



Dŵr Cymru
Welsh Water

St Nicholas Wastewater Treatment Works Bat Survey Report July 2023

Arcadis Consulting (UK)
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Welsh Water



Document control

St Nicholas WwTW Ecological Constraints Memo				
Arcadis Consulting (UK) Limited				
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Summary of Actions

Arcadis Consulting (UK) Ltd has been commissioned by Dŵr Cymru Welsh Water to undertake a range of bat surveys to inform the design of the proposed extension and upgrade to St Nicholas Wastewater Treatment Works (WwTW) and the temporary access track required for construction traffic. Previous walkover surveys of the WwTW, the proposed extension site and the access track identified grassland, tree lines and hedgerows within an agricultural landscape that have the potential to support commuting and foraging bats and offer connectivity to the wider landscape.

The proposed works will result in the removal of approximately 100m of tree line and loss of approximately 0.5 hectares of grassland habitat as well as being located within proximity (25m or less) to trees and buildings that have the potential to support roosting bats. Bat surveys were undertaken in 2022 and 2023 to determine if bats will be negatively impacted.

A summer day roost for a small number of common pipistrelle bats was recorded within the WwTW building. The proposed works will not directly impact the roost as the building is to be retained. The building is located approximately 25m from the proposed works. There is likely to be increased noise/disturbance temporarily during construction of the proposed extension, and post works; however, the existing WwTW is operational with regular noise and disturbance within the welfare building and onsite treatment tanks. It is unlikely that the roost will be indirectly impacted as the bats are already accustomed to the current noises/vibrations and are roosting onsite. No bat roosts were identified in any trees within 20m of the proposed works.

During transect surveys, bats were observed commuting along the tree line that will be removed and foraging within the field east of the existing WwTW where the extension is proposed. Bat species recorded during the transect surveys include common and soprano pipistrelle, noctule and *Myotis* species. Species recorded were predominately common and soprano pipistrelle bats with all other species recorded less frequently. Static detector surveys identified that bats used the northern boundary of the site more frequently than the southern. Species recorded during static detector surveys were the same as those recorded during the transect surveys, but also included brown long-eared, serotine and greater and lesser horseshoe bats. Common and soprano pipistrelle bats were recorded more frequently than any other species.

Results identified the tree line to be removed and the tree lines to the west and north-east of the site that will be retained were commonly used by commuting bats. Other treelines and hedgerows used by commuting bats, albeit less frequently, north-west and west of the WwTW and along Brook Lane are to be retained, these habitats are also connected to the wider area via green corridors. To ensure that foraging and commuting bats are not negatively impacted as part of the proposed works due to the loss foraging and commuting habitat onsite, mitigation is required to ensure there is no net loss, enhance the retained green corridor to the east of the red line boundary to provide similar conditions to that of the treeline being removed, ensure dark corridors are created/retained around the site boundaries and to provide a new green corridor running west to east, immediately south of the compound area. Bats should be considered throughout the design stage to ensure that bats within the wider landscape are not impacted.

Recommendations include the following:

- If trees supporting suitable bat roosting features are to be managed or felled, they should be checked for bats immediately prior to their removal;
- A suitable root protection zone should be fenced off around all trees to be retained prior to any works being undertaken, this will ensure the future health of the tree (and bat roost if present),
- Due to the presence of greater and lesser horseshoe bats (light sensitive species) within the site, the creation of dark corridors along the site boundaries is recommended;
- No new or temporary lighting should be installed. If this is not possible bat sensitive lighting should be used on site. An ecologist should be consulted as the design develops;
- No night-time working;
- The location of the compound for the proposed works will be discussed with an ecologist prior to the location being finalised.
- Landscape planting should include bat friendly plants i.e., night-time scented flowers that attract invertebrates suitable for bats to forage.
- Trees are to be planted in a west to east direction (creating a treeline), immediately south of the compound area to replace the trees that have been lost at the centre of the site. Semi-mature trees should be planted in the aim to offer an instant dark wooded corridor for bats, or younger trees should be planted in advance of the treeline being removed. Scattered broadleaved trees should

also be planted along the eastern boundary of the site to enhance this area for commuting bats and create a dark wooded corridor. Planting will mitigate for the loss of habitat and enhance retained features for bats and deliver a net benefit of biodiversity across the site. Native species to be planted include hazel, oak, hawthorn, birch and beech.

- Bat and bird boxes should be installed within the site in areas that are not subject to regular disturbance to mitigate for the loss of potential roosting features.

The bat surveys carried out are valid for a period of 2 years and will be valid until spring 2025.

1. Introduction

1.1 Objectives

Arcadis Consulting (UK) Ltd (Arcadis) has been commissioned by Dŵr Cymru Welsh Water (DCWW) to undertake bat activity surveys, ground level bat tree assessments and bat presence/absence surveys to inform the optioneering design of the project to upgrade St Nicholas Wastewater Treatment Works (WwTW). The objective of this report is to detail the results of the bat surveys undertaken on site. At the time of this assessment, the proposed development site was agricultural land comprising predominantly semi-improved grassland with hedgerows, scattered trees and scrub.

1.2 Quality Assurance

As part of our quality control this report was prepared in line with the Arcadis Business Management System (BMS). Our BMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the International Organisation for Standards (ISO) 9001, ISO 45001 and ISO 44001. All Arcadis UK Ecologists that worked on this report are members of the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct¹ when undertaking ecological work.

2. Legislation and Policy

This section provides an overview of the legislation applicable to bats. For further information the source legislation should be reviewed.

Section 7 of the Environment (Wales) Act 2016 (which replaced Section 42 of the NERC Act 2006) requires Welsh Ministers to list and maintain species and habitats in Wales that are regarded as of 'principal importance' for the purpose of maintaining and enhancing it biodiversity.

All bat species are afforded full protection under UK and European legislation, including the Wildlife and Countryside Act 1981 (as amended)², the Countryside and Rights of Way Act (2000)³ and the Conservation of Habitats and Species Regulations 2017 (as amended)⁴. Together, this legislation makes it illegal to recklessly, intentionally or deliberately:

- Take, kill or injure a bat;
- Damage, destroy, or obstruct access to, a bat roost (defined in the legislation as “any structure or place which a bat uses for shelter or protection”); and,
- Disturb a bat occupying a roost.

The Habitats Regulations further define disturbance as acts which are likely to:

- Impair the ability to survive, breed, reproduce, rear/nurture their young, hibernate or migrate; or
- Significantly affect the local distribution or abundance of the species.

Annexe II bats are those species listed on Annexe II of the European Habitats Directive, which lists animal and plant species of community interest whose conservation requires the designation of Special Areas of Conservation (SAC's). Horseshoe bat species are priority species under Annex IV of the European Habitats Directive.

Wales (the Section 42 list) as required by the Natural Environment and Rural Communities (NERC) Act 2006⁵.

¹ CIEEM (2022) Code of Professional Conduct. Available at <https://cieem.net/wp-content/uploads/2019/02/Code-of-Professional-Conduct-FEB-2022.pdf> [Accessed 5 July 2023].

² Wildlife and Countryside Act 1981. Available at <https://www.legislation.gov.uk/ukpga/1981/69> [Accessed 1 June 2023]

³ Countryside and Rights of Way Act 2000. Available at: <https://www.legislation.gov.uk/ukpga/2000/37/contents> [Accessed 1 June 2023].

⁴ The Conservation of Habitats and Species Regulations 2017. Available at:

<https://www.legislation.gov.uk/uksi/2017/1012/contents/made> [Accessed 1 June 2023].

⁵ Natural Environment and Rural Communities Act 2006. [online] Available at: <https://www.legislation.gov.uk/ukpga/2006/16/contents> [Accessed 5 July 2023].

National and local policies are in place to ensure developments have regard to protected sites and species that are notable or locally important in the area. Planning Policy Wales 2021⁶, supplemented by Technical Advice Note 5⁷, states that planning authorities must seek to maintain and enhance biodiversity providing a net benefit.

Local planning policy for ecology and biodiversity is provided in the Adopted Vale of Glamorgan Local Development Plan (LDP), 2011 – 2026⁸. The following policies are of most relevance to this report:

POLICY MD7 - ENVIRONMENTAL PROTECTION

Development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and / or the natural environment from either:

1. Pollution of land, surface water, ground water and the air;
2. Land contamination;
3. Hazardous substances;
4. Noise, vibration, odour nuisance and light pollution;
5. Flood risk and consequences;
6. Coastal erosion or land stability;
7. The loss of the best and most versatile agricultural land; or
8. Any other identified risk to public health and safety.

POLICY MD9 - PROMOTING BIODIVERSITY

New development proposals will be required to conserve and where appropriate enhance biodiversity interests unless it can be demonstrated that:

1. The need for the development clearly outweighs the biodiversity value of the site; and
2. The impacts of the development can be satisfactorily mitigated and acceptably managed through appropriate future management regimes.

POLICY MD20 - ASSESSMENT OF WASTE MANAGEMENT PROPOSALS

Development proposals for waste management facilities will be permitted where:

1. The proposal is supported by an appropriate waste planning assessment;
2. The proposal has regard to the waste hierarchy, proximity principle and the requirements of the waste framework directive;
3. It is demonstrated that the development would not result in unacceptable harm to health, the environment or to the amenity of neighbouring land uses; and
4. Where the principal road network has adequate capacity, or improvements to ensure adequate capacity can be readily and economically provided, to accommodate the transport movements associated with the proposal.

POLICY SP10 - BUILT AND NATURAL ENVIRONMENT

Development proposals must preserve and where appropriate enhance the rich and diverse built and natural environment and heritage of the Vale of Glamorgan including:

1. The architectural and / or historic qualities of buildings or conservation areas, including locally listed buildings;
2. Historic landscapes, parks and gardens;
3. Special landscape areas;
4. The Glamorgan Heritage Coast;
5. Sites designated for their local, national and European nature conservation importance;
6. Important archaeological and geological features.

POLICY MG19 - SITES AND SPECIES OF EUROPEAN IMPORTANCE

Development proposals likely to have a significant effect on a European site, when considered alone or in combination with other projects or plans will only be permitted where:

⁶ Welsh Government (2021). Planning Policy Wales Edition 11. Available at: https://www.gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf [Accessed 5 July 2023].

⁷ Welsh Government (2009). Technical Advice Note 5 Nature Conservation and Planning. Available at: <https://www.gov.wales/sites/default/files/publications/2018-09/tan5-nature-conservation.pdf> [5 July 2023].

