis	BirdsDir-A2.2
Jackdaw	<i>Corvus monedula</i>	The Necropolis	BirdsDir-A2.2
Magpie	<i>Pica pica</i>	High Street car park	BirdsDir-A2.2
Common Spotted-orchid	<i>Dactylorhiza fuchsii</i>	Ramshorn chruchyard	ECCITES-B
Broad-leaved Helleborine	<i>Epipactis helleborine</i>	Ramshorn chruchyard	ECCITES-B
Large-leaved Lime	<i>Tilia platyphyllos</i>	The Necropolis	NS-excludes
Creeping Thistle	<i>Cirsium arvense</i>	The Necropolis	SBL
Spear Thistle	<i>Cirsium vulgare</i>	The Necropolis	SBL
Bluebell	<i>Hyacinthoides non-scripta</i>	The Necropolis	SBL, WACA-Sch8
Collared Earthstar	<i>Geastrum triplex</i>	Bell Street	SBL
Collared Earthstar	<i>Geastrum triplex</i>	Bell Street	SBL
Collared Earthstar	<i>Geastrum triplex</i>	Bell Street	SBL
Upright Coral	<i>Ramaria stricta</i>	Bell Street	SBL
Acidota cruentata	<i>Acidota cruentata</i>	The Necropolis	Notable-B
Oedemera (Oedemera) virescens	<i>Oedemera (Oedemera) virescens</i>	The Necropolis	RedList_GB_Pre94-VU
Colletes (Colletes) daviesanus	<i>Colletes (Colletes) daviesanus</i>	The Necropolis	SBL
Lasioglossum (Dialictus) smeathmanellum	<i>Lasioglossum (Dialictus) smeathmanellum</i>	The Necropolis	SBL
Shaggy Mining Bee	<i>Lasioglossum (Evylaeus) villosulum</i>	The Necropolis	SBL
Lecania cyrtella	<i>Lecania cyrtella</i>	The Necropolis	SBL

Designations for Nature Conservation

Code	Designation	Description
AEWA-A2	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) Appendix 2.	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) Appendix 2. It is an intergovernmental treaty dedicated to the
Bern-A2 Bern-A3	The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) was adopted in Bern, Switzerland in 1979, and came into force in 1982	The principal aims of the Convention are to ensure conservation and protection of all wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention), to increase cooperation between contracting parties, and to regulate the exploitation of those species (including migratory species) listed in Appendix III. To this end the Convention imposes legal obligations on contracting parties, protecting over 500 wild plant species and more than 1000 wild animal species.
Bird-Red, CMS_A2	Convention on Migratory Species, Appendix 2	Migratory species having an unfavourable conservation status for which Range States are encouraged to conclude international agreements for their benefit
BirdsDir-A1 BirdsDir-A2.2	In 1979, the European Community adopted Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive'), in response to the 1979 Bern Convention on the conservation of European habitats and species (the 'Bern Convention').	The Directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe. It sets broad objectives for a wide range of activities, although the precise legal mechanisms for their achievement are at the discretion of each Member State (in the UK delivery is via several different statutes).
Bird-Amber	Bird Population Status - amber	Amber list species are those with an unfavourable conservation status in Europe; those whose population or range has declined moderately in recent years; those whose population has declined historically but made a substantial recent recovery; rare breeders; and those with internationally important or localised populations.
CMS_EUROBATS-A1	Convention on Migratory Species, EUROBATS - Annex	Protection and enhancement of species populations through legislation, education, conservation measures and international co-

