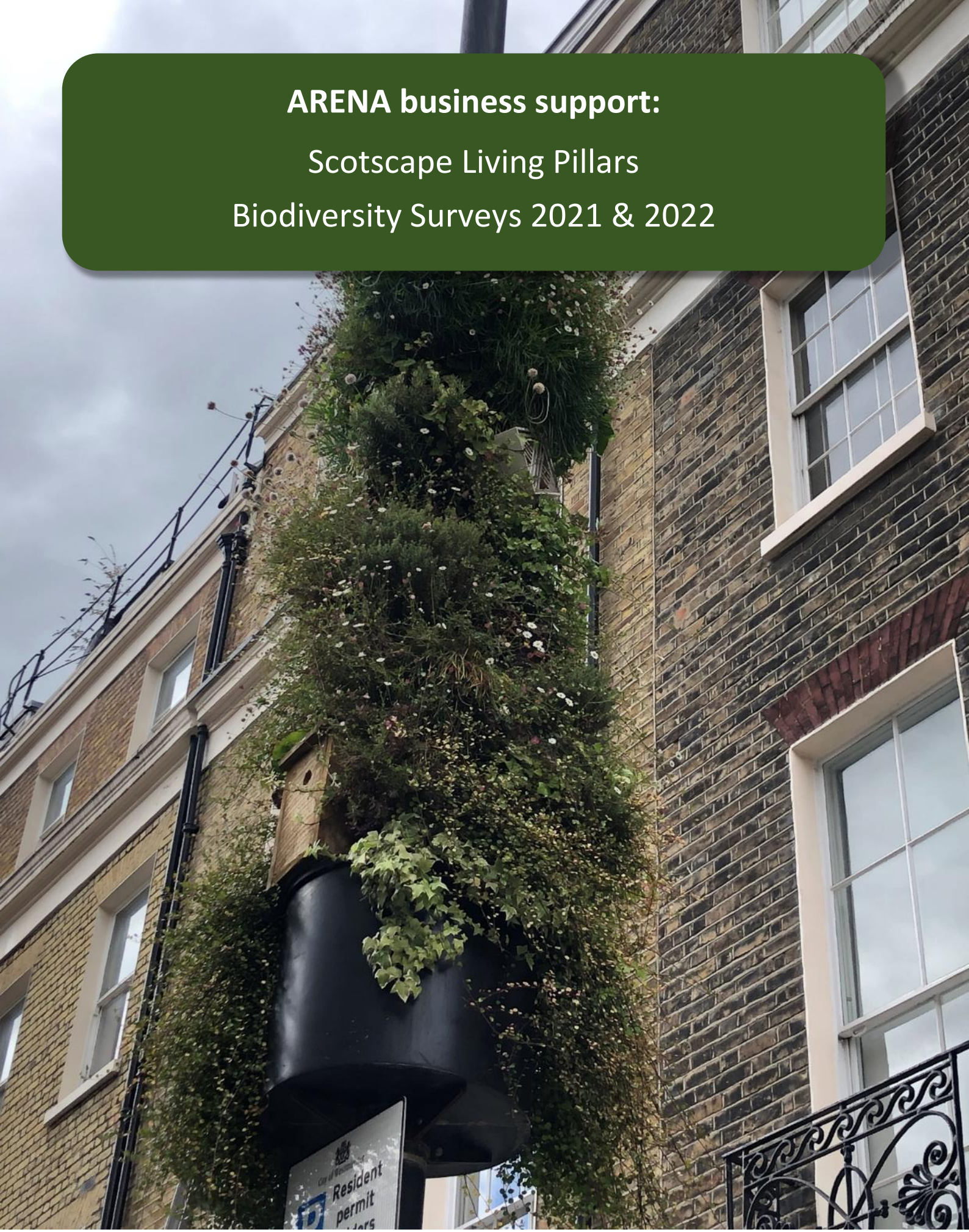
ARENA business support:

Scotscape Living Pillars

Biodiversity Surveys 2021 & 2022



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ARENA business support:
Scotscape – Living Pillars Biodiversity Surveys 2021 & 2022

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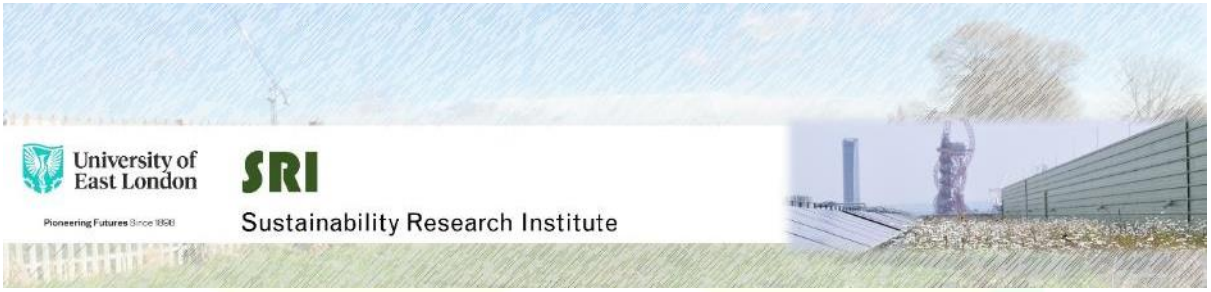

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Cover photo: Living Pillar in Ebury Street, London in July 2022 © C. Nash

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Key Findings Summary

The following summarises the key results from the Living Pillar surveys in summer 2021 and 2022:

Survey	Results
Birds 	A pair of goldfinch were recorded visiting Living Pillar 2 during the surveys in 2022, apparently foraging amongst vegetation.
	A fledgling goldfinch was found grounded close to Living Pillar 5, but it could not be confirmed if this species nested on the Living Pillars.
Flowers 	A significantly higher number of species were recorded in flower on the Hanging Baskets during the surveys, and flower abundance was also higher on the Hanging Baskets than the Living Pillars, but the difference was not significant.
	As individual units, Living Pillars had lower flower abundance/diversity of species in flower at the time of survey compared to the Hanging Baskets, but OVERALL, the Living Pillars supported a much broader diversity of flowering species (12 species versus 5 identical ornamental species for Hanging Baskets), and the Living Pillars flowers included more species of known value to pollinators than the Hanging Baskets.
Pollinators 	A greater diversity and abundance of pollinators were recorded visiting the Living Pillars compared to the Hanging Baskets during all surveys, and the difference was significant for all surveys, except Survey 3 (for which the difference was not statistically significant).
	Pollinator visits on the Living Pillars increased almost fourfold during the study, whereas visits to the Hanging Baskets remained low throughout. By 2022, average pollinator counts for the Living Pillars were 14-17 times higher than recorded for the Hanging Baskets.
	Pollinator visits and diversity were highest on Living Pillars 1 and 2, and these two pillars had the highest average flower diversity, but not the highest abundance of flowerheads compared to other pillars, indicating the potential importance of flower diversity for pollinators.
Sweep/pooter 	The sweep/pooter surveys recorded a total of 11 species from five different Orders, all of which were common and widespread species and most likely used the pillars as a foraging resource and/or stepping-stone habitat. The greatest number and diversity of species were recorded on Living Pillar 2.
Bee hotel 	All bee hotels showed signs of occupancy, with Living Pillar 3 having the highest rate of occupation. There was evidence of emergence, but further surveys would be needed to confirm successful breeding and species using these hotels.

Introduction

This report represents part of a business support project delivered through the ERDF ARENA project on behalf of Scotscape. The report summarises the methods, results, and conclusions of biodiversity surveys carried out on the Living Pillars located in Ebury Street in Belgravia, London during the summer of 2021 and 2022.

Methods

The biodiversity surveys were carried out by Caroline Nash and Stuart Connop, both professional ecologists experienced in conducting a range of biodiversity monitoring surveys. The surveys involved a basic inventory and index of species in the following groups:

- birds;
- flowering plants; and
- invertebrates.

The Living Pillars were surveyed on four occasions in 2021 and 2022 as follows:

- Survey 1 on 2nd July 2021;
- Survey 2 on 22nd July 2021;
- Survey 3 on 1st June 2022; and
- Survey 4 on 6th July 2022.

All surveys were undertaken in good conditions for observing bird and invertebrate activity, i.e. warm, dry and calm. The five Living Pillars on Ebury Street were numbered sequentially for the survey as illustrated in Figure 1 below.

Figure 1. *Diagram illustrating the location and numbering of the Living Pillars on Ebury Street, London, UK. Aerial image © Google Earth.*

Field survey methods

The field survey methods for the **Living Pillars** were as follows:

- *a bird survey:* lasting approximately 15 minutes on each of the five Living Pillars using a vantage point method, whereby the surveyor viewed the Living Pillar from a nearby vantage point to record any birds seen or heard in the vicinity of the Living Pillar. The surveyor used binoculars to assist with bird identification and recorded the registrations/numbers of each bird species observed. A vantage point survey method was selected as this minimises potential surveyor disturbance impacting the natural behaviour of birds on the pillars;
- *a flowerhead count:* comprising a count of the species/number of all open flowers/flowerheads, to provide an index of pollinator forage availability on each Living Pillar. A flowerhead count was also undertaken on five Hanging Baskets in close proximity to the Living Pillars to provide a comparison for understanding the value of the Living Pillars for pollinators (see below pollinator survey). One flower 'unit' was counted as a head (e.g. thrift), spike (e.g. Heuchera), capitulum (e.g. Mexican fleabane), umbel (e.g. yarrow) or individual flower (e.g. Geraniums);
- *a pollinator survey*: involving a timed count for 10 minutes, carried out by two surveyors standing either side of each of the five Living Pillars. Each surveyor recorded the species/number of pollinators seen visiting the pillar and their behaviour (i.e. in flight, or the floral species on which the pollinator was foraging/resting). The species were only recorded when they could be reliably identified in the field, e.g. butterflies, bumblebees, and honeybees, otherwise pollinators were categorised according to their group i.e. hoverfly, solitary bee/wasp. Counts of white and buff-tailed bumblebees were aggregated during counts as workers of these two species are difficult to reliably separate in the field. A timed count following the same methodology was carried out on five Hanging Baskets in close proximity to the Living Pillars to provide a comparison of pollinator activity;
- *a timed sweep/pooter survey:* for 10 minutes, whereby a surveyor searched the pillar and collected invertebrates using either a sweep net or directly by a pooter, to be sent for microscopy analysis and identification to species level. Species which were easily identified visually were also noted but not collected to avoid unnecessary lethal capture;
- *a bee hotel inspection:* involving a visual inspection of bee hotels installed on the pillars to record any evidence of use by nesting bees.

All microscopy analysis for surveys was carried out by Dr James McGill, an expert entomologist.

Analysis

Differences in relation to flowerhead abundance and diversity and pollinator abundance and diversity recorded on the Living Pillars and the Hanging Baskets were investigated using two-tailed Mann Whitney U Exact Tests. Test results with a *p*-value of 0.05 or lower were considered significantly different.

Limitations

It should be noted that as the experiment was not properly randomised (i.e. Pillars and Baskets randomly installed on a single street), there is a chance location could influence the experimental outcome. However, due to the proximity of the Hanging Baskets to the Living Pillars, and the distances that pollinators can travel to forage, this is unlikely.

Results

The Living Pillars were observed to generally be in good health during the surveys on both years and illustrative photographs of each Living Pillar are provided below (Figure 2). It was, however noted in June 2022 that the vegetation on Living Pillar 4 appeared much sparser than other pillars but, by the July survey, the vegetation was becoming more established. Living Pillar 2 had the most extensive plant cover and was the most structurally diverse.