⁸ Vale of Glamorgan Council (2017) Vale of Glamorgan Local Development Plan 2011 – 2026. Available at: <https://www.valeofglamorgan.gov.uk/Documents/Living/Planning/Policy/LDP/LDP-Adoption/Adopted-LDP-Written-Statement-June-2017-final-interactive-web-version.pdf> [5 July 2023]

1. The proposal is directly connected with or necessary for the protection, enhancement and positive management of the site for conservation purpose; or
2. The proposal will not adversely affect the integrity of the site;
3. There is no alternative solution;
4. There are reasons of overriding public interest; and
5. Appropriate compensatory measures are secured.

Development of Criteria for Special Landscape Area Designation for South East Wales Local Authorities (July 2007)

Development proposals likely to have an adverse effect on a European protected species will only be permitted where:

1. There are reasons of overriding public interest;
2. There is no satisfactory alternative; and
3. The action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

POLICY MG20 – NATIONALLY PROTECTED SITES AND SPECIES

Development likely to have an adverse effect either directly or indirectly on the conservation value of a site of special scientific interest will only be permitted where it is demonstrated that:

1. There is no suitable alternative to the proposed development; and
2. It can be demonstrated that the benefits from the development clearly outweigh the special interest of the site; and
3. Appropriate compensatory measures are secured; or
4. The proposal contributes to the protection, enhancement or positive management of the site.

Development proposals likely to affect protected species will only be permitted where it is demonstrated that:

1. The population range and distribution of the species will not be adversely impacted;
2. There is no suitable alternative to the proposed development;
3. The benefits of the development clearly outweigh the adverse impacts on the protected species; and
4. Appropriate avoidance, mitigation and compensation measures are provided.

Where impacts are identified the Council will require applicants to demonstrate that appropriate measures have been incorporated to reduce, or minimise the impact identified to the lowest possible acceptable level.

3. Background

Upgrade works are required at St Nicholas WwTW including an extension into the field immediately to the east. The proposed development location is shown below in Figure 1. The proposed development is located south of St Nicholas village, Vale of Glamorgan. A temporary access track for construction traffic will be constructed from Dyffryn Lane in the east as shown in Figure 2. The proposed development site is surrounded by grazing pasture in all orientations around the site. The nearest main road is the A48 located 925m north of the proposed development.

In June 2021, Arcadis undertook an ecological constraints walkover at St Nicholas WwTW (hereafter referred to as “the proposed development”) (National Grid Reference: ST 08789 73303), the results of which recommended bat activity, presence/absence and static detector surveys.

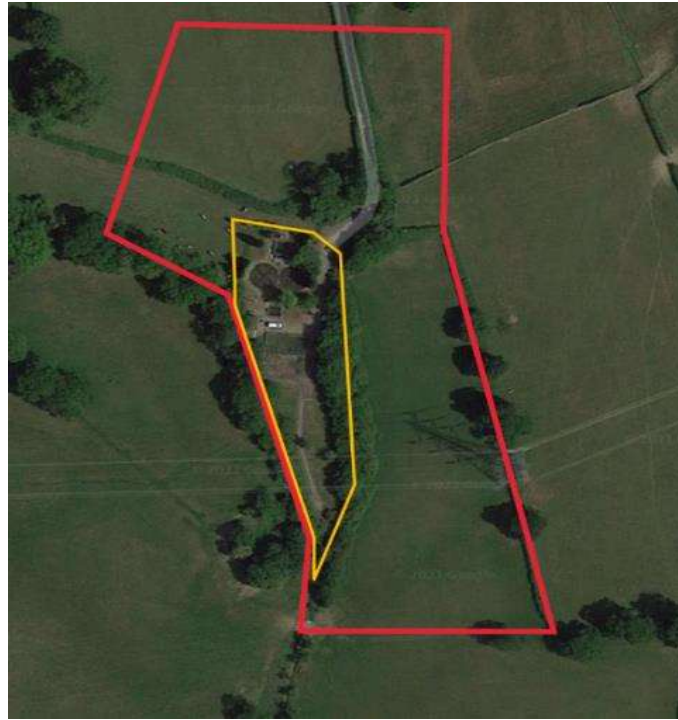


Figure 1: Aerial image of St Nicholas WwTW (approx. yellow line boundary) and the proposed development boundary (approx. red line boundary).

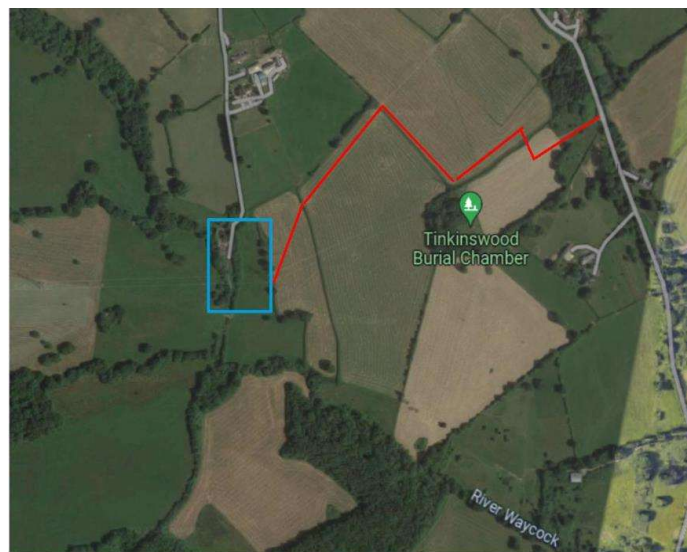


Figure 2: Aerial image of St Nicholas WwTW. Temporary access track highlighted in red and the approximate location of the WwTW works and extension is highlighted in blue.

4. Methodology

4.1 Desk study

A desk study was undertaken to determine the presence of any Special Areas of Conservation within 5km of the site and other designated nature conservation sites with bats as the designating feature, and records of bats within 2km of the proposed development. Biological records were requested from Aderyn⁹ in July 2021. Only records from the last 10 years (2011-2021) were included. The following sources were also consulted as part of the desk study:

⁹ <https://aderyn.lercwales.org.uk/>

- The Multi Agency Geographical Information for the Countryside (MAGIC) website¹⁰; and
- Natural Resources Wales (NRW)¹¹ protected areas mapping.

4.2 Field surveys

4.2.1 Preliminary Ecological Appraisal

To inform the survey design, a walkover survey was undertaken to identify habitats and areas likely to be of value for bats, including a building within the WwTW which was assessed for its suitability to support roosting bats. The building and habitat assessment was undertaken alongside the Phase 1 Habitat Survey in June 2021 by Arcadis Ecologists Siân Carr (MCIEEM) and Kailey O'Brien (ACIEEM)¹⁸. During this survey, key habitat areas for bats, including potential commuting routes, foraging areas and roosting locations were identified. The results of the assessment were used to design the scope and survey method/s of the bat surveys outlined in sections 4.2.2 – 4.4.4 below.

4.2.2 Preliminary Roost Assessment – Buildings

Surveys for bats were undertaken by a suitably qualified and experienced ecologist. The building within the site was inspected externally for features that could support roosting bats and/or signs of bat presence. (see box 15 in drawing B10181-0AG964-ZZ-ZZ-DR-NB-ED0248 for the location of the building onsite).

All potential roosting features and habitats were classified for their suitability for bats in accordance with Bat Conservation Trust Good Practice Guidance¹² best practice guidance which is summarised in Table 1 below:

Table 1: Bat Suitability Classification

Bat Suitability Classification		
Suitability	Description roosting habitats	Commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site to be used by commuting or foraging bats.
Low	<p>A structure with one or more potential roost features (PRF) that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e., unlikely to be suitable for maternity or hibernation).</p> <p>A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.</p>	<p>Habitat that could be used by small numbers of commuting bats such as a hedgerow with gaps or un-vegetated stream, but isolated, (i.e., not very well connected to the surrounding landscape by another habitat).</p> <p>Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.</p>
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	<p>Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens.</p> <p>Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.</p>

¹⁰ <https://magic.defra.gov.uk/>

¹¹ Natural Resources Wales (2023) Protected Areas Mapping available online from <https://naturalresources.wales/guidance-and-advice> Accessed May 2023

Bat Suitability Classification		
Suitability	Description roosting habitats	Commuting and foraging habitats
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	<p>Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge.</p> <p>High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broad-leaved woodland, tree-lined watercourses and grazed parkland.</p> <p>Site is close to and connected to known roosts.</p>

4.2.3 Emergence/re-entry Surveys

Emergence/re-entry surveys were undertaken on a single storey brick, flat roofed building in the WwTW site which was categorised as having low bat roost potential in June 2021 and four trees which were identified as having low and moderate potential to support roosting bats (tree numbers 5, 7, 10 and 11), the location of the building and trees can be found on drawing B10181-0AG964-ZZ-ZZ-DR-NB-ED0248 The first survey of the building confirmed it as a bat roost; therefore, an additional bat survey was undertaken to determine what type of bat roost the building supports. Trees identified as having moderate potential underwent a tree climbing survey (see section 4.2.5) and emergence/re-entry surveys.

The aim of the surveys was to confirm the presence/likely absence of roosting bats and characterise any roosts present. The surveys were undertaken by Julie Player (MCIEEM) and Siân Carr (MCIEEM), using real time, full spectrum recording Elekon Bat logger bat detectors and infrared equipment (Sony DCR-SR45 Camcorder, 96LED 45° Night Vision Light IR Infrared Illuminator and DC 12V Portable Rechargeable Li-ion Battery).

Surveys were undertaken following Bat Conservation Trust (BCT)¹². The dusk emergence surveys began 15 minutes before sunset and continued for an hour and a half after sunset. Dawn surveys began an hour and a half before sunrise and continued for 15 minutes after sunrise. The date of the bat surveys and weather can be found in Table 3 below.

Table 2: Date and weather conditions of the emergence/re-entry bat surveys

Date	Building/Tree Surveyed	Type of survey	Weather
17/8/2022	Building	Dusk emergence survey	Dry, partially cloudy, no breeze. Start temperature: 17°C; end temperature: 16°C.
8/6/2023	Trees 5 and 7	Dusk emergence survey	Dry, partially cloudy, no breeze. Start temperature: 17°C; end temperature: 13°C.
14/6/2023	Building and trees 10 and 11	Dawn re-entry survey	Dry, clear sky throughout survey, light breeze. Start temperature: 17°C; end temperature: 15°C.