	I	operation.
CMS_A2	Convention on Migratory Species, Appendix 2	Migratory species having an unfavourable conservation status for which Range States are encouraged to conclude international agreements for their benefit.
ECCITES-A ECCITES-B	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), signed in 1973	Aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The species covered by CITES are listed in three Appendices, granting varying degrees of protection to them.
Glasgow LBAP	Glasgow Local Biodiversity Action Plan	The Glasgow Local Biodiversity Action Plan contains a list of Priority Species and Habitats. Certain species and habitats are given priority within the Glasgow Biodiversity Action Plan, and these require action at the local level. Priority species identified within the BAP that are considered to be relevant in the context of the project include the following: common frog, common toad, swift and odonata (dragonflies and damselflies) and the habitat built up areas and gardens.
HabDir-A4	Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora Appendix 4	Animal and plant species of Community interest (i.e. endangered, vulnerable, rare or endemic in the European Community) in need of strict protection. They are protected from killing, disturbance or the destruction of them or their habitat. Note that the contents of this annex have been updated in April 2003 following the Treaty of Accession.
HabReg-Sch2	The Conservation of Habitats and Species. Regulations 2010. Schedule 2 Schedule 2: European protected species of animals.	Species which are endangered, the conservation of which the Community has a particular responsibility in view of the proportion of their natural range which falls within the territory of the Community. They require the designation of special areas of conservation.
NS-excludes	Nationally Scarce. Excludes Red Listed taxa	Nationally Scarce - Occurring in 16-100 hectads in Great Britain. Excludes rare species qualifying under the main IUCN criteria.
Notable-B	Nationally Notable B	Taxa which do not fall within RDB categories but which are none-the-less uncommon in Great Britain and thought to occur in between 31 and 100 10km squares of the National Grid or, for less-well recorded groups between eight and twenty vice-counties. Superseded by Nationally Scarce, and therefore no longer in use.
RedList_GB_Pre94-VU	IUCN (pre 1994) - Vulnerable	Taxa believed likely to move into the Endangered category in the near future if the

		causal factors continue operating. Superseded by new IUCN categories in 1994, but still applicable to lists that have not been reviewed since 1994.
SBL	Scottish Biodiversity List	
WACA-Sch1_part1	Wildlife and Countryside Act 1981 (Schedule 1 Part 1)	Birds which are protected by special penalties at all times.
WACA-Sch5_sect9.4b	Wildlife and Countryside Act 1981 (Schedule 5 Section 9.4, subdivision a)	Section 9.4 subdivision a - Animals which are protected from intentional damage or destruction to any structure or place used for shelter or protection.
WACA-Sch5Sect9.4c	Wildlife and Countryside Act 1981 (Schedule 5)	Animals which are protected from their access to any structure or place which they use for shelter or protection being obstructed.
WACA-Sch5_sect9.5a	Wildlife and Countryside Act 1981 (Schedule 5 Section 9.5a)	Section 9.5 Animals which are protected from being sold, offered for sale or being held or transported for sale either live or dead, whole or part.
WACA-Sch5_sect9.5b	Wildlife and Countryside Act 1981 (Schedule 5 Section 9.5b)	Section 9.5 Animals which are protected from being published or advertised as being for sale.
WACA-Sch8	Wildlife and Countryside Act 1981 (Schedule 8)	Plants which are protected from intentional picking, uprooting or destruction (Section 13 1a); selling, offering for sale, possessing or transporting for the purpose of sale (live or dead, part or derivative) (Section 13 2a); advertising (any of these) for buying or selling (Section 13 2b).

Appendix E: Summaries of Relevant Legislation, Policy and Other Instruments

This section briefly summarises the relevant legislation, policy and related issues that are mentioned in the main text of the report. The following text does not constitute legal advice. There are a number of national, regional and local planning policies that relate to nature conservation and ecology. Reference to these provides an indication of the likely requirements and expectations of statutory authorities in relation to applications for development and nature conservation and ecology within a given area. A brief outline of the relevant planning policy and guidance that relates to nature conservation and ecology is provided here.

Scottish Planning Policy

The revised and updated Scottish Planning Policy (SPP) was adopted by the Scottish Government in 2014. The SPP sets out planning policies including those that relate to the protection of biodiversity. Key policies set out within the SPP that relate specifically to biodiversity are summarised below.