Pillar 1 on 6th July 2022

Pillar 2 on 6th July 2022

Pillar 3 on 6th July 2022

Pillar 4 on 6th July 2022

Pillar 5 on 6th July 2022

***Figure 2**. Image of each Living Pillar on Ebury St, London, UK. Photos taken on 6th July 2022.*

The results from the Living Pillars biodiversity surveys are as follows:

Birds

Summer 2021

During the two bird surveys in 2021, no birds were seen directly interacting with the Living Pillars. Species recorded in the vicinity of the pillars are summarised below:

- Magpie *Pica pica* perched on a balcony near to Living Pillar 2 (Survey 1);
- Feral pigeon *Columba livia* on the ground near Living Pillar 2 (Survey 1) and Living Pillar 5 (Survey 1 and 2).

Summer 2022

During the June survey in 2022, a pair of goldfinch *Cardeulis carduelis* were seen perching and searching amongst the vegetation on Living Pillar 2. The activity indicated foraging, as they spent approximately a minute moving around vegetation, as well as perching and calling (see **Figure 3** below for images of the goldfinches). No other birds were seen directly interacting with the Living Pillars during the surveys. Species recorded in the vicinity of the pillars are summarised as follows:

- Magpie *Pica pica* perched on a TV aerial balcony near to Living Pillar 4;
- Feral pigeon *Columba livia* on the ground near Living Pillar 2;
- Herring gull *Larus argentatus* flyover near Living Pillar 4.

Figure 3. *A pair of adult goldfinch observed foraging, perching and calling on Pillar 3 during June 2022 survey.*

The goldfinch pair seen on Living Pillar 2 were also observed singing and calling in the vicinity of the Living Pillars throughout the survey, indicating a potential breeding territory in the area. Later in the survey, when arriving to survey Living Pillar 5, a member of the public found a fledgling goldfinch on the pavement adjacent to the pillar (see **Figure 4** below for an image of the fledgling). The origin of the fledgling was unclear, but the passer-by thought it had possibly emerged from Living Pillar 5. The parent birds were observed calling constantly in the vicinity of Living Pillar 5 and flying around in an agitated manner. A search was undertaken of the vegetation on Pillar 5, to try to ascertain if there was a nest, but access was limited due to working from a ladder and the location near a very busy road and street. No obvious evidence of a nest was found in the area of vegetation that could be safely searched on Living Pillar 5, but the upper half of the vegetation could not be accessed.

Figure 4. *Goldfinch fledgling found on the pavement by Living Pillar 5 during the survey in June 2022.*

To limit distress to the birds and for the safety of the fledgling, we placed the fledgling in the vegetation of Living Pillar 5 and kept watch. The parent birds quickly attended to the fledgling, and once it was apparent the fledgling was safe, we left the area as the adult birds appeared wary of our presence. We then found a second fledgling in the stairwell of a nearby business, also struggling to get airborne. It was therefore evident that the goldfinch pair had successfully raised a brood somewhere in the vicinity of the Living Pillars, and that these had just fledged.

It is not uncommon for newly fledged birds to become grounded, and generally the parents quickly locate them and help them to safety. Unfortunately, in the highly urbanised context of Ebury Street, this brings extra hazards, as there is very little low vegetation such as shrubs or hedges for fledglings to shelter in, and there is also very limited tree cover. In this instance, the Living Pillars provided a valuable refuge, but without assistance, it seemed unlikely the fledgling would have reached the safety of the Pillar vegetation from the ground. In areas like Ebury Street that are highly urbanised, a valuable approach would be to combine Living Pillars with ground level greening interventions, to provide a more holistic environment for supporting and enhancing bird biodiversity in urban areas.

During the July 2022 survey, a goldfinch was again observed entering the vegetation of Pillar 2, and spent about 30 seconds moving through the plants, apparently foraging. A pair of adult goldfinch were again heard singing/calling in the vicinity of the Living Pillars, suggesting the area forms part of their territory. At one point, three goldfinch were seen together in the area calling, suggesting that the pair may have successfully raised one chick from their brood.

No other birds were observed directly interacting with the Living Pillars during the surveys. Species recorded in the vicinity of the pillars are summarised as follows:

- Feral pigeon *Columba livia* on a TV aerial balcony near to Pillar 4;
- Lesser black-backed gull *Larus fuscus* on a roof near Pillar 1 (possibly nested here);
- Carrion crow *Corvus corone* x 2 flyover near Pillar 3.

Later in the survey during the pollinator counts, a goldfinch was seen to enter the vegetation of Pillar 2 again. The level of activity observed did not suggest active nesting, so on completion of the pollinator surveys, we inspected the vegetation of Living Pillars 2 and 5, to carefully search for evidence of nesting. No obvious evidence of a nest was found, but we could not safely search the entirety of the vegetation on either pillar, and therefore nesting by goldfinch in the Living Pillars could not be confirmed or entirely ruled out.

As stated in the previous report, several of the Living Pillars had a bird box structure installed amongst the vegetation. However, the survey ascertained that these are not available for birds to use but instead contained technical equipment for the Pillars' irrigation system.

Flowers

Flowerhead count

The average number of flowerheads counted during the surveys for Living Pillars and Hanging Baskets is shown in **Figure 5**. The flowerhead count data for the Hanging Baskets for the second survey in 2021 was missing, therefore this survey was excluded from the analysis.

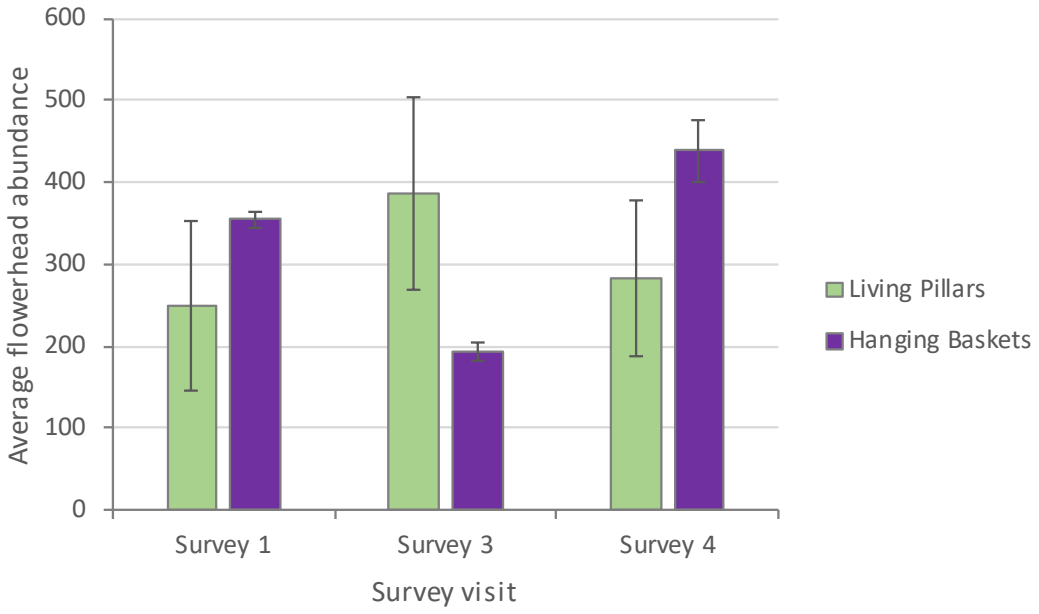

Figure 5. Average flowerhead abundance for Living Pillars and Hanging Baskets Basket for surveys undertaken across summer 2021 and 2022, excluding Survey 2 in 2021 due to missing data.

The Living Pillars had a greater abundance of flowerheads during the third survey in June 2022, otherwise the Hanging Baskets tended to support greater flowerhead abundance. A Mann-Whitney U Exact two-tailed test showed that these differences were not significant ($p > 0.05$ for all three surveys)

The average flowerhead abundance recorded on each Living Pillar during the surveys was quite variable reflecting the varied planting schemes on each Pillar, whereas the Hanging Baskets were planted with identical species and tended to have similar flowerhead counts throughout (**Figure 6**).

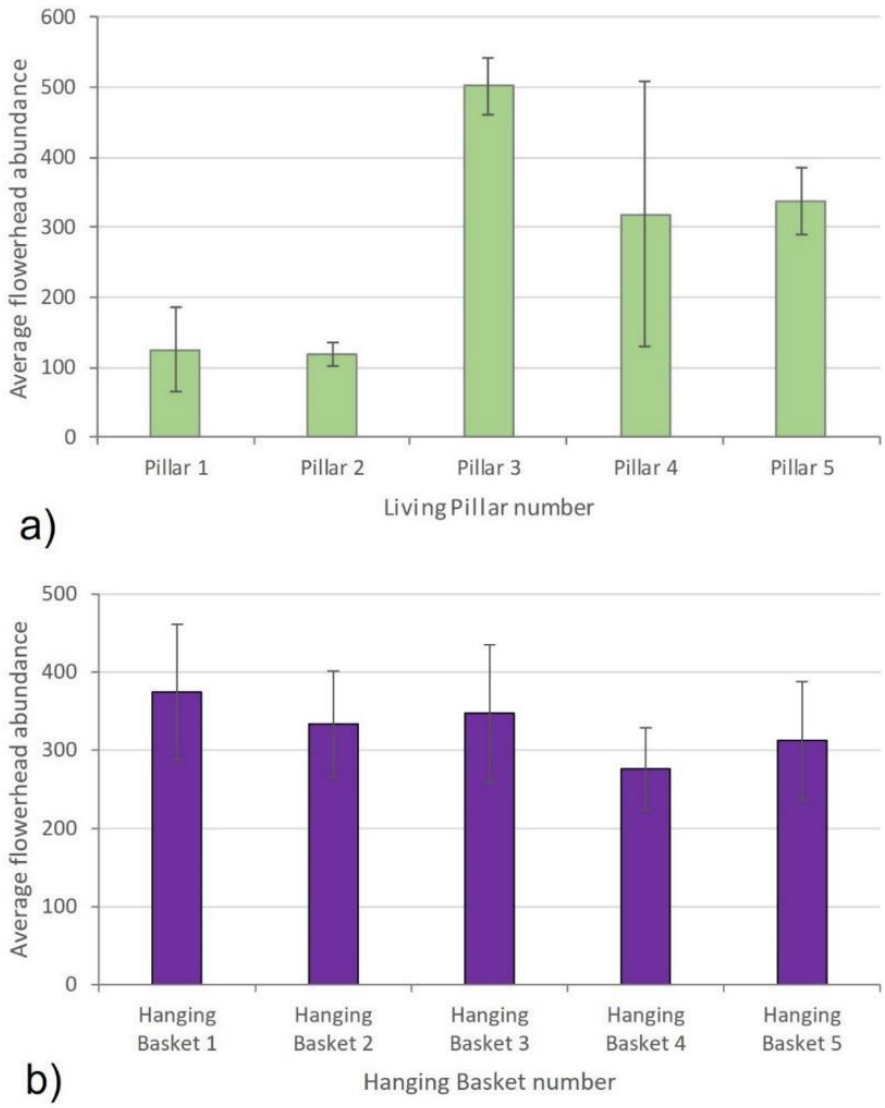

Figure 6. *Average flowerhead abundance for a) each Living Pillar and b) each Hanging Basket for all surveys undertaken across summer 2021 and 2022.*

Living Pillars 3 and 5 had the greatest abundance of flowerheads and on both pillars, this was dominated by a single species, Mexican fleabane *Erigeron karvinskianus,* with over 500 flowers counted on Living Pillar 3 in early July 2021. Similarly, for the Hanging Baskets flower abundance was dominated by a single species, in this case petunia *Petunia* sp.

