

M5 Junction 10 Improvements Scheme

Environmental Statement Appendix 7.15 Bat Mitigation Strategy TR010063 – APP 6.15

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6.15 Environmental Statement:

Appendix 7.15 Bat Mitigation Strategy

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1. Introduction

1.1. Terms of reference

- 1.1.1. Atkins, member of the SNC-Lavalin group, was commissioned by Gloucestershire County Council (GCC) to undertake a suite of bat surveys, assess impacts to bats, and design appropriate mitigation and compensation for bats to inform the Environmental Statement (ES) for the M5 Junction 10 Improvements Scheme (hereafter referred to as 'the Scheme').
- 1.1.2. This Technical Appendix presents the mitigation and compensation proposed for bats in relation to the Scheme.

2. Mitigation and compensation

2.1. Overview of strategy

2.1.1. Mitigation, compensation and enhancement measures have been embedded at the design stage to minimise or compensate for impacts on biodiversity, or to provide enhancements. Embedded mitigation measures for bats include:

- Provision of alternative roost habitat through construction of two compensatory bat roost structures.
- Measures to avoid/reduce impacts of habitat fragmentation and loss of foraging and commuting habitat including:
 - Lighting measures.
 - Hop-over planting and other landscape planting.
 - The River Chelt Link Road bridge design.
 - The Withybridge (A4019) underpass.

2.1.2. In addition to the embedded mitigation measures, the following additional essential mitigation measures for bats are required:

- Protection of retained roosts through localised implementation of sensitive timing of works and acoustic barriers to reduce disturbance.
- Works which would impact on known or assumed bat roosts will be carried out under a Natural England European Protected Species (EPS) mitigation licence.
- Pre-construction surveys prior to any tree clearance and demolition of buildings. Surveys may need to be updated to ensure that any new roosts are identified, and that the current status of roosts are understood, and surveys will also be required where access has prevented surveys being undertaken to-date. If any new roosts are identified these would need to be included in the Natural England EPS mitigation licence.
- Works under a Natural England EPS mitigation licence for bats will require presence of an appropriately licenced ecologist during the works in accordance with the method statement agreed with Natural England.
- Demolition of structures or felling of trees with features suitable to support roosting bats, but where surveys have not confirmed the presence of bats, will be completed under precautionary working methods under guidance from an appropriately licenced ecologist.
- Provision of alternative roost habitat in the form of small structures for crevice dwelling bats, night roost features suitable for lesser horseshoe bats, bat boxes and tree features, with a dark corridor maintained around such features.
- Measures to avoid/reduce impacts of habitat fragmentation through temporary installation of Heras fencing or dead hedging to protect flight lines when key commuting route vegetation is cleared.

2.1.3. Both embedded and additional essential measures are discussed in detail below. The package of mitigation and compensation provided has been based on the suite of bat surveys undertaken up to the end of 2022. In some cases, bat roost surveys were not possible due to access restrictions, and it has been necessary to predict the bat roosts present within these structures and trees, using existing survey data and taking a reasonably precautionary approach. Mitigation and compensation have been designed accounting for the predicted roosts present. The methodology for establishing the predicted bat roosts is detailed in Appendix F of Technical Appendix 7.3 – Bat Survey (application document TR010063 – APP 6.15). It is anticipated that pre-construction surveys will address the gaps in the bat survey data, and it will be necessary to refine

the mitigation and compensation package proposed here, in consultation with Natural England. The emerging 2023 survey work, which is not reported here, is confirming that a precautionary approach has been taken, and the predicted roosts presented here are likely to be an over-estimation. This, combined with lower levels of impacts anticipated, will likely result in a reduction in the mitigation and compensation package required.