4.2.4 Preliminary Ground Level Bat Roost Assessment

A preliminary bat roost assessment of trees within the red line boundary was undertaken in July 2022 for the main site and April 2023 for the access track to identify any potential roost features (PRFs) suitable for roosting bats. The assessment was undertaken by a licensed surveyor (Julie Player MCIEEM; Licence number S089646/1) and assistant (Joseph D'Souza ACIEEM) following the BCT Survey Guidelines¹⁷.

An inspection of the trees was undertaken from ground level to compile information about the tree, identify features that bats could potentially use for roosting and record any evidence of roosting bats. The survey was carried out using binoculars and a Clu-lite (Clu-Briter) torch.

A total of eighteen trees underwent a preliminary ground level bat roost assessment. The locations of these trees are shown on Drawing B10181-0AG964-ZZ-ZZ-DR-NB-ED0248

PRFs that may be used by roosting bats in trees include:

- woodpecker holes;
- rot holes;
- hazard beams;
- vertical or horizontal cracks and splits (such as frost cracks) in stems and branches;
- partially detached flaky bark;
- knot holes arising from naturally shed branches, or branches previously pruned back to the branch collar;
- man-made holes (e.g., cavities that have developed from flush cuts) or cavities created by branches tearing out from parent stems;
- cankers (caused by localised bark death) in which cavities have developed;
- butt rot cavities near the base of tree stems;
- double leaders forming compression forks with bark and potential cavities;
- gaps between overlapping stems or branches;
- partially detached Ivy (*Hedera helix*) with stem diameters in excess of 50 mm and/or dense Ivy (*Hedera helix*) foliage that could potentially conceal roosting features; and
- artificial bat, bird or dormouse nest boxes.

Trees were categorised based on the features' suitability for roosting bats, according to the descriptions provided in Table 4 below, taken from the BCT Survey Guidelines¹².

Table 3: Guidelines for assessing the potential suitability of trees to support roosting bats based on the presence of features.

Suitability	Description of Roosting Habitat
Negligible	Negligible habitat features on site likely to be used by roosting bats.
Low	A tree of sufficient size and age to contain potential roosting features but with none seen from the ground or features seen with only very limited roosting potential.
Moderate	A tree with one or more potential roosting sites that could be used by bats due to their size, shelter, protection, conditions, and surrounding habitat but are unlikely to support a roost of high conservation status.
High	A tree with one or more potential roosting sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection conditions and surrounding habitat.

4.2.5 Tree Climbing Inspection Survey

Tree climbing inspections were undertaken on trees identified as offering moderate or high bat roosting suitability and trees that could not be fully assessed from ground level. The climbing inspection included assessment of the suitability of feature(s) from height, and inspection for the presence of bats and/or further roosting features not visible from ground level, with the use of an endoscope. The tree climbing inspections were undertaken on 17 and 18 April 2023 by Sam Radonich and George Parry. Both are accredited agents under Henry Smith's Bat Licence (2018-37280-CLS-CLS) and qualified (NPTC CS38: Tree Climbing & Aerial Rescue) and experienced tree climbers.

¹² Bat Conservation Trust (2016) Bat Surveys for Professionals: Good Practice Guidance (third edition)

Surveyors recorded any evidence of bat roosting activity (e.g., presence/absence of bats/droppings, smoothing, feeding remains, smell, staining, bat fly *Nycteribiid* sp pupae and squeaking noises).

Once the potential bat roosting features were inspected the tree would be either downgraded to negligible or low potential for roosting bats or upgraded to moderate or high potential, additional surveys were recommended based on these results. Tree numbers 6,7,8,9 and 11 were climbed their locations can be found on drawing number B10181-0AG964-ZZ-ZZ-DR-NB-ED0248.

4.2.6 Bat Transect Surveys

Transect surveys involved two surveyors walking a predetermined route around the site, recording bat activity on portable handheld bat detectors (Elekon Bat loggers). Throughout the transects, surveyors included a series of five minute ‘Listening Stops’. The transect included five Listening Stops identified as ‘LS’ on Drawing B10181-0AG964-ZZ-ZZ-DR-NB-ED0249 at the end of the report. During the survey, in addition to recording bat activity on the detectors, notes were taken on the behavior of the bats observed.

Dusk transects commenced at sunset and continued for at least 2 hours after sunset.

Transect routes were designed to fulfil the following requirements as set out in best practice guidance¹²:

- Cover all of the broad habitat types present within the site boundary, including habitats of high value for bat foraging and commuting/dispersal; and
- Be a length whereby they could be walked during the two hours following sunset.

The habitat on site was identified as having moderate suitability for bats in accordance with best-practice guidelines, therefore a survey was undertaken once a month between July and October 2022 (inclusive) and April – June 2023 (inclusive). The transect route was walked in both directions during this period, with surveyors commencing transect routes from different starting locations during each survey. The route followed and location of listening stops can be seen on Drawing B10181-0AG964-ZZ-ZZ-DR-NB-ED0249. The date and times of the surveys are outlined in Table 5 below:

Table 4: Date, time and weather conditions for the bat transect surveys.

Date	Start Time	End Time	Weather Conditions
29/7/2022	21:06	23:25	Dry and warm throughout the survey, no breeze. Start temperature: 16°C; end temperature: 15°C.
25/8/2022	20:15	22:20	Dry and warm throughout survey, no breeze. Start temperature: 19°C; end temperature: 15°C.
15/9/2022	19:15	21:33	Dry and cloudy with a light breeze. Start temperature: 16°C; end temperature: 14°C.
11/10/2022	18:29	20:30	Dry, partially cloudy and a light breeze. Start temperature: 10°C; end temperature: 9°C.
26/4/2023	20:26	22:44	Dry, thick clouds and a light breeze. Start temperature: 11°C; end temperature: 10°C.
25/5/2023	20:50	23:15	Dry, partially cloudy, no breeze. Start temperature: 17°C; end temperature: 13°C.
8/6/2023	21:15	23:30	Dry, clear sky throughout survey, light breeze. Start temperature: 17°C; end temperature: 15°C.

4.2.7 Data Analysis

Following the surveys, the recordings from the Elekon Bat loggers were analysed using Kaleidoscope Software. This data analysis was completed by Malhar Tulpule with 5% of calls and noise files manually reviewed and verified by Julie Player. Appendix B illustrates the Kaleidoscope Pro settings used for bat echolocation sound analysis.

4.2.8 Bat Static Automated Surveys

Following BCT Survey Guidelines, two static detectors were deployed along the transect route. The survey period was between July and October 2022 and April to June 2023. At each static detector position, five consecutive nights of data were collected and analysed for each deployment. This data is presented in section 5.2.5 and Appendix D.

The detectors were positioned in the same location for each deployment. The locations were determined according to a 'Judgemental' sampling protocol. In this instance the judgmental positioning employed the positioning within or adjacent to a range of habitats present on and around the proposed new WTW site, ensuring that all broad habitats received coverage from the detectors.

The detector microphones were positioned at 1 - 2m above the ground, attached to linear features (branches on hedgerows/tree lines). Microphones were positioned at 90 degrees pointing away from the linear feature to give the best chance of recording bat activity and minimise interference from vegetation.

The detectors were programmed to commence recording 30 minutes prior to sunset and continue recording throughout the night until 30 minutes after sunrise, in line with BCT Survey Guidelines¹². Table 4 below outlines the deployment details for static detectors. Details of the programming of the detectors is included in Appendix A.

Table 5: Deployment Dates at both static detector positions

Month	First night of recording	Last night of recording
July	25/07/2022	29/07/2022
August	17/08/2022	21/08/2022
September	09/09/2022	13/9/2022
October	24/10/2022	28/10/2022
April	21/04/2023	25/04/2023
May	19/05/2023	23/05/2023
June	08/06/2023	12/06/2023

4.3 Data Analysis Methodology

Due to the large amount of data collected during the emergence, transect and static surveys, it was assessed that an automated detector analysis protocol would be required as detailed in Table 5. The automated bat call analysis tool Kaleidoscope was utilised to assess the data collected (hereafter referred to as 'auto ID'). The settings used when processing the files are shown in Appendix D.

Table 6: Bat Auto ID Results Data Classification

Auto ID Category	Meaning of Category	Findings	Data Handling
No ID	Kaleidoscope could not identify	10% of files manually verified	Removed from dataset if not manually verified as a bat
Noise	Identified as noise by Kaleidoscope		All included in dataset, no further verification
All other species	Where kaleidoscope identified to a species level		

4.4 Limitations / constraints

4.4.1 Tree Climbing

All features could be inspected at the time of the survey. However, many bat species that roost in trees switch roosts on a regular basis¹³ and droppings do not persist in trees in the same way as they do in buildings¹⁴. The chances of confirming the presence of roosting bats within trees is therefore relatively low; equally, surveys are unlikely to conclusively prove absence of roosting bats¹⁵. Emergence/re-entry surveys were also undertaken on trees that were climbed and identified as having moderate bat roost potential.

¹³ Woodland Trust (2016). *Wood Wise – Woodland Conservation News, Summer 2016*.

<https://www.woodlandtrust.org.uk/media/1753/wood-wise-marvellous-mammals.pdf> [last accessed 27.04.2023].

¹⁴ Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn). The Bat Conservation Trust, London

¹⁵ Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn). The Bat Conservation Trust, London

Trees next to the access track were not surveyed at this time as the proposed location of the access track had not been finalised. This is not considered a constraint as no impacts within 20m of trees along the access track are anticipated.

4.4.2 Transects and Statics

No static bat survey results are available for July 2022 as both detectors malfunctioned. Data was collected throughout the rest of the survey period, this together with the walked transect data provides sufficient information to determine bat activity across the season.

Transects did not include the access track as the proposed location for the track had not been finalised at the time of survey. As the works are temporary it is considered that any likely impact will be minimal with minimal vegetation requiring removal.

4.4.3 Equipment

Long-eared bats are less likely to be recorded during bat detector surveys, due to their quiet echolocation. This is a limitation of all surveys using acoustic detectors. The manned transect surveys, which include visual observations, reduce the impact of this limitation.

4.4.4 Analysis

Determining the number of bats within a set of static data without visual observations is inherently problematic. This is because the methodology cannot distinguish between an individual bat passing the detector multiple times, or multiple bats passing the detector once. It is not possible for any static (automated) detector data to accurately assess the number of bats. To address this issue, the same parameters for file partitioning were utilised on all detectors and a single sound file was identified as a bat 'pass'. This allowed for a repeatable comparison of activity levels between static locations.

5. Results

5.1 Desk Study

Desk study information relating to bat species including designated sites is outlined below. A full breakdown of all ecological information returned from the desk study can be found in the Preliminary Ecological Appraisal Report¹⁶.