It was noted in the July 2022 survey that maidenhair vine *Muehlenbeckia complexa* was in flower. The flowers were too tiny to count from ground-level, therefore these were excluded from the count data but their presence was noted. Maidenhair vine flowers appeared to be particularly numerous on Living Pillars 1 and 2, and these were attracting pollinators, particularly honeybees. As such the lower flowerhead abundance counts for these two pillars may understate their potential value as a forage resource for pollinators.

Diversity of species in flower

The average number of species in flower counted during the surveys for Living Pillars and Hanging Baskets is shown in **Figure 7** (excluding Survey 2 as some data was lost).

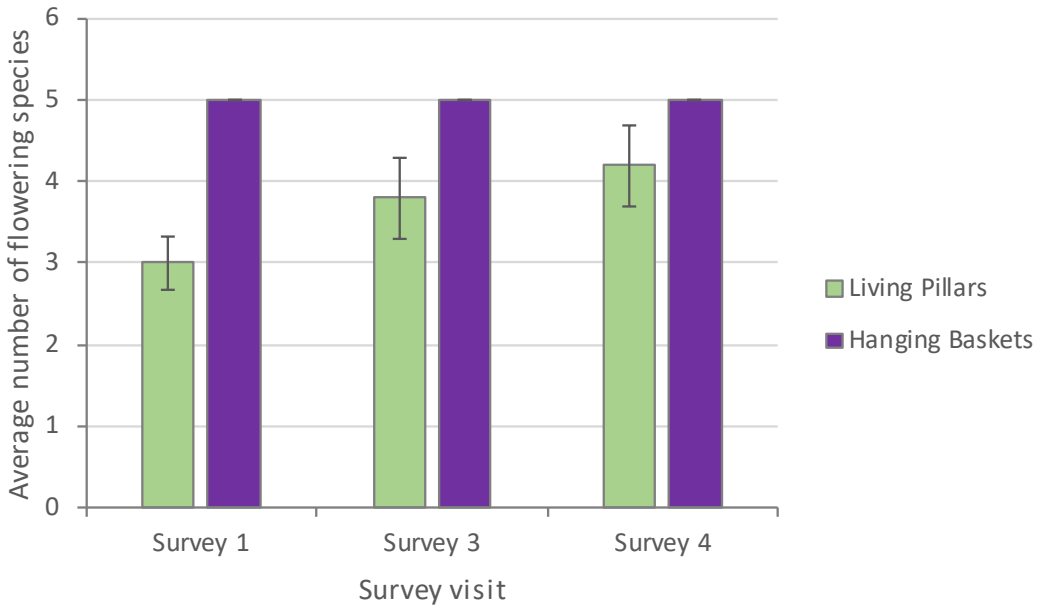

Figure 7. Average number of flowering species for Living Pillars and Hanging Baskets Basket for surveys undertaken across summer 2021 and 2022, excluding Survey 2 in 2021 due to missing data.

A higher number of species were recorded in flower on the Hanging Baskets during the surveys, and a Mann-Whitney U Exact two-tailed test showed that the difference for each survey was significant (Survey 1: $p = 0.008$; Survey 3 and 4: $p = 0.048$).

The Hanging Baskets were each planted with five identical flower species during all surveys (*Petunia* sp., *Lobelia* sp., *Pelargonium* sp., *Verbena* sp., and *Scaevola* sp.), whereas the Living Pillars were planted with a variety species. Therefore, the overall flower diversity offered by the five hanging baskets was lower than that provided by the five Living Pillars. Across all surveys, a total of 12 different species were recorded in flower on the Living Pillars as follows:

1. Geranium
2. Thrift *Armeria* sp.
3. Mexican fleabane
4. Bellflower *Campanula* sp.
5. Wallflower
6. Heuchera
7. Bistort *Persicaria* sp.
8. Maidenhair vine
9. Spurge
10. Silver ragwort
11. Willowherb *Epilobium* sp. (wildflower coloniser)
12. Groundsel *Senecio vulgaris* (wildflower coloniser)

Other flowering species planted on the Living Pillars that were not in flower at the times of the surveys were noted, for instance rosemary *Salvia rosmarinus* and thyme *Thymus* sp., indicating additional potential flower resources for pollinators beyond the above list. Most of the flowering species on the Living Pillars are of known value to pollinators (for instance, included in the Royal Horticultural Society's (RHS) 'plants for pollinators' guides).

For the Living Pillars, the average number of species in flower recorded during the surveys was broadly similar for each pillar (Figure 8). Living Pillar 2 had the greatest flower diversity, with a maximum total count of six flowering species recorded in July 2022 as follows: wallflower *Erysimum* 'Bowles Mauve', spurge *Euphorbia* sp., *Heuchera* 'Firechief', cranesbill *Geranium* sp., silver ragwort *Senecio cineraria* and maidenhair vine.

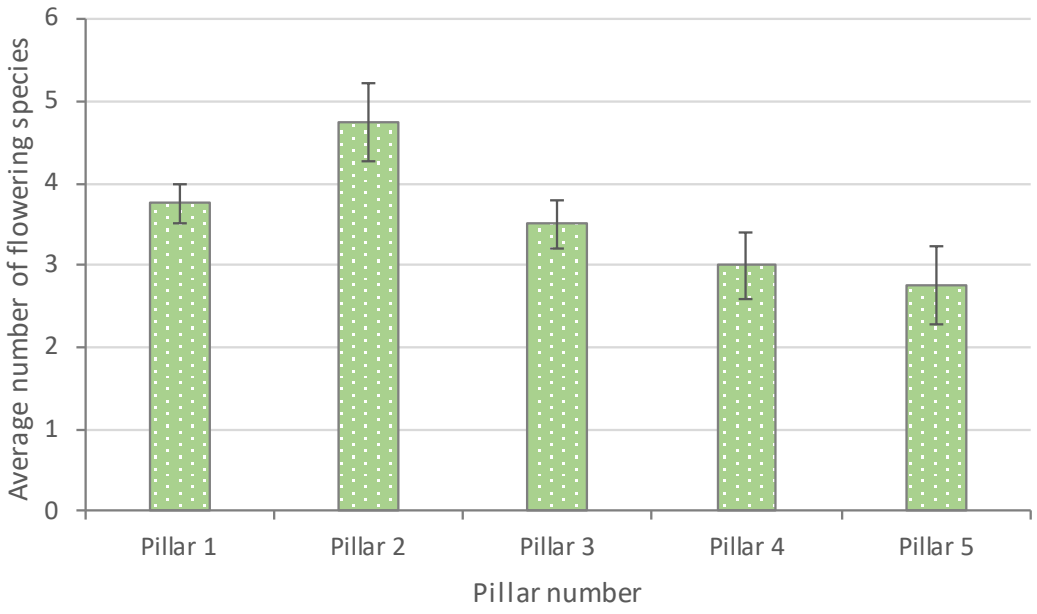

Figure 8. *Average flowering species diversity for each Living Pillar for four surveys across summer 2021 and 2022.*

Invertebrates

Pollinator survey

Pollinator species that could be reliably identified in the field recorded visiting the Living Pillars during the surveys were as follows:

- Honeybee *Apis mellifera*
- Hairy-footed flower bee *Anthophora plumipes*
- Buff/white-tailed bumblebee agg. *Bombus terrestris/lucorum* agg.
- Common carder bee *Bombus pascuorum*
- Tree bumblebee *Bombus hypnorum*
- Red admiral *Vanessa atalanta*

In addition to these, a number of solitary bees/wasps and species of fly, including hoverflies, were seen visiting the pillars and foraging on flowers during the counts. A sample of these species will be represented in the samples collected by sweep net/pooter during the surveys, provided later in the report.

Pollinator abundance

The average number of pollinators counted visiting the Living Pillars and the Hanging Baskets during the surveys are shown in Figure 9.

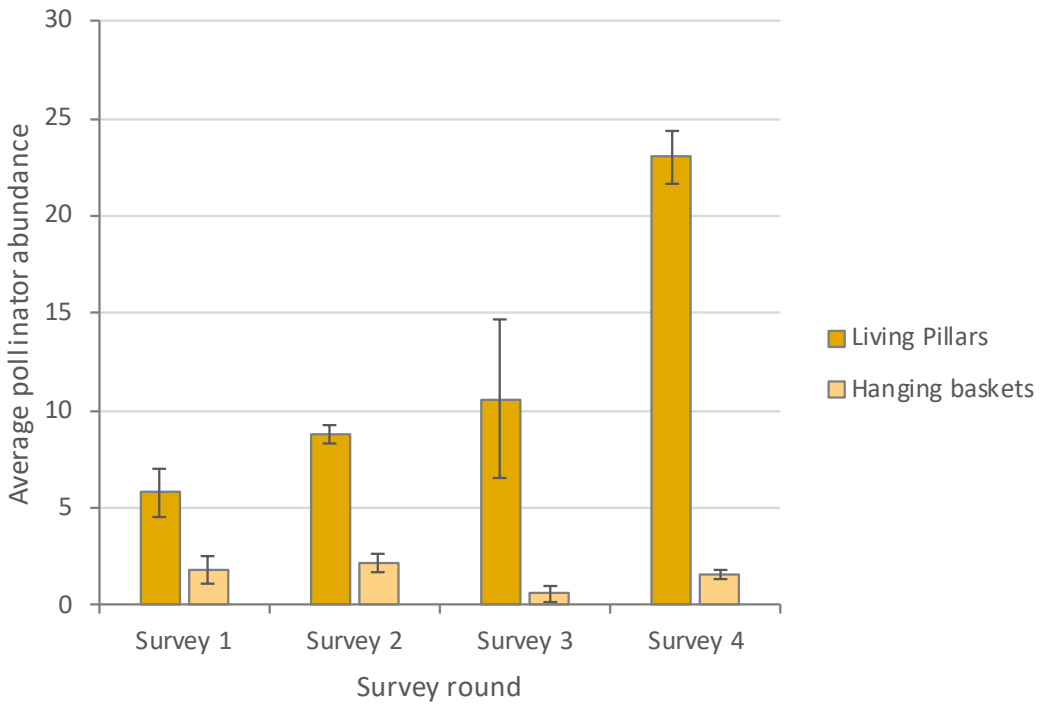

Figure 9. *The average number of pollinators counted visiting the Living Pillars and Hanging Baskets during the surveys in summer 2021 and 2022.*

The abundance of pollinators visiting the Living Pillars was higher than that recorded for Hanging Baskets for all surveys, and two-tailed Mann Whitney U exact tests confirmed this difference was significant for Survey 1 (p = 0.024), Survey 2 (p = 0.008) and Survey 4 (p = 0.008), but not significant for Survey 3 (p = 0.063). The limited level of replication achievable for this study means that the variability in the data recorded for the Living Pillars for Survey 3 (larger error bars) can produce a not significant result despite a seemingly big difference in the counts.

Average pollinator visits to the Living Pillars increased substantially during the period the surveys were conducted, with an almost fourfold increase from the first survey in 2021 to the last survey in 2022. In contrast, pollinator visits to the Hanging Baskets remained low throughout the surveys, with typically only one to two pollinator visits recorded for each basket. The increased pollinator counts for the Living Pillars in 2022 were on average, at least 17 times higher than the Hanging Baskets during the June survey, and 14 times higher during the July survey.

The results for average pollinator visits recorded for each Living Pillar during the surveys is shown in Figure 10 below. On average, pollinator visits were highest on Living Pillar 1, followed by Pillar 2. Interestingly, whilst these two pillars did not have the highest abundance of flowerheads compared to other pillars, these two pillars had the highest average flower diversity. However, differences between all pillars were relatively minor and greater levels of survey replication would be needed to explore the impact of floral diversity on pollinator visits.