2.2. Protection of retained roosts

- 2.2.1. Eleven bat roosts have been recorded within the Ecological Zone of Influence (EZoI) for bats (generally within 40 m of the Scheme Boundary) but at locations where they can be retained¹. These include BU_668, tree 627, BU_11, BU_862, BU_661, BU_737, BU_705, BU_990, BU_992, tree 101 and tree 675. In some cases no mitigation is required (tree 627 and tree 675), in others acoustic barriers and/or strategic timings of works will be implemented to avoid disturbance impacts, or minimise potentially disturbing activities to acceptable levels so roosts can continue to be used by bats.
- 2.2.2. In order to reduce the risk of noise disturbance and potential roost abandonment, acoustic barriers will be installed to reduce noise levels. This will comprise Heras fencing, or similar, with an acoustic blanket or layer attached. It has been estimated that where the Heras fencing is installed in direct line of sight, this will result in a 10 dB reduction in noise levels at the roost. Where not in direct line of sight, a 5 dB reduction will be achieved (see Section 6.8.31 in Chapter 6 - Noise and Vibration (application document TR010063 – APP 6.4)).
- 2.2.3. Therefore, all general construction activities within 20 m of a roost and demolition activities within 30 m of a roost will be reduced to acceptable noise levels (background level of 65dB) assuming the implementation of an acoustic barrier in direct line of sight of the roost. See Table 2-1 in Technical Appendix 7.3 – Bat Survey (application document TR010063 – APP 6.15).
- 2.2.4. There are a further 12 roosts where acoustic barriers will be installed in attempts to retain and protect the roosts. However, for these 12 roosts, given the proximity to the works the efficacy cannot be confirmed and there is a risk of temporary disturbance, on a precautionary basis. These include the following roosts: BU_370, BU_376, BU_614, tree 86, tree 578, tree 576, BU_378, BU_834, BU_638, BU_723, BU_735 and BU_1034.

2.3. Provision of alternative roost habitat

- 2.3.1. Alternative roosting habitat in the form of bat boxes, tree features or compensatory structures have been included for where roosts are being lost as a result of the Scheme, through demolition, felling or disturbance. A total of 16 roosts will be lost directly, through the demolition of 15 buildings and the felling of one tree. These include BU_1042, BU_965, BU_1039, BU_963, BU_972, BU_981, BU_1030, BU_653, BU_987, BU_507, BU_610, BU_611, BU_694, BU_709, BU_819 and tree 496. A further 12 roosts are predicted to be temporarily disturbed during the construction works, as a result of increased noise levels (although noise barrier mitigation will still be implemented as detailed above), and alternative roost habitat will be provided.
- 2.3.2. In addition, there are a number of roosts predicted to be present within unsurveyed or partially surveyed structures/trees.
- 2.3.3. Table 7-1 in Appendix F of Technical Appendix 7.3 – Bat Survey (application document TR010063 – APP 6.15) outlines the known and predicted roosts, impacts/predicted impacts to the roosts and proposed roost compensation.

¹ A number of bat roosts are located beyond the 40 m EZoI, but between the Link Road and the M5, where potential for impacts as a result of fragmentation were identified. However, the design of the River Chelt Link Road bridge (part of the suite of embedded mitigation measures) will ensure that connectivity is maintained and habitat fragmentation will be avoided. No other impacts to these roosts are anticipated, and they are not discussed further in this report.

2.3.4. The locations of compensatory roosts will be as close as possible to the original roost locations, and within the same quadrant². The package of compensatory roost provision for both known and predicted roosts is as follows:

- Northern quadrant – Three crevice dwelling bat roost structures, five artificial bat boxes for crevice dwelling species, one artificial maternity bat box, one tree roosting feature.
- Eastern quadrant – One compensatory bat roost structure with numerous features; two horseshoe night roosts, three hibernation bat boxes, one tree roosting feature.
- Southern quadrant – One compensatory bat roost structure with numerous features; three horseshoe night roosts, two crevice dwelling bat roost structures, five hibernation bat boxes, one artificial maternity bat box.
- Western quadrant – One artificial bat box for crevice dwelling species, two tree roosting features.

2.3.5. These features are described in more detail in the below sections.

Compensatory bat roost structures

2.3.6. Two compensatory bat roost structures have been included as embedded mitigation; one north of the A4019 east of Uckington in the eastern quadrant, and one in the southern quadrant within the flood storage area located south-east of Junction 10. The locations of these are shown on Figure 7-15 in Appendix A.