5.1.1 Statutory Designated Sites

The desk study identified no statutory designated sites designated for bats within 2km of the proposed development. There are also no Special Areas of Conservation (SACs) designated for bats within 5km of the proposed development.

5.1.2 Species Records

The information from Aderyn LERC returned records of seven different bat species within 2km of the proposed development and records that could not be identified to species level. Table 8 presents a summary of the desk study data obtained from Aderyn. Definitive records were not provided to determine 'roost' or 'non-roost'.

Table 7: Summary of bat species Aderyn LERC results

Species	Scientific Name	Records	Nearest record to site in metres
Bat	N/A	3	1089
Brown Long-eared	<i>Plecotus auritus</i>	11	1089
Common Pipistrelle	<i>Pipistrellus pipistrellus</i>	14	696
Soprano Pipistrelle	<i>Pipistrellus Pygmaeus</i>	9	1200
Pipistrelle bat	<i>Pipistrellus sp.</i>	6	896
Lesser Horseshoe bat	<i>Rhinolophus hipposideros</i>	2	1143
Noctule Bat	<i>Nyctalus noctula</i>	10	763
Serotine	<i>Eptesicus serotinus</i>	2	1089
Whiskered Bat	<i>Myotis mystacinus</i>	1	1398

¹⁶ Arcadis (2022) St Nicholas WwTW Preliminary Ecological Appraisal Doc No B10180-0AG964-ZZ-ZZ-RP-NA-ED013

Species	Scientific Name	Records	Nearest record to site in metres
Myotis Bat	<i>Myotis</i> sp.	16	848

5.2 Field Surveys

5.2.1 Preliminary Roost Assessments of Trees and Buildings

The preliminary ground level roost assessment included trees within a 20m radius of the proposed works, and the single storey flat roof building located within the WWTW site as shown on Drawing B10181-0AG964-ZZ-ZZ-DR-NB-ED0248.

The ecological constraints walkover survey undertaken in June 2021 identified one PRF on the north-western aspect of the building adjacent to the fence line and trees (a photograph of the building is provided as Figure 3 below). The feature (gap between fascia board and the building) was considered to have low bat roost potential and would therefore require a single bat presence/absence survey between May and September as per BCT guidelines¹².



Figure 3 - Welfare building located within existing WwTW.

A total of eighteen trees underwent a preliminary ground level bat roost assessment. The locations of these trees are shown on Drawing B10181-0AG964-ZZ-ZZ-DR-NB-ED0248 (number 15 on the drawing is the building). Trees 1-4, 13 and 16 – 19 were identified as being outside the likely zone of influence for the works and no anticipated impacts on roosts/bats even if present. No further inspection surveys were undertaken on these trees. Trees 5-12 and 14 were subject to additional surveys to determine if any of the PRFs present were suitable to support roosting bats. Any potential features identified as unsuitable for roosting bats after the tree climbing survey were discounted, and no further surveys were required.

5.2.2 Tree Climbing Surveys

No confirmed bat roosts were identified during the surveys. Trees 6, 8, 9, 12 and 14 were considered unsuitable to support roosting bats. Trees 5, 7, 10 and 11 had suitable features that had the potential to support bats, but no evidence was found of a roost being present. The results of the survey are outlined in Table 9.

Table 8: Bat tree climbing survey results.

Tree Number and species	Survey Type	Feature	Result and further surveys
1-4, 13, 16 - 19	Identified as outside the likely zone of influence of the works and no anticipated impacts on roosts/bats even if present. No further inspection surveys undertaken.		
5 Oak	Ground level inspection with binoculars only	Split beam with potential for cavity but open to elements on both sides.	Low potential – One emergence/re-entry survey required.
6 Oak	Climbed inspection	A - Knot hole	All features filled with water and considered unsuitable for roosting bats – no further surveys required.
		B - Split branch	
		C - Large cavity (south)	
		D - Large cavity (north)	
7 Oak	Climbed inspection	A - Split beam	Moderate potential but no evidence of bats – two surveys undertaken (one tree climbing survey and one emergence/re-entry survey)
		B - Split limb (west, 4m high)	
		C - Split limb (west, 12 m high)	
8 Oak	Climbed inspection	No suitable features	No further surveys required
9 Oak	Climbed inspection	No suitable features	No further surveys required
10 Hawthorn	Ground level inspection with extendable endoscope	Buttress rot cavity	Moderate potential but no evidence of bats – two surveys undertaken (one tree climbing survey and one emergence/re-entry survey)
11 Aspen	Climbed inspection.	A – knot hole	No depth to support bats.
		B – bark fissure	
		C – knot hole	The knot hole extends into a cavity 15cm deep, and 30cm up and 30cm down the trunk. Moderate potential – two surveys undertaken (one tree climbing survey and one emergence/re-entry survey)
12 Oak	Ground level inspection with extendable endoscope	Split limb	No suitable features – no further survey required
14 Hazel	Ground level inspection with extendable endoscope	Split stem	No suitable features – no further surveys required

5.2.3 Emergence/Re-Entry Surveys

No bats were observed re-entering or emerging from trees 5, 7 10 and 11.

Three common pipistrelle bats were recorded emerging from the WwTW building during the August 2022 survey, see location of the roost in the image below. As the building was identified as a bat roost, an additional survey was required to confirm the type of bat roost the building supported, and an additional bat survey was undertaken in June 2023. No bats were observed entering the building during the dawn re-entry

survey. The results of the surveys indicate that the building is an occasional day roost for a small number of common pipistrelle bats during the summer.



Figure 4: Location of bat roost

5.2.4 Bat Transect Survey

The bat transect survey identified key foraging and commuting habitats for bats. Figure 5 below identifies the key locations where bats were observed foraging and commuting. Bats recorded during the transect survey included common and soprano pipistrelle, *Myotis* sp, and noctule. High numbers of common and soprano pipistrelle were observed commuting along the hedgerows and tree lines and foraging within the grazed fields east, north-west and south-west of the WwTW, as well as within the WwTW and the trees immediately north-east from the WwTW entrance. Limited commuting was observed along the most eastern hedgerow. Small numbers of noctule bats were recorded commuting over the site.

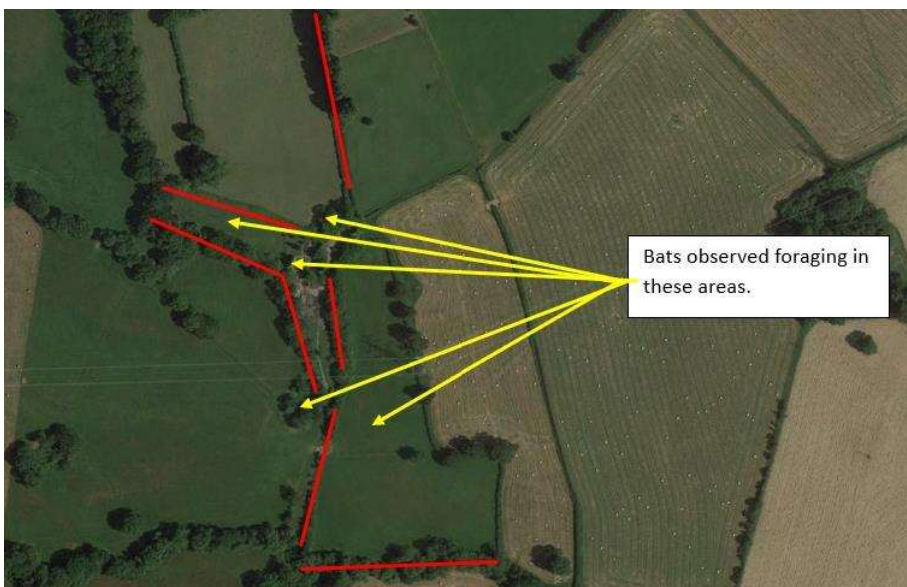


Figure 5: Results of bat transect survey (red lines = commuting routes used by common and soprano pipistrelle and the yellow arrows identify key areas where bats were recorded foraging).

5.2.5 Static Detector Survey

A higher number of calls were recorded on the static detector located on the northern boundary in the period August to September 2022 and in the months of April and May 2023 indicating that bats used the northern boundary of the site more frequently than the southern boundary during these months. During October 2022 the southern boundary was used more than the northern boundary, and both were used equally in June 2023. As illustrated in Figure 6, bats were recorded more frequently on the northern static detector than the south, Appendix D illustrates the bat activity recorded each month.

Species recorded on the static detectors include, common and soprano pipistrelle, noctule and *Myotis* sp, brown long-eared, serotine, greater (*Rhinolophus ferrumequinum*) and lesser horseshoe (*Rhinolophus hipposideros*) bats. Common and soprano pipistrelle bats were recorded most frequently overall, although their numbers did drop significantly in October 2022. A total of five greater horseshoe bat passes were recorded between August and October 2022 and in the period April to June 2023, four were recorded on the northern detector and one on the southern detector. Twenty lesser horseshoe bat passes were recorded between August and October 2023 and the period April to June 2023, fifteen calls of these calls were recorded on the southern detector, this is most likely due to the tree line to the south and west of the site being more mature and denser than the northern and eastern side of the site, providing a darker corridor for these light sensitive species.

*Unable to identify down to species level, bats recorded in this group are classed as big bats and could be noctule, serotine, leisler bats

Static Detector Location	Species									
	Serotine	Noctule	Big Bat*	Common Pipistrelle	Soprano Pipistrelle	Pipistrelle sp	Brown Long-eared	Greater Horseshoe	Lesser Horseshoe	Myotis Sp
North	45	120	6	7456	1769	0	19	4	5	119
South	50	149	11	1909	1038	2	18	1	15	89

Summary of Static Survey Results

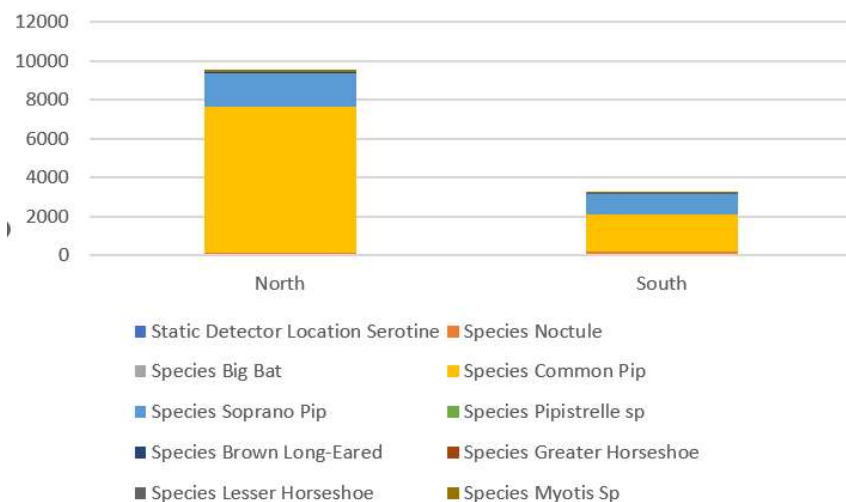


Figure 6: Summary of total static bat survey results from August to October 2022 and April to June 2023 (see Appendix A for monthly breakdown).