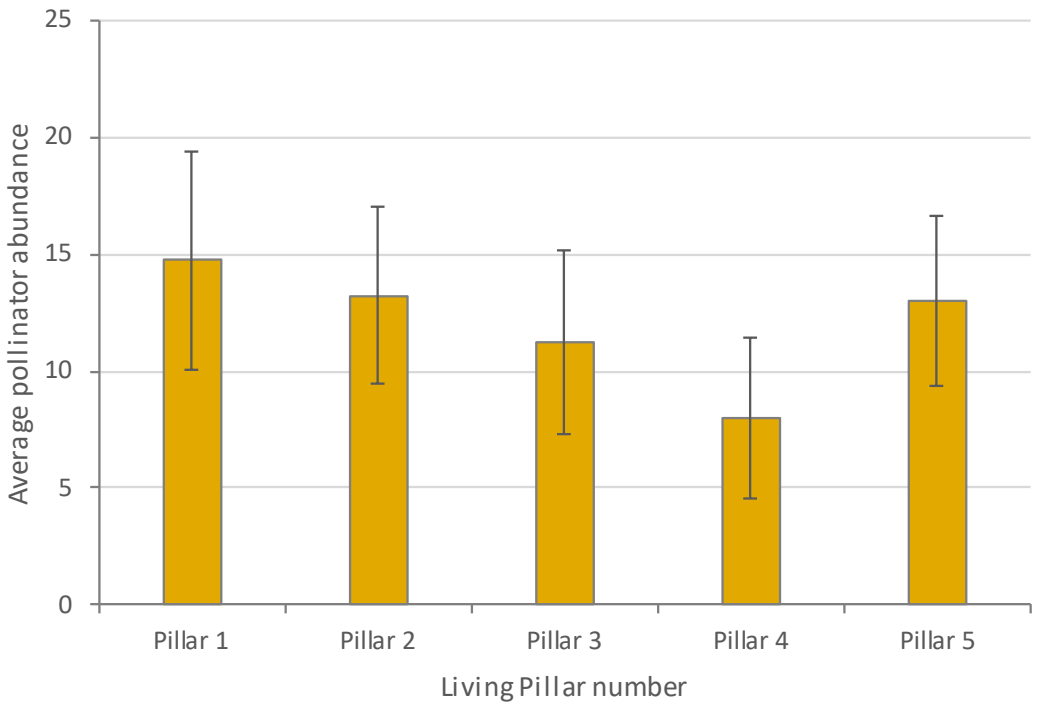

Figure 10. *Average number of pollinators counted visiting each Living Pillar during the surveys in summer 2021 and 2022.*

Pollinator diversity

A direct count of pollinator species diversity was not possible, due to the difficulties of reliably identifying species using only a visual observation method in the field. Instead, a diversity index count based on distinctive groups (i.e. identified species plus hoverflies, solitary bees/wasps separated into more than one 'type' where the morphology was distinctly different, for instance size or markings) was calculated for the Living Pillars and Hanging Baskets (Figure 11).

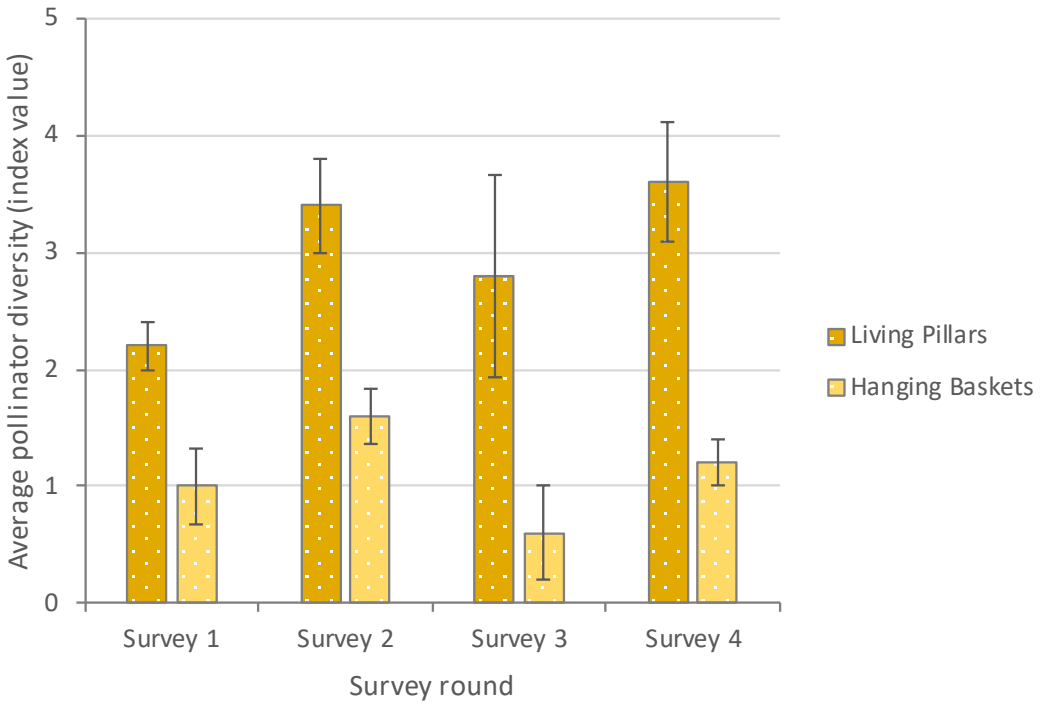

Figure 11. Average pollinator diversity index count for each survey for the Living Pillars and Hanging Baskets for surveys undertaken during summer 2021 and 2022. Diversity count includes species identified in the field plus 'morpho' species from identified for certain taxa (e.g. small/medium/large hoverflies or solitary bees etc).

A greater diversity of pollinators were recorded visiting the Living Pillars compared to the Hanging Baskets, and this pattern was consistent for all surveys. Two-tailed Mann Whitney U exact tests confirmed this difference was significant for Survey 1 (p = 0.040), Survey 2 (p = 0.032) and Survey 4 (p = 0.016), but not significant for Survey 3 (p = 0.103). By Survey 4, pollinator diversity was 3 times higher on the Living Pillars than the Hanging Baskets.

The results for each Living Pillar (Figure 12) indicated that on average, Living Pillar 2 was visited by the greatest diversity of pollinators, followed by Living Pillar 1. This trend follows the pattern for pollinator abundance and average flower diversity, indicating a potential link between these factors, i.e. higher flower species richness correlated with higher diversity and abundance of pollinators. Nonetheless, as with pollinator abundance, differences in diversity between all pillars were relatively minor and greater levels of survey replication would be needed to explore the impact of floral diversity on pollinator visits.

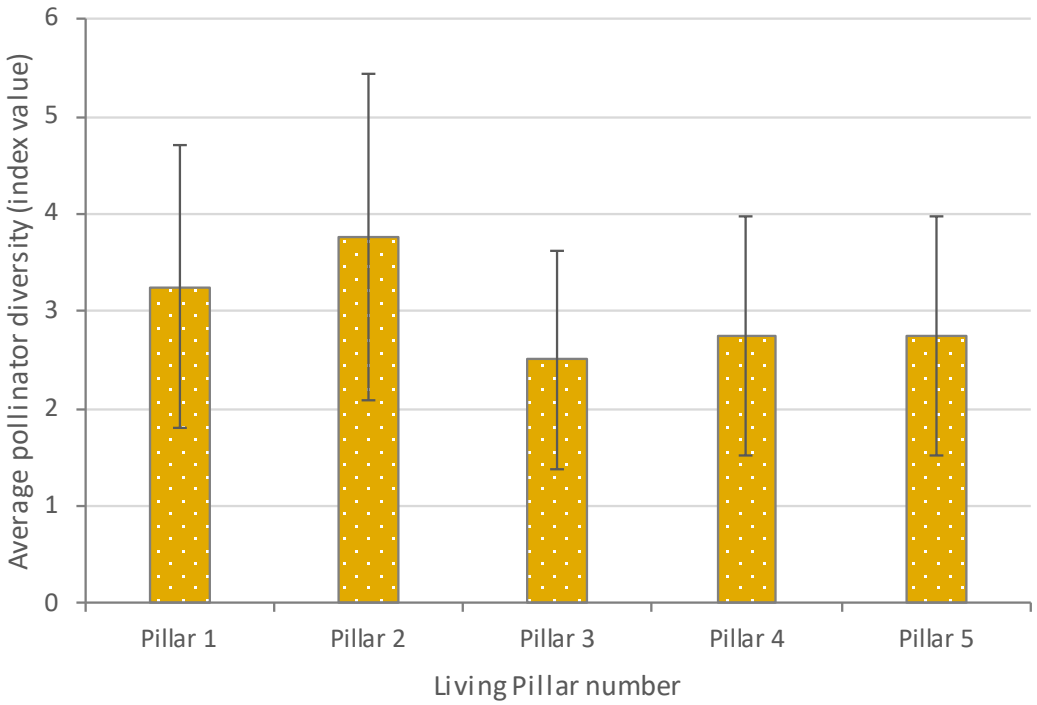

Figure 12. *Average pollinator diversity recorded for each Living Pillar during surveys in summer 2021 and 2022. Diversity count includes species identified in the field plus 'morpho' species from identified for certain taxa (e.g. small/medium/large hoverflies or solitary bees etc).*

Timed sweep/pooter survey

A total of eleven species from five different Orders were collected during the sweep/pooter surveys, and the results are summarised in Table 1 below. None of the species recorded had a conservation status and all are considered common and widespread. The greatest number and diversity of species were recorded on Living Pillar 2 (5 species). It should be noted that during the June 2022 survey, it was not possible to carry out a sweep/pooter survey on Living Pillar 5, as a fledgling goldfinch had been placed there for safety, and this would have caused additional disturbance and distress to the bird. Consequently, the species list for Living Pillar 5 for this survey method may be understated.

It is likely several species recorded during the surveys were visiting the Living Pillars to forage on flowers or plants, although parasitoid wasp species such as *Passaloecus gracilis* and *Diodontus tristis* may be visiting the pillars to collect aphid prey. The presence of carpet beetle *Anthrenus verbasci* may have been an import on the water retention fabric used. The presence of three mirid bug species that typically associate with plant species not recorded on the Living Pillars and not observed in the local area (i.e. hedge woundwort, bramble and *Antirrhinum*), suggests the individuals may use the pillars as a dispersal stepping stone habitat, or were potentially imported with the plant stock for the pillars.

In addition to the species below, observations noted during the surveys included orb and sheet webs indicating the presence of spider species that were not successfully collected by this survey method. Aphids, midges, and a flower beetle were also seen on the pillars but were not near enough to be collected for identification.