2.3.7. These structures will be built and be functional for roosting bats prior to the demolition of any buildings.

2.3.8. The structures have been designed to provide like-for-like compensation, to replicate structures which will be lost or subject to disturbance.

2.3.9. In order to minimise disturbance of the structures during construction, from increased noise levels for example, Heras fencing or similar will be used to delineate a 'no interference zone' around the structures. An ecologist will advise on an appropriately sized buffer, depending on the works, and if necessary additional measures such as acoustic barriers will be used to ensure that the background noise levels (65 dB) are not exceeded.

Eastern quadrant

2.3.10. One structure will be created as embedded mitigation north of the A4019 east of Uckington in the eastern quadrant. This structure will provide compensatory roosting opportunities to replace a series of features supporting different species, which are described below.

2.3.11. Although five structures will be destroyed where the presence of lesser horseshoe bats have been confirmed (BU_611, BU_694, BU_507, BU_709 and BU_819), it is likely that these structures are used by only a small number of lesser horseshoe bats. This is because no bats were recorded during the internal survey, and only one lesser horseshoe bat was seen emerging from BU_709 throughout all of the emergence/re-entry surveys. The only other evidence of lesser horseshoe bats is from recent bat droppings (confirmed via DNA analysis) in these structures. Therefore, it is proposed that the five structures can be compensated for adequately with a single structure that provides a range of micro-habitats to mimic the lesser horseshoe roosts to be lost.

2.3.12. In addition, it is predicted that two low/moderate suitability void dwelling roosts will be lost and a low conservation value Natterer's roost that was used for light sampling will be temporarily disturbed (BU_723).

²Different sectors of the Scheme are referred to as 'quadrants,' defined by the A4019 and the M5. Northern quadrant – north of the A4019 and west of the M5; Eastern quadrant – north of the A4019 and east of the M5; Southern quadrant – south of the A4019 and east of the M5; Western quadrant – south of the A4019 and west of the M5.

- 2.3.13. Taking into account the impacts, and as no high conservation value/suitability roosts for lesser horseshoe or void dwelling bats (brown long-eared, Natterer's or barbastelle) are to be lost, a structure with a void within the ground floor and roof void suitable for lesser horseshoes/void dwelling and light sampling species with at least four additional lean to/outhouses on the exterior of the structure is considered appropriate compensation.
- 2.3.14. Additionally, ten low conservation value or low/moderate suitability crevice dwelling bat roosts will be lost or disturbed in this quadrant (BU_507, BU_610, BU_638, BU_723, BU_735, predicted loss of two roosts and predicted permanent disturbance of one roost, as well as a further two being temporarily disturbed (BU_614 and predicted temporary disturbance of one other roost)). These will be replaced with a minimum of ten crevice dwelling bat features within the structure in the eastern quadrant.
- 2.3.15. Finally, the potential temporary disturbance of a hibernation roost for larger numbers of bats has been compensated for with a cool tower that can provide hibernation habitat for large numbers of bats. This is considered to be an overall site enhancement.
- 2.3.16. The location has been selected because it is within a dark corridor along the A4019, to ensure that bats, specifically light averse species such as lesser horseshoe, are able to access the structure freely (see Appendix A for the locations of the dark corridors). This structure is located within the adjacent North-West Cheltenham Development Area (Elms Park). Careful consideration has been given to integrating this structure with this future development, and the location of the compensatory bat roost structure is adjacent to a retained hedgerow and within a dark corridor, as identified on the Elms Park masterplan. Landscape planting design includes a minimum of three large trees between the structure and the A4019 to provide a buffer from traffic. This position will ensure that the structure is not lit above 0.2 lux.
- 2.3.17. The Scheme includes commitment CEA2 within the Register of Environmental Actions and Commitments (REAC) (Application document TR010063 – App 7.4), which is intended to secure the continued efficacy and realise long term benefits of the Scheme environmental design in the context of strategic development sites, which include the North West Cheltenham Development Area, specifically to manage inter-project effects.
- 2.3.18. The detailed design of the compensatory structures will be undertaken post-planning, to inform the final bat licence application, but will be based on the design parameters set out in Table 2-1 below.