The Scottish Planning Policy introduces a presumption in favour of development that contributes to sustainable development. This means that policies and decisions should be guided by a number of principles that are set out within the SPP, and these include the need to protect, enhance and promote access to natural heritage, including green infrastructure, landscape and the wider environment.

The SPP notes that planning authorities, and all public bodies, have a duty under the Nature Conservation (Scotland) Act 2004 to further the conservation of biodiversity. This duty must be reflected in development plans and development management decisions. They also have a duty under the Water Environment and Water Services (Scotland) Act 2003 to protect and improve Scotland's water environment.

International, national and locally designated areas and sites as outlined in the SPP should be identified and afforded the appropriate level of protection in development plans.

The presence (or potential presence) of a legally protected species is an important consideration in decisions on planning applications. The level of protection afforded by legislation must be factored into the planning and design of development and any impacts must be fully considered prior to the determination of an application.

Plans should identify and safeguard the character of areas of wild land as identified on the 2014 SNH map of wild land areas. Development may be appropriate in wild land in some circumstances.

Ancient semi-natural woodland is an irreplaceable resource and, along with other woodlands, hedgerows and individual trees should be protected from adverse impacts resulting from development.

Development management decisions should take account of potential effects on landscapes, the natural and water environment, including cumulative effects. Developers should seek to minimise adverse impacts through careful planning and design, considering the services which the natural environment is providing and maximising the potential for enhancement.

Glasgow Development Plan

The Glasgow City Council's existing development plan consists of Glasgow and the Clyde Valley Joint Structure Plan 2006 and City Plan 2 which was adopted in December 2009. Together these documents form the statutory development plan for Glasgow. The City Plan 2 has the following development and design policies for the environment:

EN6 – To protect and enhance Glasgow's habitats and species

All development within the City shall take cognisance of, and be compatible with, the Glasgow Local Biodiversity Action Plan, (LBAP) (available at www.glasgow.gov.uk/biodiversity), which sets out a number of species and habitat action plans. Many of the sites identified as important for habitats and species are also

covered by Environmental Designations (see Environmental Policy Designations Maps and policy ENV 7: National Regional and Local Environmental Designations).

Development should not have any adverse effect on existing habitats or species protected in law, international conventions or agreements or which are identified as a priority in government objectives, the Glasgow LBAP or are important because of their conservation status. Proposals will require to demonstrate, to the satisfaction of the Council, that:

- *there will be no fragmentation or isolation of habitats or species as a result of the development;*
- *the development will be sited and designed to minimise adverse impacts on the biodiversity of the site (including its environmental quality, ecological status and viability); and*
- *public benefits at a national, or city region wide level, will clearly outweigh the value of the habitat for biodiversity conservation*

The Council may require the developer to undertake surveys prior to planning permission being determined and site clearance/development preparation works beginning. This will be at the developers own expense and to the satisfaction of the Council. The surveys may relate to the sites environment and ecology or its wider ecological functions and should include recommendations for mitigation, restoration or enhancing the biodiversity as well as other information that the Council might require. Surveys may be required where there are grounds for believing, or there is the possibility, that:

- *a protected or important natural heritage interest relating to the site (or an ecological network it is part of) could be adversely affected or suffer damage/disturbance as a result of the proposed development. Such natural heritage interests would include those habitats, species or landscape features which are of concern by virtue of their conservation status, ecological function, national and international significance/ protection by legislation and agreements or which relate to the UK Biodiversity Action Plan or Glasgow LBAP; or*
- *the site supports, or has suitable habitats/features present which could support, a European Protected Species (e.g. it has water courses suitable for use by otters and mature trees or old buildings suitable for bats). In this case surveys will be required*

Where planning permission is granted, planning conditions will be imposed, or agreements negotiated, to minimise disturbance, protect, enhance and promote existing habitats and/or species and/or create new habitats and put in place measures to provide for their effective future management.