Table 1. *Species recorded on the Living Pillars during the sweep net/pooter surveys during summer 2021 and 2022.*

Pillar	Order	Family	Species	Comments
Pillar 1	Hemiptera	Miridae	*Dicyphus stachydis*	Mirid bug, found widely on hedge woundwort *Stachys sylvatica*[1] (a woodland edge plant)
	Psocoptera	Ectopsocidae	*Ectopsocus briggsi*	Common barkfly. That feeds on the fungal spores and various microflora on the surface of the leaves
Pillar 2	Diptera	Syrphidae	*Episyrphus balteatus*	Marmalade hoverfly. Larvae feed on aphids and adults feed on a variety of flowers
	Hemiptera	Miridae	*Dicyphus stachydis*	Mirid bug, found widely on hedge woundwort[1] (a woodland edge plant)
		Miridae	*Macrolophus rubi*	Mirid bug typically found on bramble *Rubus fruticosus*[1], most records come from the southern half of Britain
	Hymenoptera	Halictidae	*Lasioglossum smeathmanellum*	Smeathman's Furrow Bee. Not regarded as scarce/threatened but declined nationally in recent years. Polylectic. Nests in old walls/cliffs
		Crabronidae	*Passaloecus gracilis*	Digger wasp. Occurs in a variety of habitats, including suburban gardens. Females nest in dry, hollow plant stems and abandoned beetle burrows in old timber, prey on aphids (parasitoid)
Pillar 3	Hemiptera	Lygaeidae	*Nysius senecionis*	Seed bug. A fairly recent arrival in Britain, associated with a range of composites such as ragwort and fleabane
		Miridae	*Macrolophus rubi*	Mirid bug typically found on bramble[1], most records come from the southern half of Britain
	Hymenoptera	Crabronidae	*Diodontus tristis*	Melancholy Black Wasp. Occurs in sandy places, including heathland, sand/gravel pits and hedge-banks. Nests in dry, sandy soil, often in sloping or vertical faces. Preys on aphids (parasitoid)
		Halictidae	*Lasioglossum smeathmanellum*	Smeathman's Furrow Bee. Not regarded as scarce/threatened but declined nationally in recent years. Polylectic. Nests in old walls/cliffs
Pillar 4	Coleoptera	Coccinellidae	*Harmonia axyridis*	Harlequin, habitat generalists that feed on aphids and other ladybirds
Pillar 5	Coleoptera	Dermestidae	*Anthrenus verbasci*	Varied carpet beetle. Adults feed on flowers, larvae on carpet/fabric/detritus in bird nests
	Hemiptera	Miridae	*Dicyphus escalerae*	Mirid bug, found exclusively on *Antrirrhinum*[1], often in gardens or ruderal situations on brownfield sites
	Hymenoptera	Halictidae	*Lasioglossum smeathmanellum*	Smeathman's Furrow Bee. Not regarded as scarce/threatened but declined nationally in recent years. Polylectic. Nests in old walls/cliffs

[1] This plant species is not present on the pillar or seen in the local area

Bee hotel survey

The results of the bee hotel inspection are summarised in **Table 2** below. All bee hotels showed signs of occupation, and the bee hotel on Pillar 3 had the highest rate of occupation. Bee hotels on Living Pillars 1, 3 and 4 showed evidence of possible emergence, indicating nesting success. However, this is a cautionary finding, as without direct observation of emergence, it is possible parasitism or predation may have occurred. The bee hotel on Living Pillar 5 showed no signs of use during the 2022 survey period.

***Table 2**. Summary of the bee hotel survey results during the summer 2021 and 2022*

Pillar Number	Results 2021	Results June 2022	Results July 2022
Living Pillar 1	no signs of occupation	2 nesting cavities filled	1 nesting cavity filled, 1 possible emergence
Living Pillar 2	no bee hotel installed	no bee hotel installed	no bee hotel installed
Living Pillar 3	5 nesting cavities filled, 1 possible emergence	3 nesting cavities filled	5 nesting cavities filled
Living Pillar 4	no signs of occupation	2 nesting cavities filled	1 nesting cavity filled, 1 possible emergence
Living Pillar 5	1 nesting cavity filled	no signs of occupation	no signs of occupation

Discussion

The following is a summary of the survey findings for 2021/2022:

Survey	Results
Birds	A pair of goldfinch were recorded visiting Living Pillar 2 during the surveys in 2022, apparently foraging amongst vegetation.
	A fledgling goldfinch was found grounded close to Living Pillar 5, but it could not be confirmed if this species nested on the Living Pillars.
Flowers	A significantly higher number of species were recorded in flower on the Hanging Baskets during the surveys, and flower abundance was also higher on the Hanging Baskets than the Living Pillars, but the difference was not significant.
	As individual units, Living Pillars had lower flower abundance/diversity of species in flower at the time of survey compared to the Hanging Baskets, but OVERALL, the Living Pillars supported a much broader diversity of flowering species (12 species versus 5 identical ornamental species for Hanging Baskets), and the Living Pillars flowers included more species of known value to pollinators than the Hanging Baskets.
Pollinators	A greater diversity and abundance of pollinators were recorded visiting the Living Pillars compared to the Hanging Baskets during all surveys, and the difference was significant for all surveys, except Survey 3.
	Pollinator visits on the Living Pillars increased almost fourfold from the first survey in 2021 to the last survey in 2022, whereas visits to the Hanging Baskets remained low throughout the surveys. By 2022, average pollinator counts for the Living Pillars were between 14 and 17 times higher than recorded for the Hanging Baskets.
	Pollinator visits and diversity were highest on Living Pillar 1 and 2. These two pillars had the highest average flower diversity, but not the highest abundance of flowerheads compared to other pillars, indicating the potential importance of flower diversity for pollinators.
Sweep/pooter	The sweep/pooter surveys recorded a total of 11 species from five different Orders, all of which were common and widespread species and most likely used the pillars as a foraging resource and/or stepping-stone habitat. The greatest number and diversity of species were recorded on Living Pillar 2.
Bee hotel	All bee hotels showed signs of occupancy, with Living Pillar 3 having the highest rate of occupation. There was evidence of emergence, but further surveys would be needed to confirm successful breeding.

A more detailed discussion of the survey findings is provided below, along with some recommendations to enhance the biodiversity value of the Living Pillars.

Birds

The findings of a pair of goldfinch visiting Living Pillar 2 several times, and apparently foraging amongst vegetation, plus the incidental record of a fledgling goldfinch found close to Living Pillar 5, indicated the potential for the Living Pillars to provide foraging and nesting resources, as well as offering shelter/refuge for certain bird species in the Ebury Street local area. It was evident that a breeding pair of goldfinch had successfully raised a brood in the vicinity of the Living Pillars, but restricted access to search the entire vegetation on the pillars meant that nesting could not be

confirmed or ruled out. It is recommended therefore, that during routine maintenance visits to the pillars outside the main bird nesting season (typically March to August), contractors undertake a thorough search of the vegetation, particularly on Living Pillars 2 and 5 as these attracted the most bird activity, to see if a nest can be located.

Generally, bird activity in the Ebury Street local area was low, reflecting the highly urbanised surroundings that offer limited suitable bird habitat in close proximity to the Living Pillars. It is possible the Living Pillars might attract more birds and a wider range of species in a context that has a higher proportion of natural vegetation cover in the surroundings. It would be useful to study bird activity at comparison sites, for instance along an urban, peri-urban and rural gradient, to record how the Living Pillars function in varying landscape contexts that may support a more diverse and abundant bird population than Ebury Street. In highly urbanised areas like Ebury Street it could be beneficial to combine Living Pillars with ground level greening interventions, to provide a more holistic environment to support and enhance bird biodiversity in urban areas.

The majority of bird activity was recorded on Living Pillar 2. This pillar had more extensive vegetation cover (largely due to the dense growth of silver ragwort on this pillar), plus greater structural diversity and organic build up from leaf litter than the other pillars. This additional habitat complexity may attract and support more invertebrates for birds to forage on, and this could account for the more frequent visits by goldfinch, who feed their chicks on a mixture of regurgitated insects and seeds. The deeper and denser vegetation could also provide more shelter for resting, and/or potentially nesting birds, particularly small passerines like goldfinch that build a small nest cup amongst vegetation.

As stated in the previous report, it was surprising to discover that the bird boxes on the Living Pillars were inaccessible to birds. If a box is needed for the sensors and technical equipment, it would be good to also install a secondary box that can be used by breeding birds. This would enhance the ecological functionality of the Living Pillars, by providing an extra resource to support the lifecycle of hole nesting birds. In highly urban areas such as Ebury Street, where nesting opportunities may be limited but there are enough greenspaces in the surrounding area to provide food sources for breeding birds, nest boxes could provide valuable additional breeding sites. Ideally, the bird box should be accessible, so that it can be cleaned out at the end of each nesting season.

Overall, the bird survey findings suggest that the extent of vegetation cover on most of the Ebury Street Living Pillars can provide a supporting or stepping-stone habitat for birds.

Flowers

During the surveys, flower diversity and abundance typically was higher for Hanging Baskets compared to Living Pillars. However, whilst this quantitative survey method was intended to give an index of pollinator forage availability, it requires further ecological analysis to interpret the findings.

As individual units, each Living Pillar tended to have lower flower abundance/diversity compared to the Hanging Baskets during the surveys but, overall, the Living Pillars supported a much broader diversity of flowering species because each Living Pillar was planted with a different variety of species. Consequently, a total of 12 different flowering species were recorded for the Living Pillars across the surveys, compared to just five identical species for the Hanging Baskets. Furthermore, the Living Pillars flowers included more species of known value to pollinators than the ornamental species used for the Hanging Baskets. Finally, this metric only included species that were in flower during the surveys. Other species noted during the surveys that were planted on the Living Pillars but were not in flower on the survey dates, e.g. rosemary and thyme, would further increase the diversity of flowers

provided by the Living Pillars compared to the Hanging Baskets, enhancing their potential value for pollinators.

As a general rule, higher flower diversity and abundance would be desirable for nature-based solutions intended to support native wildlife such as pollinators and birds. Nonetheless, many flower species bred for horticultural purposes that have complex or frilly petals can lose their ability to produce pollen and nectar, or these resources can become inaccessible to pollinators. This was likely the case for some of the flower species used for the Hanging Baskets. These types of flowers should be avoided, and particularly in planting schemes aimed at benefitting pollinators. For certain declining specialist pollinators, flower 'form' (i.e. shape and structure) can be extremely important, and is an essential factor to consider as part of flower species selection. Also important is to provide a range of flowers that offer a continuous succession of floral resources from spring through to autumn, to ensure forage availability throughout the pollinator season. Links to useful resources related to flower species and forms attractive to pollinators are provided in the next section below.

Vegetation structural complexity and biodiversity are typically positively correlated and, as noted in the section above on birds, the more structurally complex nature of the vegetation on Living Pillar 2 could be a desirable feature, increasing niche availability for a broader range of flora and fauna to utilise the pillars.

Invertebrates

Pollinator survey

The findings confirmed that the Living Pillars supported a greater diversity and abundance of pollinators than the traditional Hanging Baskets. There was a trend for increased pollinator visits to the Living Pillars during the survey period, whereas pollinator visits to the Hanging Baskets remained similarly low throughout. The trend of increasing pollinator visits could be due to the Living Pillar vegetation being in-situ for longer and becoming more established, unlike the Hanging Baskets, which offer a transient resource, being planted with summer annuals that typically are replaced each season. The 2022 pollinator survey results clearly demonstrated that the Living Pillars were attracting much higher numbers of pollinator visits, up to 17 times more than the Hanging Baskets. As discussed in the previous section, flowers bred for aesthetic purposes can lose their ecological value and this was likely another key factor for the lower numbers of pollinators recorded visiting the Hanging Baskets.

It was interesting that pollinator visits and pollinator diversity were highest on Living Pillar 1 and 2, as these two pillars had the highest average flower diversity, but not the highest abundance of flowerheads compared to other pillars. This finding highlights the potential importance of the relationship between Living Pillar flower diversity (or type) and pollinators. However, differences were small and a more comprehensive study would be needed to demonstrate this, with more replicated Living Pillar designs and more intensive survey techniques.

Whilst pollinator diversity/abundance was greater for the Living Pillars and increased over time, it should be noted that pollinator activity and species richness recorded for the Living Pillars was still fairly limited. Incidental observations recorded during the June 2022 survey indicated that a broader range and greater number of pollinators were visiting raised planters on the junction of Ebury Street and Elizabeth Street (**Figure 13**). Whilst certainly not an ideal plant selection, the planters had a more diverse range of flower types available compared to the Living Pillars, and this included species such as foxglove *Digitalis* sp. and a range of salvias *Salvia* sp., which are known to attract a wide range of pollinators.