Table 2-1 Compensatory Roost Requirements (Eastern Quadrant)

	Eastern Quadrant Specifications	Reason for Requirement
General construction	The building will include a pitched roof with two gable walls. A fly through access point suitable for horseshoe bats (approximately 40 cm wide by 30 cm tall) will be incorporated into one of the gable walls.	To allow access for lesser horseshoe. Only one access is permitted to ensure that it does not become draughty, and unsuitable for horseshoe bats.
	Secure door on the structure.	To allow future access but to deter trespassing.
	The structure will contain at least one un-insulated cavity wall that is accessible from the top of the wall.	To support crevice dwelling bat species such as pipistrelle bats.
	A chimney will be included in the design.	This will allow additional access for horseshoe bats, as the exact access points for BU_611 and BU_694 were unknown.
	Any roof lining must be Type 1F bitumastic felt.	General requirements to support roosting bats.
Internal	The size of the ground floor and roof voids will	To mimic the habitat within BU_611 and BU_694 (lesser horseshoe

	Eastern Quadrant Specifications	Reason for Requirement
ground floor and roof voids	each be at least 3 m by 5 m. The roof will be lined with wooden sarking internally and will be of an 'open construction', to allow bats to fly freely within the voids. A wooden ridge board will be present in the roof void and wooden boards will be fixed to the ceiling within the ground floor void to allow bats to hang on to.	day/feeding/night roosts to be lost). As compensation for the predicted loss of two low/moderate suitability roosts for void dwelling/light sampling bats.
	Apex height within the roof void and the ceiling height will be at least 2.8 m each (Bat Mitigation Guidelines ³)	To support other bat species such as brown long-eared bats, following best practice guidelines.
	Internal timbers will be rough sawn.	To allow bats to easily grip
	No loft hatch will be present to allow access between all floors, however an open fly through will be present 0.75 m by 0.75 m (to allow future ladder access)	To mimic BU_694
	Insulated ceiling, with purlins (or false purlins)	To allow horseshoes to hang freely in these areas
Lean-to / outhouse	A minimum of three lean-to structures will be constructed. This will provide at least three 1 m by 2 m, by 2.5 m high compartments (likened to outhouses). These will be open access for lesser horseshoe bats but discourage trespassers (an example would be a locked half door, with a metal grate above). Additionally, at least one large lean-to will be attached to the structure (at least the length of the structure and 5 m in width). All of these lean-to / outhouses will have internal roosting features for crevice and void dwelling bats species.	To mimic BU_507, BU_709 and BU_819 (lesser horseshoe day/feeding/transitional roosts to be lost). To mimic BU_723 (Natterer's and common pipistrelle day/feeding/night roost to be temporarily disturbed).
Crevice dwelling features	At least ten points approximately 20 mm high by 50 mm wide each leading to a crevice at between 20 mm and 50 mm deep. All access points will be a minimum of 2 m from ground level.	To provide crevice roosting features as compensation for: Loss of BU_507 and BU_610 (common and soprano pipistrelle day roosts). Temporary disturbance of BU_638, BU_723 and BU_735 (common pipistrelle day roosts). The predicted loss of two and predicted permanent disturbance of one low/moderate suitability roost for crevice dwelling bats. Temporary disturbance of BU_614 (soprano pipistrelle day roost). The predicted temporary disturbance of one low/moderate

³ Mitchell-Janes, A (2004) Bat Mitigation Guidelines. English Nature.