EN7 – To maintain, protect and enhance national, regional and local sites of landscape, cultural or nature conservation importance

Proposals should not have an adverse effect, either directly or indirectly, on the integrity or character of one or more of the natural, or special, features covered by an Environmental Designation (see Definition) listed below, or those sites which receive such a designation during the lifetime of City Plan 2:

- *Sites of Special Scientific Interest (SSSI)*
- *Local Nature Reserves (LNR)*
- *Sites of City-wide Importance for Nature Conservation (C-SINC)*
- *Local Sites of Importance for Nature Conservation (L-SINC)*
- *Green Corridors (formerly Corridors of Wildlife and/or Landscape Importance)*
- *Sites of Special Landscape Importance (SSLI)*
- *Tree Preservation Orders (TPO)*
- *Ancient, Long Established and Semi-natural Woodlands*
- *Gardens and Designed Landscapes*

- *Water courses, lochs, ponds and wetlands*

EN8 – To protect trees, woodlands and hedgerows from inappropriate development

Development should not cause the loss of, or serious damage to, trees, woodlands or hedgerows, which are covered by an existing tree preservation order (TPO) (see Environmental Policy Designation Maps), are on Council owned land, are of significant ecological, recreational, historical, shelter or landscape value or are in a conservation area. In these situations, trees, woodland or hedgerows protected by a TPO, or as if covered by a TPO, must not be removed without the explicit written consent of the Council.

Proposals should demonstrate, to the satisfaction of the Council, that:

- *where they are in, or near, an ancient, long established or semi-natural woodland there has been consultation with and approval from the Central Scotland Conservator, Forestry Commission Scotland;*
- *the public benefits at the local level clearly outweigh the value of the habitat;*
- *the development will be sited and designed to minimise adverse impacts on the biodiversity of the site, including its environmental quality, ecological status and viability;*
- *there will be no further fragmentation or isolation of habitats as a result of the development;*
- *all mature trees affected by a development proposal have been, or will be, surveyed for bats prior to the granting of planning permission (see policy ENV 6: Biodiversity)*
- *where any individual trees, groups of trees, woodlands or hedgerows would be lost, the applicant will provide compensatory planting (where appropriate, native species will be preferred) either as part of the overall scheme or elsewhere in the vicinity (this may require a Section 69 or 75 legal agreement); and*
- *appropriate legal agreements to guarantee future maintenance arrangements are in place and the details of methods to be adopted agreed.*

In addition, the Council will:

- *encourage new planting, particularly of native species, especially if it relates to areas of ancient, long established or semi-natural woodland that are small, isolated or in close proximity;*
- *encourage developers to consult the Forestry Commission Scotland on woodland establishment plans; and*
- *support grant applications to Forestry Commission Scotland for the management and establishment of woodland.*

UK and Glasgow Local Biodiversity Action Plan (LBAP)

The Government has drawn up a national strategy to conserve our threatened native species and habitats - the UK Biodiversity Action Plan (BAP). The UK BAP includes detailed Action Plans for priority habitats and species. The list of priority habitats and species included within the UK BAP is closely related to the list of habitats and species on the Scottish Biodiversity List.

The UK BAP is supported by a series of Local Biodiversity Action Plans (LBAPs), usually set up on a local authority administrative boundary basis. Each LBAP identifies those habitats and species considered to be most important in that area (usually referred to as priority habitats and species). Commonly, a LBAP will identify a number of habitats and species for which "action plans" have been prepared.

Certain species and habitats are given priority within the Glasgow Biodiversity Action Plan, and these require action at the local level. Priority species identified within the BAP that are considered to be relevant in the context of the project include the following: common frog, common toad, swift and odonata (dragonflies and damselflies) and the habitat built up areas and gardens.