6. Conclusion and Recommendations

The proposed works will result in the removal of one tree line (approximately 100m) and the loss of approximately 0.5 hectare of grassland habitat to allow the expansion of the WwTW as shown on Figure 7. The construction compound may also result in temporary damage to grassland habitat and the temporary access track will pass through a gateway under the canopy of Tree 5.

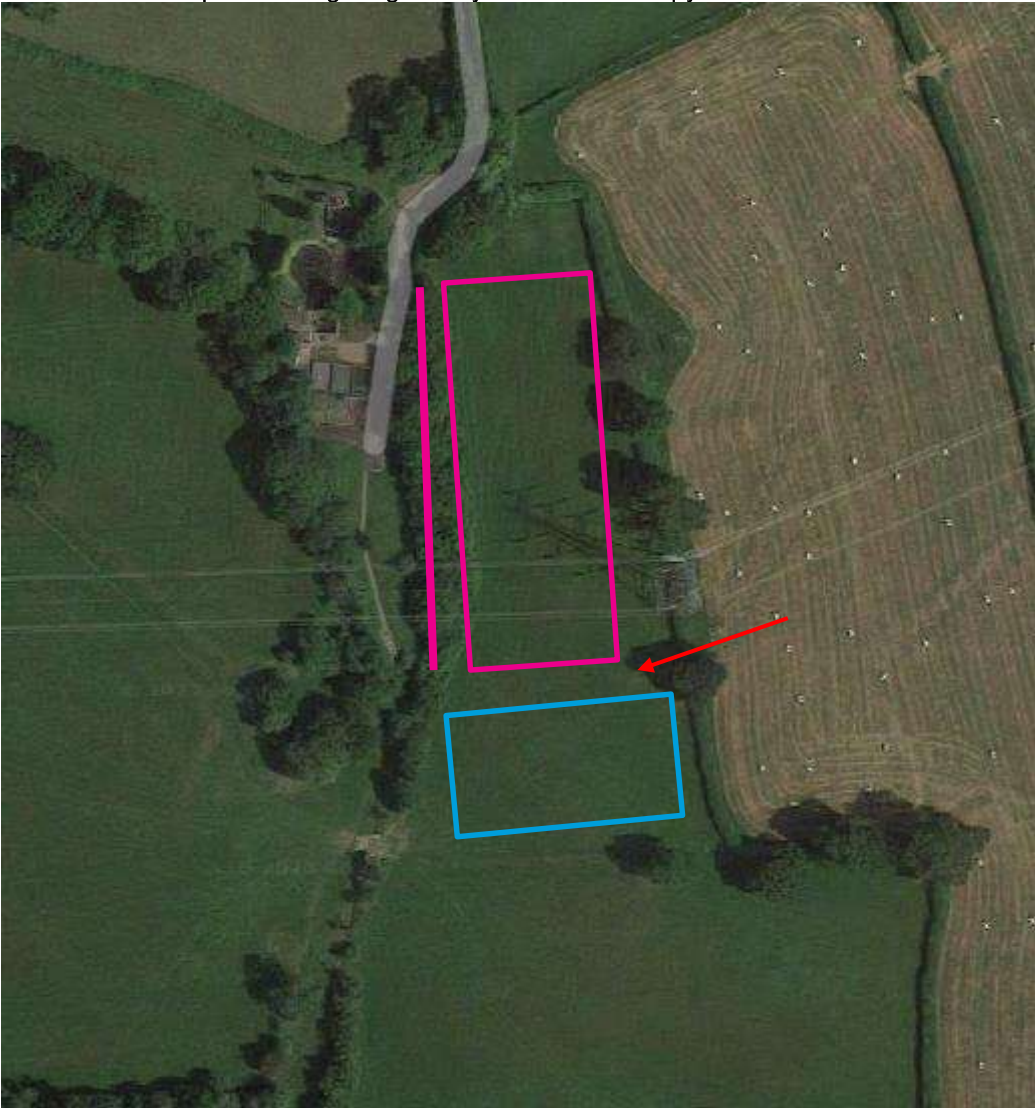


Figure 7: Proposed works and impacts (pink – likely extent of vegetation lost to the WwTW expansion, blue – temporary construction compound area, red arrow – access through gate under canopy of tree T5).

6.1 Roosts

A summer day roost for a small number of common pipistrelle bats was recorded in a building within the WwTW. The proposed works will not directly impact the roost as the building is to be retained. The building is located approximately 25m from the proposed works. There is likely to be increased noise/disturbance temporarily during construction of the proposed extension, and post works; however, the existing WwTW is operational with regular noise and disturbance within the welfare building and onsite treatment tanks. It is unlikely that the roost will be indirectly impacted as the bats are already accustomed to the current noises/vibrations and are roosting onsite. Motion sensor lighting is located on the building and is regularly illuminated when by insects and bats flying across the sensor. The emergence/re-entry surveys showed that this light did not discourage bats commuting and foraging within the site and/or roosting within building. No bat roosts were identified in trees within trees 20m of the proposed works. Works can therefore be undertaken without the requirement of a bat licence. However, if any limbs are to be removed from Tree 5 to enable access or if its removal is required, a precautionary approach should be taken, and the tree should be

inspected beforehand by a bat licenced ecologist to confirm the continued absence of roosting bats. A soft felling approach should be adopted if any branches are to be removed.

6.2 Transect and Static Survey

For most of the season the bat activity observed during the transects was higher along the central tree line that is to be removed, but the activity captured on the static detectors suggests that the northern boundary is used more frequently overall. The central tree line provides a dark corridor across the field and to the east of the WwTW. Other treelines and hedgerows used by commuting bats, albeit less frequently, north-west and west of the WwTW and along Brook Lane are to be retained, these habitats are connected to the wider area via green corridors. To ensure that foraging and commuting bats are not negatively impacted by the proposed works, mitigation is required to enhance the retained green corridor to the east of the red line boundary to provide similar conditions to that of the treeline being removed, ensure dark corridors are created/retained around the site boundaries and to provide a new green corridor west to east, immediately south of the compound area.

6.3 Recommendations

Bats should be considered through the design stage to minimise impacts. Recommendations include the following:

- If trees supporting suitable bat roosting features are to be managed or felled, they should be checked for bats immediately prior to their removal;
- A suitable root protection zone should be fenced off around all trees to be retained prior to any works being undertaken, this will protect the future health of the tree (and bat roost if present),
- Due to the presence of greater and lesser horseshoe bats (light sensitive species) within the site, the creation of dark corridors along the site boundaries is recommended;
- No new or temporary lighting should be installed. If this is not possible bat sensitive lighting should be used on site. An ecologist should be consulted as the design develops;
- No night-time working;
- The location of the compound for the proposed works should be discussed with an ecologist prior to the location being finalised.
- Landscaping should include bat friendly plants i.e., night-time scented flowers that attract invertebrates suitable for bats to forage.
- Trees should be planted to form a west to east corridor immediately south of the compound area to replace the trees that need to be removed at the centre of the site. Semi-mature trees should be planted to provide an instant dark wooded corridor for bats. Scattered broadleaved trees should also be planted along the eastern boundary of the site to enhance it for commuting bats and create a dark wooded (see Appendix C).
- New tree planting should mitigate for the loss of trees and enhance the value of the site for bats to provide a net benefit of biodiversity across the site. Native species to be planted include hazel, oak, hawthorn, birch and beech.
- Bat and bird boxes should be installed in areas that won't be subject to disturbance within the site to mitigate for the loss of potential roosting and nesting habitat (See Appendix C).

The bat surveys carried out are valid for a period of 2 years and will be valid until spring 2025.

DRAWING B10181-0AG964-ZZ-ZZ-DR-NB-ED0248

Building and Tree Roost Assessment Location Plan

Notes: Layer: Cymru; OS Topographic; Contains OS data © Crown Copyright and database right 2022. Contains data from OS Zoomstack. OS: Hillshade; Contains OS data © Crown Copyright and database right 2019.

Legend

- Site Boundary
- Trees
- Building



Rev	Date	Description	Drawn	Check	Approv
01	20/06/2023	INITIAL ISSUE	DP	JP	SC

Client:

PROJECT:
ST NICHOLAS
WWTW

Client: ST NICHOLAS WWTW

Site: _____
Site Address

Client: _____
Client Address

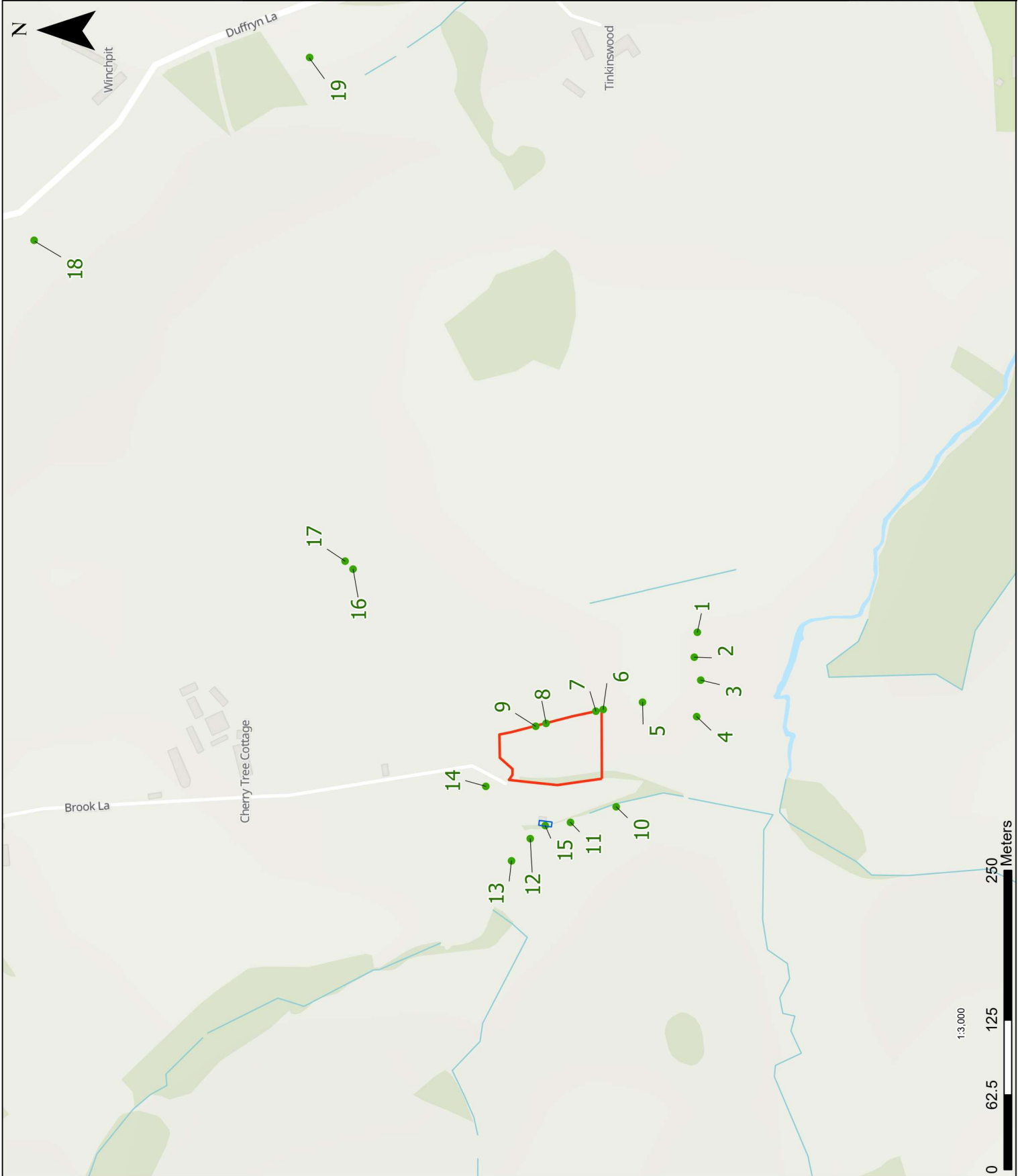
Registered office:
Cherry House
1 Church Street
Cambridge
CB2 1LX
www.arcadis.com

Title: Preliminary Roost Assessment - Building and Trees

Designed	J. Player	Date	20/06/2023	Signat
Drawn	D. Paltrasi	Date	20/06/2023	Signat
Checked	J. Player	Date	20/06/2023	Signat
Approved	S. Carr	Date	20/06/2023	Signat
Scale:	1:3,000	Datum:	AOD	
Original Size:	A3	Grid:	OS	
Suitability Code:	S2	Project Number:	10048098	
Suitability Description:				

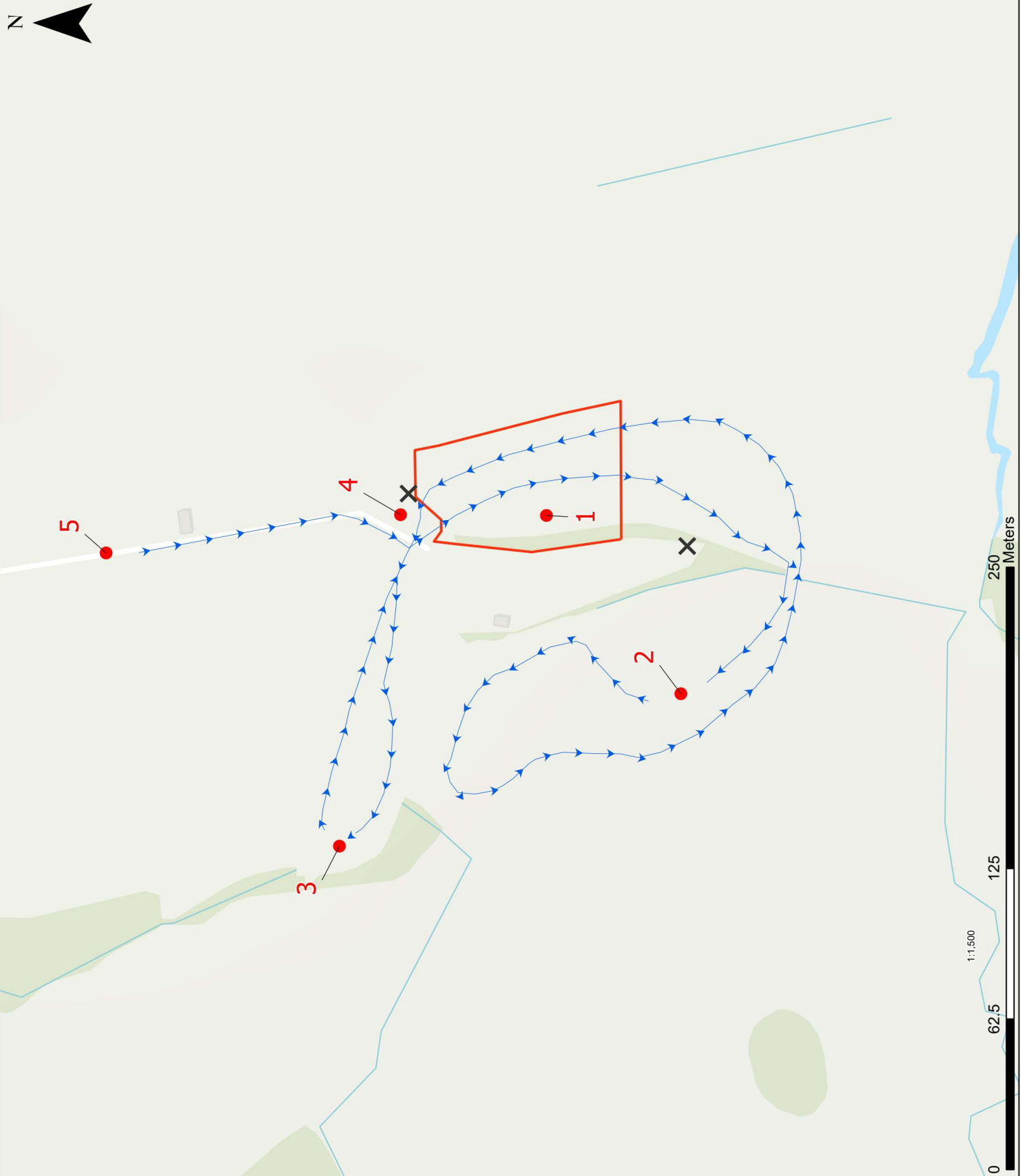
For Information

Drawing Number: XXXXXX
Revision: P01



DRAWING B10181-0AG964-ZZ-ZZ-DR-NB-ED0249

Static Locations and Activity Transect Plan



- Legend**
- Site Boundary
 - Listening Stops
 - ✕ Static Bat Detector Location
 - Bat Activity Transect

Notes: Layer: Cymru; GB Topographic; Contains OS data © Crown Copyright and database right 2022
 Contains data from OS Zorombed
 GB: Heliaba; Contains OS data © Crown Copyright and database right 2019



Rev	Date	Description	Drawn	Check	Approv
01	20-06-2023	INITIAL ISSUE	DP	JP	SC

Client:

PROJECT:
 Dŵr Cymru
 Welsh Water
 ST NICHOLAS
 WWTW

Site: _____ Client: _____
 Site Address: _____ Client Address: _____



Title: **Bat Activity Transect and Static Bat Detector Location**

Designed	J. Player	Date	20-06-2023	Signal
Drawn	D. Prakrasi	Date	20-06-2023	Signal
Checked	J. Player	Date	20-06-2023	Signal
Approved	S. Carr	Date	20-06-2023	Signal
Scale:	1:1,500	Datum:	AOD	
Original Size:	A3	Grid:	OS	
Suitability Code:	S2	Project Number:	10048098	
Suitability Description:				

For Information

Drawing Number: XXXXXX
 Revision: P01

Appendix A – Static detector programming

Deployment Scenario	
SM4BAT-FS	
Start dd/mm/yy hh:mm:ss	
Slot A	128GB
Slot B	128GB
Mic 0:	SMM-U1
Trig Ratio (%)	10% (default)
Battery (Wh)	72 Wh (default)
Prefix	SM4-FS-001 (to 030)
Gain	12dB
Timezone	UTC+01 (= BST. Need to change to UTC when the clocks go back)
Lat	See below for approximations. Adjusted manually in the field for accuracy
Long	See below for approximations. Adjusted manually in the field for accuracy
16 kHz HPF	Off
Sample rate	256kHz
Call duration min	0.5ms
Call duration max	Off
Call frequency min	10kHz (default is 16kHz)
Trigger level	Use default (12dB)
Trigger window	3s
Trigger max time	00:15
Sunrise/sunset	
LED delay	off
Start	Set – 00:30
Duty	always

Deployment Scenario	
End	Rise + 00:30

Site	Latitude	Longitude
Northern Static	51.451530 ,	-3.3135581
Southern Static	53.744346 N	-0.98386288 W

Appendix B – Kaleidoscope Pro settings

The table below shows the Kaleidoscope Pro settings used for bat echolocation sound analysis.