Figure 13. An example of flower planter on the junction of Ebury Street and Elizabeth Street, June 2022.

As mentioned in the above section on flowers, diversity should be considered a crucial design factor as well as flower abundance and, in particular, providing a range of flower 'types' (shapes/colours/forms) to benefit as many pollinators as possible. This is because some specialist pollinators are attracted to specific flower types, for instance flowers for the pea/bean family (Fabaceae) and mint family (Lamiaceae) are important for long-tongued bee species such as the garden bumblebee *B. hortorum* and hairy-footed flower bee *Anthophora plumipes.* Planting a broader range of pollinator-friendly flowers and, also importantly, ensuring these provide a succession of flowering resources throughout the pollinator season (spring to autumn), will offer maximum value for native wild pollinators. Native/near-native species should generally be favoured over exotic plantings, although some non-natives of known value to pollinators/wildlife can be beneficial, if used to bolster natives and extend the flowering season. The following online resources detail a range of other suitable flower forms and plant species to attract a diversity of pollinators:

- Buglife's 'garden flowers for bumblebees',
- RHS 'plants for pollinators' guides,
- Api:cultural's matrix of pollinator-friendly plants,
- The Wildlife Trust's 'nectar café' for pollinators.

Timed sweep/pooter survey

This survey method was intended to augment the findings of the pollinator counts and it captured an additional 11 species that could not be recorded using the ground level visual count method. The results provide supporting evidence that the Living Pillars can offer habitat to additional invertebrate groups other than pollinators, for instance spiders, seed bugs and aphids as well as potentially supporting the food web for species which prey on aphids, such as the parasitoid wasp species recorded. As with the pollinator surveys, the quantity and diversity of invertebrates inhabiting the pillars was low, but appeared to be increasing over time, although a more comprehensive survey would be needed to confidently demonstrate this.

Bee hotel survey

All of the bee hotels showed signs of use, with the highest occupation rate on Living Pillar 3 and the lowest on Living Pillar 5, with no occupation recorded in 2022. Use of the bee nesting hotels was in general fairly low, and anecdotal evidence from other studies has indicated that occupancy can be low for the first year after installation, but increases subsequently. This did not appear to be the pattern with the hotels on the Living Pillars, but the context may mean that colonisation takes longer due to a lower local solitary bee population. Nonetheless, the inclusion of these nesting features offers an extra habitat niche and extends the value of the pillars beyond just a foraging resource. Of interest for further study would be an 'emergence survey' to see if the species using the hotels for nesting successfully develop and emerge. Even with low occupancy rates, the addition of bee nesting habitat offers an opportunity to support breeding populations and could help some bee/wasp species complete their complex lifecycles. Also of interest, would be creating more variability in the size and types of holes created for cavity nesting pollinators. Creating such diversity would provide opportunities for a broader range of pollinators to both nest and forage on the Living Pillars.

As discussed for birds, also, of interest for future research would be a study of the Living Pillars ecological functionality for invertebrates, including pollinators, in relation to the surrounding landscape context. The location for this study in Ebury Street was highly urban, and whilst there were large greenspaces in the surrounding areas (e.g. Eaton Square Gardens, Buckingham Palace gardens, and Hyde Park), these were relatively distant from the street and the pillars. It is possible that the 'habitat resource' value of the Living Pillars would be, to an extent, related to other habitat features in the surrounding landscape, since the pillars would likely be providing an element of the habitat requirements for most species, rather than providing resources to support their entire habitat/lifecycle requirements.

Appendix: Living Pillars survey raw data

Survey 1

Date	Pillar	Time	Survey type	Spp	Behaviour	Number	Notes
20210702	1	12:30	Bee hotel	no activity		0	
20210702	2	11:00	Bee hotel	none filled?		0	
20210702	3	11:45	Bee hotel	filled		5	1 emerged?
20210702	4	09:30	Bee hotel	filled		2	
20210702	5	10:15	Bee hotel	Nothing in lower		0	
20210702	5	10:15	Bee hotel	Upper filled		1	
20210702	1	07:20	Bird survey	N/A	N/A	0	Bird box, bee hotel.
20210702	2	07:40	Bird survey	Magpie	nearby on balcony	1	Bees foraging. Birdbox, ladybird/lacewing box
20210702	2	07:40	Bird survey	Feral pigeon	on ground nearby	1	
20210702	3	08:00	Bird survey	N/A	N/A	0	Bird box, bee hotel. Mexican fleabane
20210702	4	08:40	Bird survey	N/A	N/A	0	2 bees foraging
20210702	5	08:40	Bird survey	Feral pigeon	on ground nearby	1	Bird box/bee hotel
20210702	1	12:30	Flowerhead count	Geranium		34	Ivy, thyme, maidenhair, blue fescue, Heuchera
20210702	1	12:30	Flowerhead count	Thrift		4	
20210702	1	12:30	Flowerhead count	Mexican fleabane		56	
20210702	2	11:00	Flowerhead count	Erysimum		56	
20210702	2	11:00	Flowerhead count	Geranium		28	
20210702	2	11:00	Flowerhead count	Serbian bellflower (?)		20	
20210702	2	11:00	Flowerhead count	Heuchera		7	
20210702	3	11:45	Flowerhead count	Mexican fleabane		525	Thyme, Ivy, Heuchera

20210702	3	11:45	Flowerhead count	Thrift		18	White
20210702	3	11:45	Flowerhead count	Geranium		2	
20210702	4	09:30	Flowerhead count	Bigroot cranesbill		15	Maidenhair, ivy, pine
20210702	4	09:30	Flowerhead count	Ladies thumb knotweed		3	
20210702	4	09:30	Flowerhead count	Mexican fleabane		26	
20210702	5	10:15	Flowerhead count	Mexican fleabane		~440	Bergenia, Ivy, Geranium, Thyme, Heuchera
20210702	5	10:15	Flowerhead count	Ladies thumb knotweed		11	
20210702	Hanging basket 1	13:15	Flowerhead count	Petunias		320	
20210702	Hanging basket 1	13:15	Flowerhead count	Scaevola		8	
20210702	Hanging basket 1	13:15	Flowerhead count	Pelargonium		25	
20210702	Hanging basket 1	13:15	Flowerhead count	Nemesia?		5	
20210702	Hanging basket 2	13:30	Flowerhead count	Petunias		300	
20210702	Hanging basket 2	13:30	Flowerhead count	Scaevola		34	
20210702	Hanging basket 2	13:30	Flowerhead count	Pelargonium		50	
20210702	Hanging basket 3	13:45	Flowerhead count	Petunias		320	
20210702	Hanging basket 3	13:45	Flowerhead count	Scaevola		8	
20210702	Hanging basket 3	13:45	Flowerhead count	Pelargonium		25	
20210702	Hanging basket 3	13:45	Flowerhead count	Nemesia?		5	
20210702	Hanging basket 4	14:00	Flowerhead count	Petunias		300	
20210702	Hanging basket 4	14:00	Flowerhead count	Nemesia?		6	
20210702	Hanging basket 4	14:00	Flowerhead count	Scaevola		4	
20210702	Hanging basket 4	14:00	Flowerhead count	Pelargonium		30	
20210702	Hanging basket 5	14:15	Flowerhead count	Petunias		300	
20210702	Hanging basket 5	14:15	Flowerhead count	Pelargonium		24	
20210702	Hanging basket 5	14:15	Flowerhead count	Begonia		3	
20210702	Hanging basket 5	14:15	Flowerhead count	Nemesia?		6	
20210702	Hanging basket 5	14:15	Flowerhead count	Scaevola		0	
20210702	1	12:30	Pollinator count	B. ter/luc agg	Geranium	2	

20210702	1	12:30	Pollinator count	Apis mellifera	In flight	1	
20210702	2	11:00	Pollinator count	B. ter/luc agg	Geranium	2	
20210702	2	11:00	Pollinator count	Bombus hypnorum	In flight	1	
20210702	2	11:00	Pollinator count	Bombus hypnorum	Geranium	1	
20210702	3	11:45	Pollinator count	Hoverfly	Mexican fleabane	1	
20210702	3	11:45	Pollinator count	Diptera	Mexican fleabane	1	
20210702	3	11:45	Pollinator count	Hoverfly	Ivy	1	
20210702	3	11:45	Pollinator count	Diptera	In flight	4	
20210702	4	09:30	Pollinator count	Bombus hypnorum	Geranium	1	Birdbox, closed
20210702	4	09:30	Pollinator count	Bombus spp	In flight	3	
20210702	4	09:30	Pollinator count	Hoverfly	Geranium	1	
20210702	5	10:15	Pollinator count	Hoverfly	Mexican fleabane	4	
20210702	5	10:15	Pollinator count	Hoverfly	Ladies thumb	1	
20210702	5	10:15	Pollinator count	Diptera	Ivy	2	
20210702	5	10:15	Pollinator count	Hoverfly	In flight	1	
20210702	5	10:15	Pollinator count	Diptera	In flight	1	
20210702	5	10:15	Pollinator count	Hoverfly	Geranium	1	
20210702	Hanging basket 1	13:15	Pollinator count	Hoverfly	Petunia	4	
20210702	Hanging basket 2	13:30	Pollinator count	Hoverfly	Petunia	2	
20210702	Hanging basket 3	13:45	Pollinator count	Hoverfly	Petunia	1	
20210702	Hanging basket 3	13:45	Pollinator count	Ladybird	petunia leaves	1	
20210702	Hanging basket 4	14:00	Pollinator count	Hoverfly	Petunia	1	
20210702	Hanging basket 5	14:15	Pollinator count	Nothing		0	
20210702	1	12:30	Pooter	Spiders web		2	
20210702	2	11:00	Pooter	Midges			
20210702	2	11:00	Pooter	Spiders web			Nothing in sweepnet
20210702	3	11:45	Pooter	Spiders web			
20210702	3	11:45	Pooter	Solitary bee			
20210702	4	09:30	Pooter	Aphids			Nothing in sweepnet

20210702	4	09:30	Pooter	Midges			
20210702	4	09:30	Pooter	Spiders web			
20210702	5	10:15	Pooter	Spiders web			Nothing in sweep net

Survey 2

Date	Pillar	Time	Survey type	Spp	Behaviour	Number	Notes
20210722	1	07:00	Bird survey	N/A	N/A	0	
20210722	2	07:16	Bird survey	N/A	N/A	0	
20210722	3	07:32	Bird survey	N/A	N/A	0	
20210722	4	07:48	Bird survey	N/A	N/A	0	
20210722	5	08:04	Bird survey	Feral	Nearby	1	
20210722	1	13:10	Flowerhead count	Geranium macrorrhizum		19	
20210722	1	13:10	Flowerhead count	Heuchera		1	
20210722	1	13:10	Flowerhead count	Thrift		7	
20210722	1	13:10	Flowerhead count	Mexican fleabane		17	
20210722	2	12:15	Flowerhead count	Wallflower		82	
20210722	2	12:15	Flowerhead count	Heuchera		6	
20210722	2	12:15	Flowerhead count	Campanula		6	
20210722	2	12:15	Flowerhead count	Geranium macrorrhizum		1	
20210722	3	11:45	Flowerhead count	Mexican fleabane		450	
20210722	3	11:45	Flowerhead count	Thrift		29	
20210722	3	11:45	Flowerhead count	Heuchera		1	
20210722	4	10:45	Flowerhead count	Bistort		1	
20210722	4	10:45	Flowerhead count	Geranium macrorrhizum		13	
20210722	4	10:45	Flowerhead count	Mexican fleabane		9	
20210722	5	10:05	Flowerhead count	Mexican fleabane		350	
20210722	5	10:05	Flowerhead count	Bistort		21	
20210722	1	13:10	Pollinator count	Solitary bee/wasp	Maidenhair vine	2	