Scottish Wildlife Legislation

In Scotland wildlife is afforded protection via a range of legal instruments. The key Acts and Regulations, which have been taken into account throughout this report, are as follows:

- Wildlife and Countryside Act 1981 (as amended)
- Nature Conservation (Scotland) Act 2004 (as amended)
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)

Species and Habitats of Principal Importance for Biodiversity Conservation

Section 1 of the Nature Conservation Scotland Act 2004 states that 'It is the duty of every public body and office-holder, in exercising any functions, to further the conservation of biodiversity so far as is consistent with the proper exercise of those functions'. To assist with this objective Section 2(4) of the Act sets out the requirement to publish a list of flora and fauna considered to be of principal importance in Scotland.

The list required under Section 2(4) of the Act has now been published and includes a diverse range of habitats and species, some of which may be present at the site (www.biodiversityscotland.gov.uk). The measures required to protect these species and habitats are set out in the document 'Scotland's Biodiversity: It's in Your Hands - A strategy for the conservation and enhancement of biodiversity in Scotland' (Scottish Executive, 2004). Biodiversity Targets are outlined in the 'Strategic Plan for Biodiversity 2011-2020', and the European Union's Biodiversity Strategy for 2020. It is a supplement to 'Scotland's Biodiversity: It's in Your Hands' which was published in 2004 and set out a 25-year strategy for the conservation and enhancement of biodiversity in Scotland. The two documents together comprise the Scottish Biodiversity Strategy

Appendix F: Examples of Biodiversity Enhancement Measures

<p>Rain Garden</p>	 <p>http://inhabitat.com/melbourne-water-encourages-australian-citizens-to-build-10000-rain-gardens/</p>	 <p>http://www.berkshireagle.com/ci_23646100/nature-watch-pittsfield-rain-gardens-send-runoff-river</p>	 <p>http://www.baag.com.au/raingardens/</p>
<p>Urban beehive</p>	 <p>www.urbangardensweb.com/2011/12/01/urban-beehive-for-design-loving-beekeepers/</p>	 <p>http://snohetta.com/project/186-vulkan-beehive</p>	 <p>http://www.uwolnicprojekt.org/en/objects/35-artur-gosk-ul.html</p>

Insect Hotels



<http://inhabitat.com/leading-architects-unveil-luxury-bug-hotels-in-london/>



<http://www.arupassociates.com/en/projects/insect-hotel/>



<http://www.nigeldunnett.info/profile/>

Wildflower Meadow



<http://www.bristol-culture.com/2013/08/27/bristols-new-wildflower-meadows/>



<http://www.bristol-culture.com/2013/08/27/bristols-new-wildflower-meadows/>



<http://urbanpollinators.blogspot.co.uk/2012/08/re-ading-flower-meadows-in-august-2012.html>

Green walls



<https://abominableink.wordpress.com/2012/06/18/the-dawn-of-a-new-age-vertical-gardens-living-walls-sky-farms/>



<http://www.greendiary.com/gorgeous-green-walls-the-next-big-thing-in-green-building-design.html>



<http://www.frenchenviro.com.au/example-post/>

Ponds



<http://ruralgardener.co.uk/2011/04/13/building-your-own-wildlife-pond/>



<https://www.pinterest.com/astridbrouwer/gartenteich/>



<http://www.wildlifetrusts.org/forgottenrailways>

<p>Bird boxes</p>	 <p>http://www.arborvitae.uk.com/shop/schwegler-house-martin-double-no-9a/</p>	 <p>http://www.dezeen.com/2009/08/28/animal-wall-by-gitta-gschwendtner/</p>	 <p>http://www.haiths.com/schwegler-spherical-wren-house/</p>
<p>Bat boxes</p>	 <p>http://www.bats.org.uk/pages/bat_boxes.html</p>	 <p>http://www.bats.org.uk/pages/bat_boxes.html</p>	 <p>http://www.rutlandwater.org.uk/shop/small-bat-box-1/#</p>

Green roofs



<https://www.pinterest.com/pin/352969689516645889/>



<http://www.greenroofs.com/projects/pview.php?id=760>



<http://www.livingroofs.org/king-alfreds-green-roof>

Blank Sheet