Tab	Parameter	Setting
Batch	Time expansion factor	Auto
	Create subdirectories	Nightly
	Split to maximum duration	5 seconds
	Compression	None
	Noise	Delete noise files
Signal parameters	Minimum frequency range	8 kHz
	Maximum frequency range	120kHz
	Minimum length of detected pulse	2ms
	Maximum length of detected pulse	500ms
	When zero crossing for conversion of analysis, enhance with advanced signal processing	Selected
	DC offset	Unticked
Auto ID for bats	Version	Bats of Europe 5.1.0
	Sensitivity	0 Balanced (Neutral)
	Select by region	United Kingdom
Cluster analysis	Disabled	

APPENDIX C

Proposed Mitigation Plan

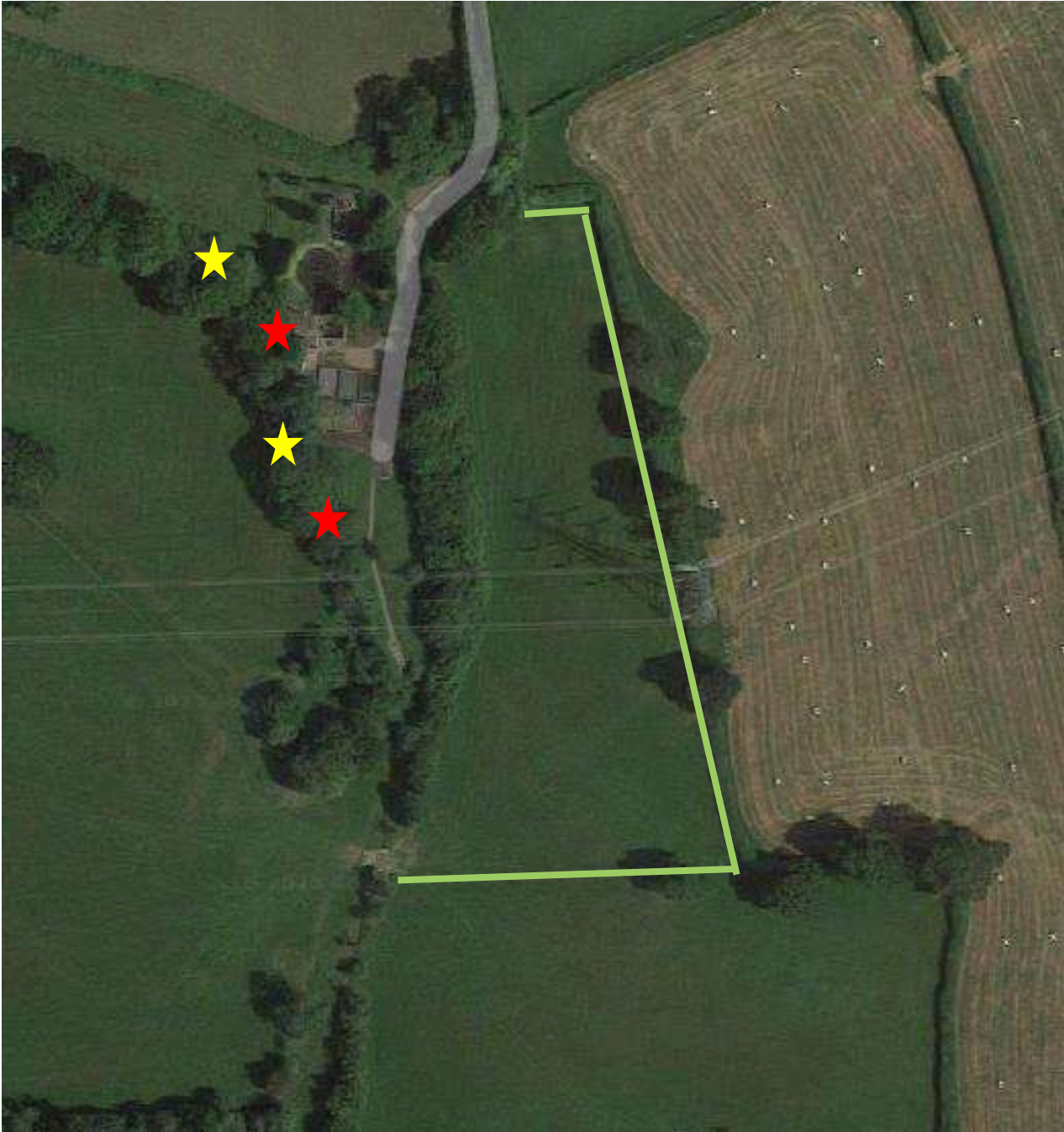
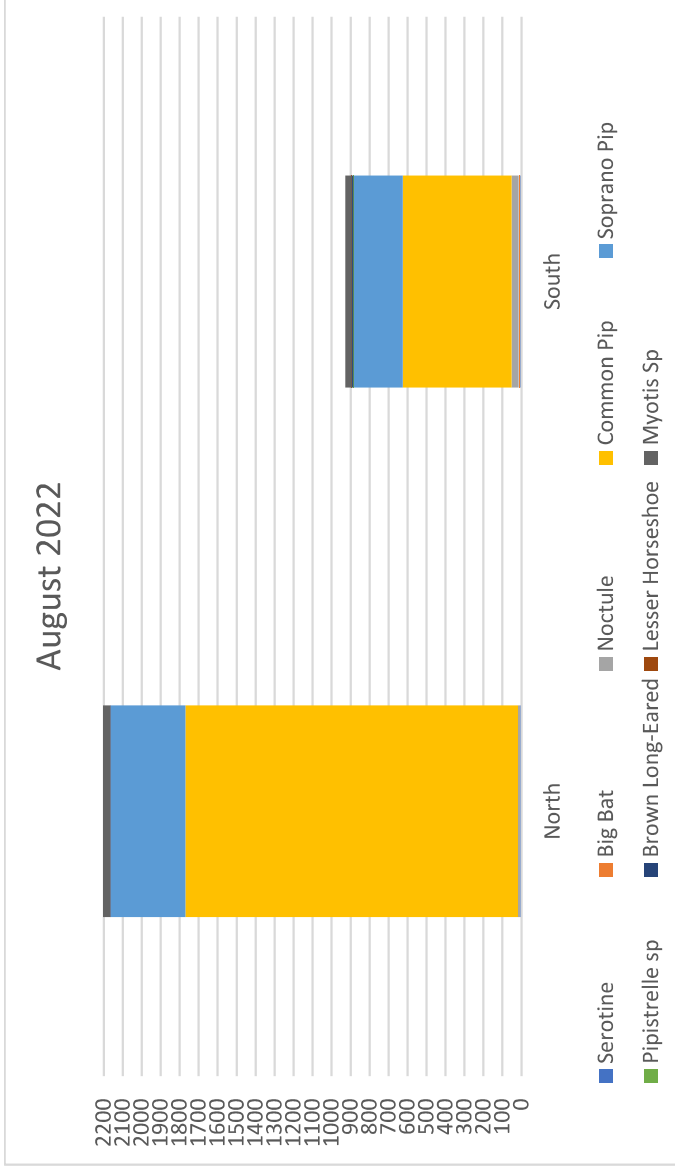


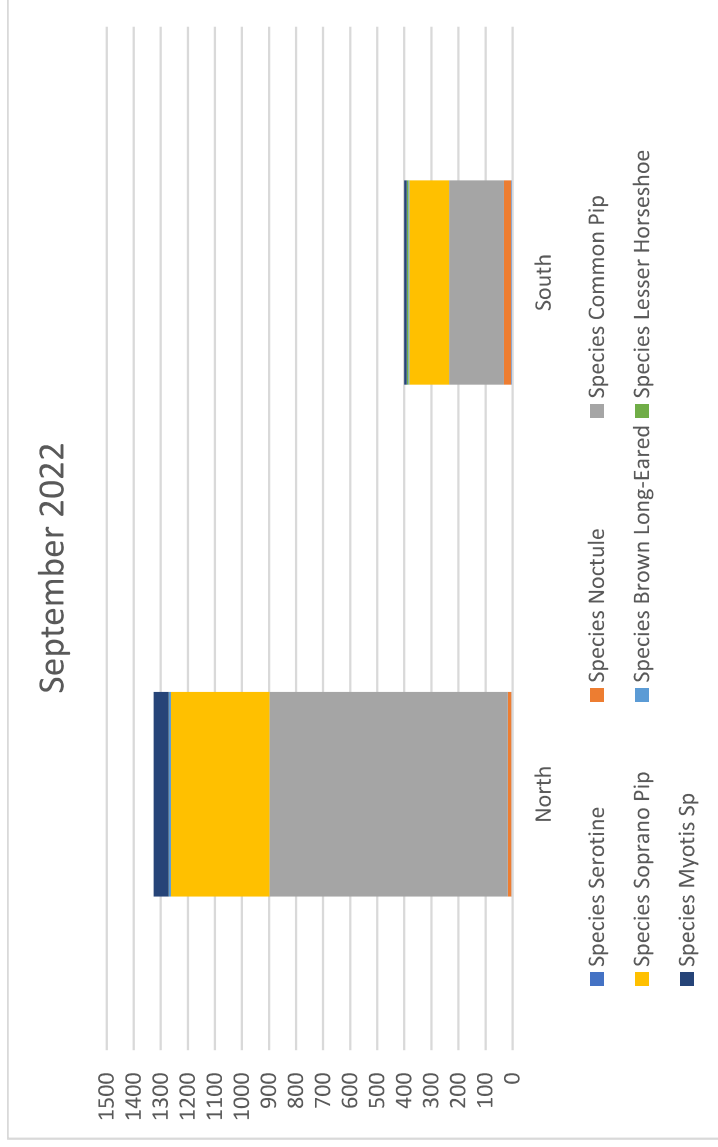
Figure 7 - Proposed mitigation plan (green line = tree planting, yellow stars = bird box locations, red stars = bat box locations)

APPENDIX D

Monthly static bat detector survey results

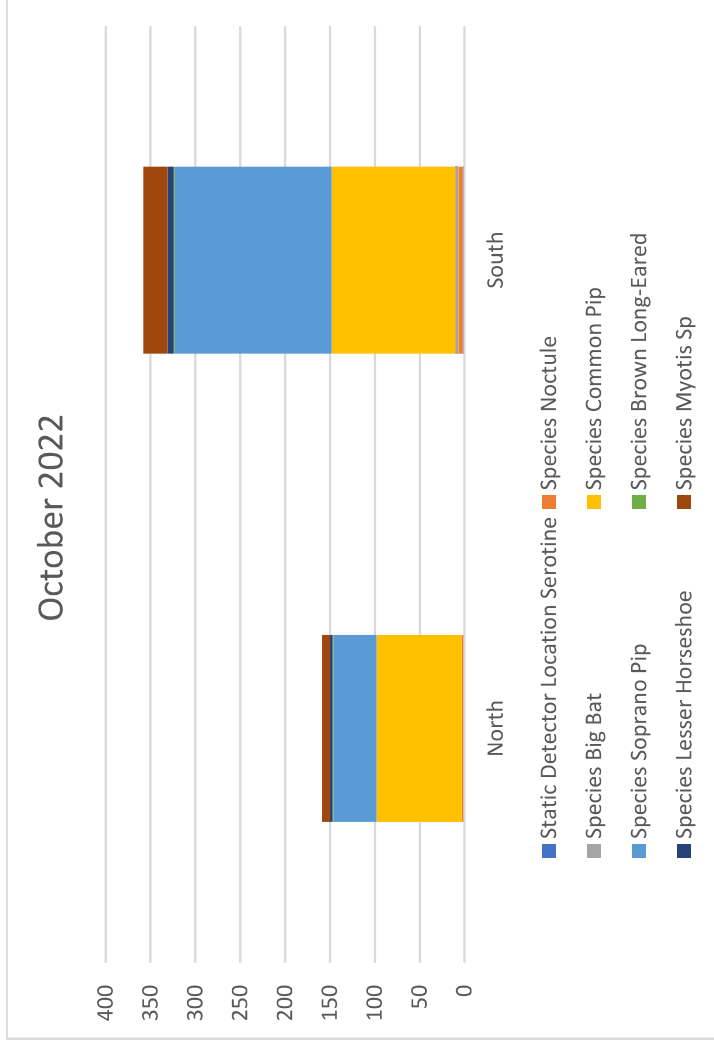


Static Detector Location	Species								
	Serotine	Big Bat	Noctule	Common Pip	Soprano Pip	Pipistrelle sp	Brown Long Eared	Lesser Horseshoe	Myotis Sp
North	7	0	10	1752	393	0	3	0	43
South	10	3	38	574	259	2	7	1	34