20210722	1	13:10	Pollinator count	Solitary bee/wasp	Heuchera	2	
20210722	1	13:10	Pollinator count	Solitary bee/wasp	Geranium	1	
20210722	1	13:10	Pollinator count	Honeybee	Geranium	1	
20210722	1	13:10	Pollinator count	Honeybee	Mexican fleabane	2	
20210722	1	13:10	Pollinator count	B. ter/luc agg	Geranium	1	
20210722	2	12:15	Pollinator count	Honeybee	Wallflower	1	Clear, sunny, 26 degrees - IN SHADE
20210722	2	12:15	Pollinator count	Honeybee	Heuchera	1	
20210722	2	12:15	Pollinator count	Solitary bee/wasp	Wallflower	4	
20210722	2	12:15	Pollinator count	Hoverfly	Wallflower	2	
20210722	2	12:15	Pollinator count	B. ter/luc agg	Brief stop	1	
20210722	3	11:45	Pollinator count	Solitary bee/wasp	Mexican fleabane	7	Clear, sunny, 24 degrees - IN SUN
20210722	3	11:45	Pollinator count	Solitary bee species 2	Mexican fleabane	1	
20210722	3	11:45	Pollinator count	Honeybee	Mexican fleabane	1	
20210722	3	11:45	Pollinator count	Ichneumonid wasp	Mexican fleabane	1	Black with red band
20210722	4	10:45	Pollinator count	Solitary bee/wasp	Ivy	2	Clear, sunny, 24 degrees - IN SHADE
20210722	4	10:45	Pollinator count	Solitary bee/wasp	Buxus	1	
20210722	4	10:45	Pollinator count	Solitary bee/wasp	Mexican fleabane	1	
20210722	4	10:45	Pollinator count	Solitary bee/wasp	Geranium	1	
20210722	4	10:45	Pollinator count	B. ter/luc agg	Geranium	1	
20210722	4	10:45	Pollinator count	Solitary bee/wasp	Searching	1	
20210722	4	10:45	Pollinator count	Red admiral	Fly by	1	
20210722	4	10:45	Pollinator count	Honeybee	Geranium	1	
20210722	5	10:05	Pollinator count	Hoverfly	Mexican fleabane	2	Clear, sunny, 24 degrees - IN SUN
20210722	5	10:05	Pollinator count	Solitary bee/wasp	Mexican fleabane	4	
20210722	5	10:05	Pollinator count	Solitary bee/wasp	Bistort	1	
20210722	Hanging basket 1	14:15	Pollinator count	Honeybee	Petunia	2	
20210722	Hanging basket 1	14:15	Pollinator count	Solitary bee/wasp	Petunia	1	
20210722	Hanging basket 1	14:15	Pollinator count	Solitary bee/wasp	Scaevola	1	
20210722	Hanging basket 2	14:45	Pollinator count	Honeybee	Verbena	1	

20210722	Hanging basket 2	14:45	Pollinator count	Solitary bee/wasp	Around petunias	1	
20210722	Hanging basket 3	14:25	Pollinator count	Solitary bee/wasp	Geranium	1	
20210722	Hanging basket 3	14:25	Pollinator count	Solitary bee/wasp	Scaevola	1	
20210722	Hanging basket 4	14:25	Pollinator count	Solitary bee/wasp	Petunia	1	
20210722	Hanging basket 4	14:25	Pollinator count	Large white	Fly by	1	
20210722	Hanging basket 5	14:30	Pollinator count	Solitary bee/wasp	Around petunias	1	
20210722	1	13:10	Pooter	Spider web		1	
20210722	2	12:15	Pooter	Hoverfly	out of reach	1	2 sp solitary bee pootered for ID
20210722	3	11:45	Pooter	Nil		0	2 sp. pootered for ID
20210722	4	10:45	Pooter	B. ter/luc agg	Pine	2	
20210722	4	10:45	Pooter	B. pascuorum		1	
20210722	4	10:45	Pooter	Honeybee		1	
20210722	5	10:05	Pooter	Spider orb web		1	
20210722	5	10:05	Pooter	Spider sheet web		1	
20210722	5	10:05	Pooter	Flower beetle	on bistort (too far to poot)	1	
20210722	5	10:05	Pooter	Honeybee	Mexican fleabane	2	
20210722	5	10:05	Pooter	Solitary bee/wasp	out of reach	1	

Survey 3

Date	Pillar	Time	Survey type	Spp	Behaviour	Number	Notes
20220601	1	09:15	Bird survey	N/A	N/A	0	
20220601	2	09:30	Bird survey	Goldfinch x 2	Foraging	2	Pair of adults, also singing nearby
20220601	3	09:15	Bird survey	N/A	N/A	0	Feral pigeon pavement by pillar
20220601	4	09:30	Bird survey	N/A	N/A	0	Magpie on nearby aerial, herring gull flyover

20220601	5	09:45	Bird survey	N/A	N/A	0	Later a goldfinch fledgling was found by pillar
20220601	1	14:35	Bug hotel	Occupied holes		2	
20220601	3	13:00	Bug hotel	Occupied holes		3	
20220601	4	11:45	Bug hotel	Occupied holes		2	
20220601	1	14:30	Flowerhead count	Geranium	white	110	(thyme not in flower, Maidenhair vine tiny flowers)
20220601	1	14:30	Flowerhead count	Geranium (pale pink)		79	
20220601	1	14:30	Flowerhead count	Heuchera		16	
20220601	1	14:30	Flowerhead count	Heuchera		22	
20220601	1	14:30	Flowerhead count	Mexican fleabane		55	
20220601	1	14:30	Flowerhead count	Thrift		7	
20220601	1	14:30	Flowerhead count	Thrift		13	
20220601	2	13:45	Flowerhead count	Erysimum 'bowles'		22	
20220601	2	13:45	Flowerhead count	Euphorbia		4	
20220601	2	13:45	Flowerhead count	Geranium (pale pink)		49	
20220601	2	13:45	Flowerhead count	Geranium macrorrhizum		30	
20220601	2	13:45	Flowerhead count	Heuchera		15	
20220601	2	13:45	Flowerhead count	Heuchera		5	
20220601	2	13:45	Flowerhead count	Senecio		12	
20220601	2	13:45	Flowerhead count	Silver-leaved senecio		3	
20220601	2	13:45	Flowerhead count	Wallflower		30	
20220601	3	13:00	Flowerhead count	Geranium		36	
20220601	3	13:00	Flowerhead count	Geranium		8	
20220601	3	13:00	Flowerhead count	Heuchera		2	
20220601	3	13:00	Flowerhead count	Mexican fleabane		140	(Rosemary/Thyme not in flower)
20220601	3	13:00	Flowerhead count	Mexican fleabane		200	
20220601	3	13:00	Flowerhead count	Thrift		12	
20220601	3	13:00	Flowerhead count	Thrift		2	

20220601	4	11:45	Flowerhead count	Campanula		800	
20220601	4	11:45	Flowerhead count	Mexican fleabane		32	
20220601	5	11:00	Flowerhead count	Bistort		22	
20220601	5	11:00	Flowerhead count	Campanula		13	
20220601	5	11:00	Flowerhead count	Geranium		70	
20220601	5	11:00	Flowerhead count	Mexican fleabane		123	
20220601	Hanging basket 1	10:25	Flowerhead count	Lobellia		29	
20220601	Hanging basket 1	10:25	Flowerhead count	Pelargonium		30	
20220601	Hanging basket 1	10:25	Flowerhead count	Petunias		175	
20220601	Hanging basket 2	10:00	Flowerhead count	Lobellia		32	
20220601	Hanging basket 2	10:00	Flowerhead count	Pelargonium		16	
20220601	Hanging basket 2	10:00	Flowerhead count	Petunias		150	
20220601	Hanging basket 2	10:00	Flowerhead count	Verbena		2	
20220601	Hanging basket 3	10:25	Flowerhead count	Lobelia		60	
20220601	Hanging basket 3	10:25	Flowerhead count	Pelargonium		10	
20220601	Hanging basket 3	10:35	Flowerhead count	Petunias		105	
20220601	Hanging basket 3	10:25	Flowerhead count	Scaevola		10	
20220601	Hanging basket 3	10:25	Flowerhead count	Verbena		5	
20220601	Hanging basket 4	10:25	Flowerhead count	Lobelia		32	
20220601	Hanging basket 4	10:25	Flowerhead count	Pelargonium		15	
20220601	Hanging basket 4	10:25	Flowerhead count	Petunias		110	
20220601	Hanging basket 4	10:25	Flowerhead count	Scaevola		5	
20220601	Hanging basket 4	10:25	Flowerhead count	Verbena		10	
20220601	Hanging basket 5	10:10	Flowerhead count	Lobelia		40	
20220601	Hanging basket 5	10:10	Flowerhead count	Pelargonium		8	
20220601	Hanging basket 5	10:10	Flowerhead count	Petunias		120	
20220601	Hanging basket 5	10:10	Flowerhead count	Scaevola		5	
20220601	1	14:35	Pollinator count	A. mellifera	Geranium	3	
20220601	1	14:35	Pollinator count	A. mellifera	Thrift	1	

20220601	1	14:35	Pollinator count	A. mellifera	Mexican fleabane	1	
20220601	1	14:35	Pollinator count	Anthophora plumipes	Mexican fleabane	1	
20220601	1	14:35	Pollinator count	A. plumipes	Geranium	2	
20220601	1	14:30	Pollinator count	Apis mellifera	In flight	1	
20220601	1	14:30	Pollinator count	Apis mellifera	Geranium	2	
20220601	1	14:30	Pollinator count	B. hypnorum	Geranium	2	
20220601	1	14:30	Pollinator count	B. hypnorum	Geranium	1	
20220601	1	14:30	Pollinator count	B. hypnorum	Heuchera	1	
20220601	1	14:35	Pollinator count	B. luc/terr agg.	Heuchera	1	
20220601	1	14:30	Pollinator count	B. pascuorum	Geranium	2	
20220601	1	14:30	Pollinator count	B. terrestris/lucroum	Heuchera	2	
20220601	1	14:30	Pollinator count	B. terrestris/lucroum	Geranium	1	
20220601	1	14:30	Pollinator count	A. plumipes	Geranium	1	
20220601	2	13:45	Pollinator count	A. mellifera	Wallflower	1	
20220601	2	13:45	Pollinator count	A. mellifera	Senecio	2	
20220601	2	13:45	Pollinator count	Apis mellifera	Silver senecio	3	
20220601	2	13:45	Pollinator count	B. hypnorum	Heuchera	1	
20220601	2	13:45	Pollinator count	B. hypnorum	Heuchera	3	1 fly seen during hand search
20220601	2	13:45	Pollinator count	B. luc/terr agg.	Geranium	1	
20220601	2	13:45	Pollinator count	B. pacsuorum	Heuchera	1	
20220601	2	13:45	Pollinator count	B. pascuorum	Erysimum	4	
20220601	2	13:45	Pollinator count	B. terrestris/lucroum	Silver senecio	1	
20220601	3	13:00	Pollinator count	Apis mellifera	Mexican fleabane	2	
20220601	3	13:00	Pollinator count	Hoverfly	Mexican fleabane	1	
20220601	3	13:00	Pollinator count	Hoverfly	Heuchera	1	
20220601	4	11:45	Pollinator count	No pollinators		0	looks partially planted, only bellflower looks healthy
20220601	4	11:45	Pollinator count	No pollinators		0	
20220601	5	11:00	Pollinator count	B. hypnorum	Geranium	2	

20220601	5	11:00	Pollinator count	B. hypnorum	Geranium	5	
20220601	5	11:00	Pollinator count	B. pascuorum	Geranium	1	
20220601	5	11:00	Pollinator count	B. terrestris/lucroum	Geranium	2	Couldn't do handsearch due to goldfinch fledgling
20220601	Hanging basket 1	10:25	Pollinator count	No pollinators		0	
20220601	Hanging basket 2	10:00	Pollinator count	Bombus terrestris/lucorum	Petunia	1	
20220601	Hanging basket 3	10:25	Pollinator count	No pollinators		0	
20220601	Hanging basket 4	10:25	Pollinator count	No pollinators		0	
20220601	Hanging basket 5	10:10	Pollinator count	A. mellifera	Petunia	1	
20220601	Hanging basket 5	10:10	Pollinator count	B. luc/terr agg.	Petunia	1	
20220601	1	14:40	Pooter	A. mellifera	Maidenhair vine	2	
20220601	1	14:40	Pooter	B. luc/terr agg.	Geranium	1	
20220601	1	14:40	Pooter	B. pacsuorum	Geranium	1	
20220601	1	14:40	Pooter	Spider pooted		1	JM Ids?
20220601	1	14:40	Pooter	Spider web		numerous	
20220601	2	13:55	Pooter	A. mellifera	Senecio	1	(1 fly in pooter pot)
20220601	2	13:55	Pooter	A. plumipes?	Geranium	1	
20220601	2	13:55	Pooter	Spider web		numerous	more than other pillars
20220601	3	13:10	Pooter	A. mellifera	Mexican fleabane	2	More than two hoverflies around hi-vis during hand search
20220601	3	13:10	Pooter	A. mellifera	Geranium	1	
20220601	3	13:10	Pooter	A. plumipes?	Thrift	1	
20220601	3	13:10	Pooter	Spider web		1	
20220601	3	13:10	Pooter	Tiny flies	Thyme	numerous	Tried to poot sample
20220601	4	11:50	Pooter	B. hypnorum	Campanula (bellflower)	1	nothing in sweep net
20220601	4	11:50	Pooter	Spider web		1	2 x Bombus flyby during handsearch

20220601	5	-	Pooter	Not completed due to fledgling goldfinch on pillar			

Survey 4

Date	Pillar	Time	Survey type	Spp	Behaviour	Number	Notes
20220706	1	09:00	Bird survey	N/A	N/A	0	Other birds in area incl. lesser black-backed gull, 2 x crow, 1 x swift over
20220706	2	09:00	Bird survey	Goldfinch	Foraging	1	Went deep into vegetation for ~30 seconds, pair of adults in area singing
20220706	3	09:00	Bird survey	N/A	N/A	0	
20220706	4	09:30	Bird survey	N/A	N/A	0	
20220706	5	09:15	Bird survey	N/A	N/A	0	
20220706	1	14:15	Bug hotel	Occupied holes		1	
20220706	3	12:50	Bug hotel	Occupied holes		5	
20220706	4	12:15	Bug hotel	Occupied holes		1	
20220706	1	14:10	Flowerhead count	Maidenhair vine		numerous	
20220706	1	14:10	Flowerhead count	Mexican Fleabane		25	
20220706	1	14:10	Flowerhead count	Thrift		14	
20220706	1	14:10	Flowerhead count	Thrift		18	
20220706	2	13:20	Flowerhead count	Erysimum		22	
20220706	2	13:20	Flowerhead count	Euphorbia		3	
20220706	2	13:20	Flowerhead count	Geranium		1	
20220706	2	13:20	Flowerhead count	Heuchera		1	
20220706	2	13:20	Flowerhead count	Maidenhair vine		numerous	
20220706	2	13:20	Flowerhead count	Senecio		30	
20220706	2	13:20	Flowerhead count	Silver senecio		21	
20220706	2	13:20	Flowerhead count	Wallflower		22	Leaf litter build up - senecio making more structural diversity
20220706	3	12:45	Flowerhead count	Fleabane		130	

20220706	3	12:45	Flowerhead count	Geranium		4	
20220706	3	12:45	Flowerhead count	Mexican Fleabane		400	
20220706	3	12:45	Flowerhead count	Thrift		13	
20220706	3	12:45	Flowerhead count	Thrift		32	
20220706	4	12:00	Flowerhead count	Campanula		60	
20220706	4	12:00	Flowerhead count	Campanula		35	
20220706	4	12:00	Flowerhead count	Epilobium sp.		5	
20220706	4	12:00	Flowerhead count	Groundsel		20	
20220706	4	12:00	Flowerhead count	Mexican Fleabane		80	
20220706	4	12:00	Flowerhead count	Mexican fleabane		175	
20220706	5	11:30	Flowerhead count	Bistort		35	
20220706	5	11:30	Flowerhead count	Campanula		50	
20220706	5	11:30	Flowerhead count	Mexican Fleabane		160	
20220706	5	11:30	Flowerhead count	Mexican fleabane		56	
20220706	Hanging basket 1	10:25	Flowerhead count	Pelargonium		28	
20220706	Hanging basket 1	10:25	Flowerhead count	Petunias		500	
20220706	Hanging basket 1	10:25	Flowerhead count	Verbena		5	
20220706	Hanging basket 2	10:45	Flowerhead count	Lobelia		75	
20220706	Hanging basket 2	10:45	Flowerhead count	Pelargonium		36	
20220706	Hanging basket 2	10:45	Flowerhead count	Petunias		300	
20220706	Hanging basket 2	10:45	Flowerhead count	Verbena		7	
20220706	Hanging basket 3	10:40	Flowerhead count	Lobelia		60	
20220706	Hanging basket 3	10:40	Flowerhead count	Pelargonium		60	
20220706	Hanging basket 3	10:40	Flowerhead count	Petunias		360	
20220706	Hanging basket 3	10:40	Flowerhead count	Scaevola		7	
20220706	Hanging basket 3	10:40	Flowerhead count	Verbena		7	
20220706	Hanging basket 4	10:30	Flowerhead count	Lobelia		20	
20220706	Hanging basket 4	10:30	Flowerhead count	Pelargonium		90	
20220706	Hanging basket 4	10:30	Flowerhead count	Petunias		195	

20220706	Hanging basket 4	10:30	Flowerhead count	Scaevola		5	
20220706	Hanging basket 4	10:30	Flowerhead count	Verbena		7	
20220706	Hanging basket 5	10:20	Flowerhead count	Lobelia		100	
20220706	Hanging basket 5	10:20	Flowerhead count	Pelargonium		55	
20220706	Hanging basket 5	10:20	Flowerhead count	Petunias		270	
20220706	Hanging basket 5	10:20	Flowerhead count	Scaevola		6	
20220706	1	14:15	Pollinator count	Apis mellifera	Maidenhair vine	1	
20220706	1	14:15	Pollinator count	Apis mellifera	Thrift	1	
20220706	1	14:15	Pollinator count	Medium solitary bee	Heuchera	3	
20220706	1	14:15	Pollinator count	Small solitary bee	Maidenhair vine	4	
20220706	1	14:15	Pollinator count	Small solitary bee	Heuchera	2	
20220706	1	14:15	Pollinator count	Small solitary bee	Thrift	3	
20220706	1	14:15	Pollinator count	Small solitary bee	Mexican fleabane	2	
20220706	1	14:15	Pollinator count	Small solitary bee	Maidenhair	3	
20220706	1	14:15	Pollinator count	Small solitary bee	Patrolling near top	6	
20220706	2	13:30	Pollinator count	Apis mellifera	Senecio	2	
20220706	2	13:30	Pollinator count	B. luc/terr agg.	Wallflower	1	
20220706	2	13:30	Pollinator count	Large fly	Maidenhair	2	
20220706	2	13:30	Pollinator count	Small black solitary bee	Patrolling around Senecio	8	
20220706	2	13:30	Pollinator count	Small solitary bee	Maidenhair vine	3	Goldfinch arrived and foraged x 2
20220706	2	13:30	Pollinator count	Small solitary bee	Senecio	4	
20220706	2	13:30	Pollinator count	Small solitary bee	Euphorbia	2	
20220706	2	13:30	Pollinator count	Solitary bee (med)	In flight	1	
20220706	3	12:50	Pollinator count	A. mellifera	Mexican fleabane	1	
20220706	3	12:50	Pollinator count	Apis mellifera	Fleabane	1	
20220706	3	12:50	Pollinator count	Small solitary bee	Mexican fleabane	9	(same as Pillar 5 sample?)
20220706	3	12:50	Pollinator count	Small solitary bee	Maidenhair vine	1	

20220706	3	12:50	Pollinator count	Small solitary bee	Fleabane	11	Cleptoparasite? Behaviour looks like patrolling
20220706	3	12:50	Pollinator count	Small solitary bee	Thrift	1	
20220706	4	12:05	Pollinator count	A. mellifera	Mexican fleabane	2	
20220706	4	12:05	Pollinator count	Apis mellifera	Fleabane	5	
20220706	4	12:05	Pollinator count	Medium solitary bee	Ivy	2	
20220706	4	12:05	Pollinator count	Medium solitary bee	Fleabane	2	
20220706	4	12:05	Pollinator count	Small solitary bee	Mexican fleabane	2	
20220706	4	12:05	Pollinator count	Small solitary bee	Thrift	1	
20220706	4	12:05	Pollinator count	Small solitary bee	Fleabane	3	
20220706	4	12:05	Pollinator count	Waspish solitary (large)	In flight	1	
20220706	5	11:35	Pollinator count	A. mellifera	Campanula	2	
20220706	5	11:35	Pollinator count	A. mellifera	Mexican fleabane	4	
20220706	5	11:35	Pollinator count	Apis mellifera	Mexican fleabane	1	
20220706	5	11:35	Pollinator count	Hoverfly	In flight	2	
20220706	5	11:35	Pollinator count	Medium solitary bee	Mexican fleabane	1	
20220706	5	11:35	Pollinator count	Small black solitary bee	In flight	1	
20220706	5	11:35	Pollinator count	Small solitary bee	Mexican fleabane	14	
20220706	Hanging basket 1	10:25	Pollinator count	Small solitary bee	In flight	1	
20220706	Hanging basket 2	10:45	Pollinator count	Small black solitary bee	In flight	2	
20220706	Hanging basket 3	10:40	Pollinator count	Small solitary bee	Scaevola	1	
20220706	Hanging basket 3	10:40	Pollinator count	Small solitary bee	Petunia	1	
20220706	Hanging basket 4	10:30	Pollinator count	A. mellifera	Petunia	1	
20220706	Hanging basket 4	10:30	Pollinator count	Small solitary bee	Petunia	1	
20220706	Hanging basket 5	10:20	Pollinator count	A. mellifera	Petunia	1	
20220706	1	14:25	Pooter	Apis mellifera		1	
20220706	1	14:25	Pooter	Spider web		numerous	
20220706	2	13:40	Pooter	A. mellifera	Senecio	1	
20220706	2	13:40	Pooter	Spider web		numerous	

20220706	3	13:00	Pooter	Spider web		numerous	
20220706	4	12:15	Pooter	Small spider		1	escaped
20220706	4	12:15	Pooter	Small wasp	Scots pine	1	
20220706	4	12:15	Pooter	Spider web		numerous	
20220706	5	11:45	Pooter	B. luc/terr agg.		1	
20220706	5	11:45	Pooter	Spider web		numerous	

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