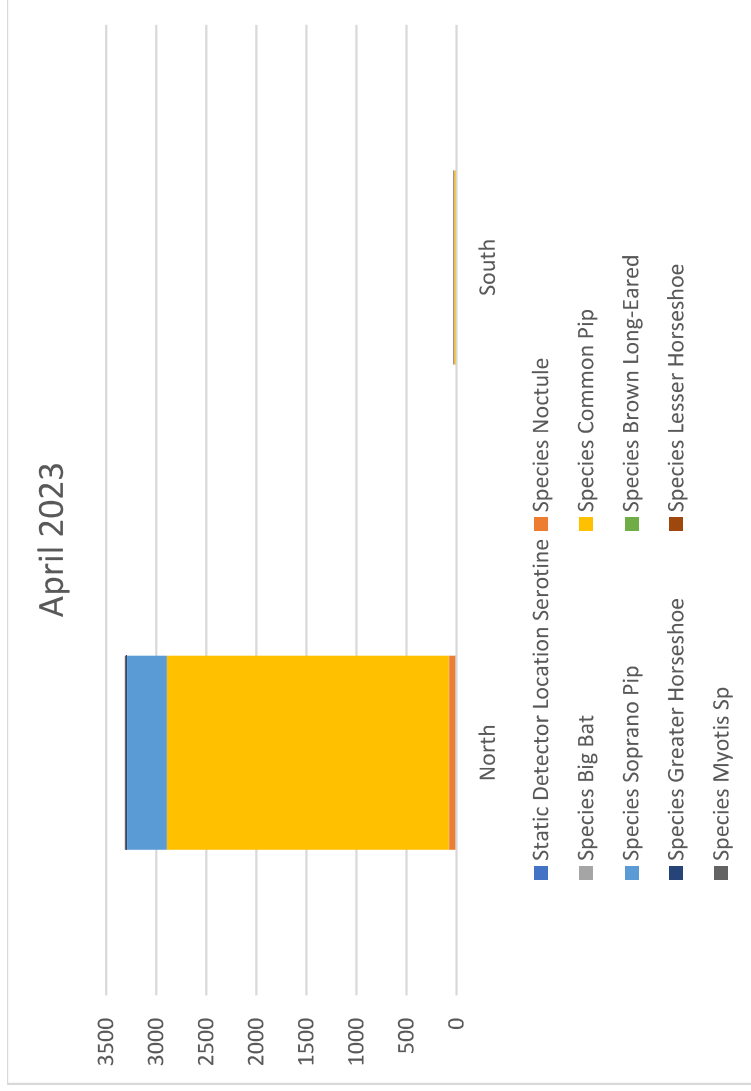
Static Detector Location	Species						
	Serotine	Noctule	Common Pip	Soprano Pip	Brown Long Eared	Lesser Horseshoe	
North	4	14	881	363	8	1	
South	6	26	202	148	3	6	
							Myotis Sp
							56
							10

St Nicholas WwTW Bat Survey Report



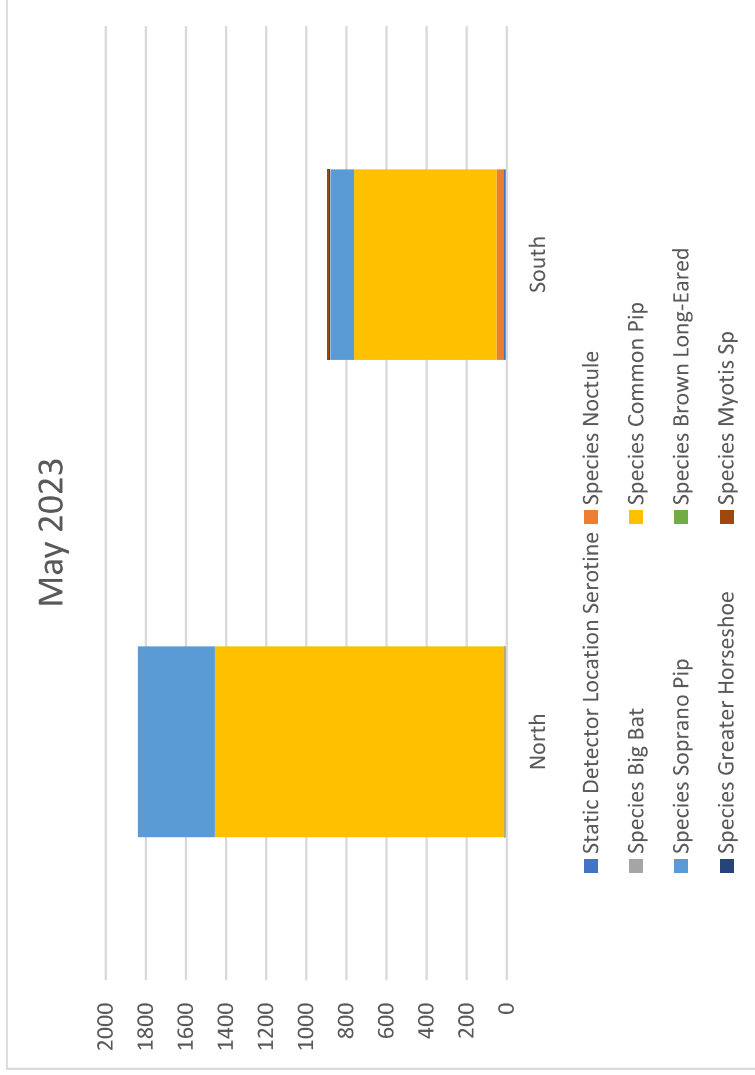
Static Detector Location	Species									
	Serotine	Noctule	Big Bat	Common Pip	Soprano Pip	Brown Long Eared	Lesser Horseshoe	Myotis Sp	Static Detector Location Serotine	Species Noctule
North	0	3	0	95	48	1	3	9	0	2
South	2	5	3	138	175	1	7	27	0	1

St Nicholas WwTW Bat Survey Report



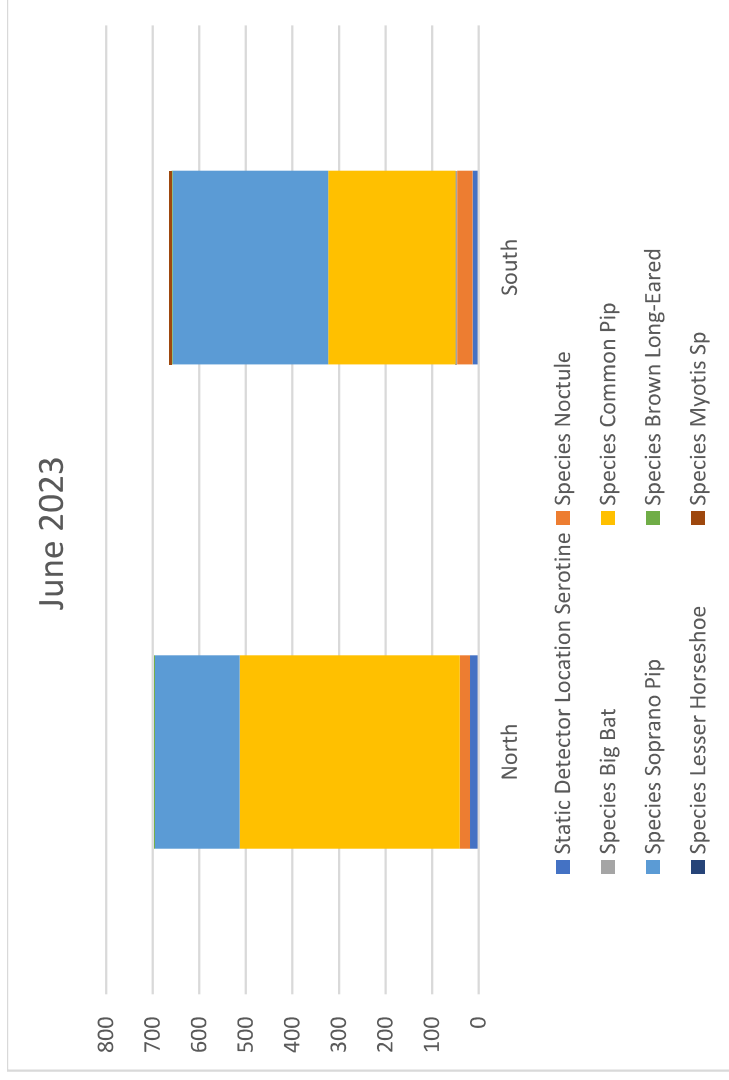
Static Detector Location	Species										
	Serotine	Noctule	Big Bat	Common Pip	Soprano Pip	Brown Long Eared	Greater Horseshoe	Lesser Horseshoe	Myotis Sp	Species Myotis Sp	Species Lesser Horseshoe
North	12	63	4	2814	399	5	4	1	11		
South	1	13	1	13	4	0	0	1	4		

St Nicholas WwTW Bat Survey Report



Static Detector Location	Species								
	Serotine	Noctule	Big Bat	Common Pip	Soprano Pip	Brown Long Eared	Greater Horseshoe	Myotis Sp	
North	3	8	2	1442	384	0	0	0	
South	18	34	0	709	118	5	1	9	

St Nicholas WwTW Bat Survey Report



Static Detector Location	Species									
	Serotine	Noctule	Big Bat	Common Pip	Soprano Pip	Pipistrelle sp	Brown Long Eared	Greater Horseshoe	Lesser Horseshoe	Myotis Sp
North	45	120	6	7456	1769	0	19	4	5	119
South	50	149	11	1909	1038	2	18	1	15	89