	Eastern Quadrant Specifications	Reason for Requirement
		suitability roost for crevice dwelling bats.
Cool tower	<p>Earth floor, made from breeze block (or similar), within the centre, or toward the north of the structure (no light should be able to penetrate the cool tower walls).</p> <p>This will be sealed with the exception of one access point that is 0.75 m wide by 0.5 m high. The structure will be approximately 2 m wide and 2 m in length, and at least 2 m tall.</p> <p>It will have rough sawn timber internally for hanging bats as well as at least five crevices for roosting bats.</p>	To provide hibernation features for large numbers of bats as compensation for the predicted temporary disturbance of a hibernation roost for larger numbers of bats.

Southern quadrant

- 2.3.19. One structure will be created as embedded mitigation south of the A4019 east of Junction 10 in the southern quadrant. This structure will provide compensatory roosting opportunities to replace a series of features supporting different species, which are described below.
- 2.3.20. Within the southern quadrant, there will be predicted loss of one void dwelling maternity bat roosts. In addition, there will be loss of a low conservation value void dwelling bat roost (BU_965, a brown long-eared day roost) and predicted loss of two low/moderate suitability roosts for void dwelling/light sampling bats. There will also be temporary disturbance of a low conservation value void dwelling bat roost (BU_378, a brown long-eared day roost) and predicted temporary disturbance of one high suitability (potentially maternity) horseshoe bat roost. These roosts can be adequately compensated for with the voids within the compensatory roost structure (based on the structure providing a void within the ground floor, one void in the roof void and four lean-to/outhouses all providing suitable features for lesser horseshoes/void dwelling and light sampling bat species).
- 2.3.21. Two assumed (on a precautionary basis only) maternity crevice dwelling roosts (BU_1030 and BU_987) will be lost and these will be compensated for with two crevice features suitable for maternity. Additionally, 17 low conservation value or low/moderate suitability bat roosts will be lost or permanently disturbed in this quadrant (BU_1039, BU_965, BU_1042, BU_987, BU_653, predicted loss of three roosts and predicted permanent disturbance of two roosts), as well as a further seven being temporarily disturbed (BU_376, Tree 86, BU_370, BU_378, BU_834 and predicted temporary disturbance of two roosts). These will be replaced with a minimum of 17 crevice dwelling bat features.
- 2.3.22. The potential loss of a hibernation roost for larger numbers of bats has been compensated for with a cool tower that can provide hibernation habitat for large numbers of bats.
- 2.3.23. The flood storage area will be transformed into an area supporting wetland habitats surrounded by woodland, scrub and species-rich grassland. The area will incorporate a permanently wet area, plus ephemeral wet grassland pools. The flood storage area will provide optimal habitat for foraging bats and also incorporates the Withybridge (A4019) Underpass (see Section 2.4.24 below) which will allow bats to safely cross the A4019.
- 2.3.24. The detailed design of the compensatory structures will be undertaken post-planning, to inform the final bat licence application, but will be based on the design parameters set out in Table 2-2 below, which have been agreed with Natural England.

Table 2-2 Compensatory Roost Requirements (Southern Quadrant)

	Southern Quadrant Specifications	Reason for Requirement
General construction	The building will include a pitched roof with two gable walls. A fly through access point suitable for horseshoe bats (approximately 40 cm wide by 30 cm tall) will be incorporated into one of the gable walls.	To allow access for lesser horseshoe. Only one access is permitted to ensure that it does not become draughty, and unsuitable for horseshoe bats.
	Secure door on the structure.	To allow future access but to deter trespassing.
	The structure will contain at least one un-insulated cavity wall that is accessible from the top of the wall.	To support crevice dwelling bat species such as pipistrelle bats.
	A chimney will be included in the design.	This will allow additional access for horseshoe bats
	Any roof lining must be Type 1F bitumastic felt.	General requirements to support roosting bats.
Internal ground floor and roof voids	The size of the ground floor and roof voids will be at least 3 m by 5 m each. The roof will be lined with wooden sarking internally and will be of an 'open construction', to allow bats to fly freely within the void. A wooden ridge board will be present in the roof void and wooden boards will be fixed to the ceiling within the ground floor void to allow bats to hang on to.	To provide roosting / light sampling opportunities for lesser horseshoe and void dwelling bats as compensation for: Predicted temporary disturbance of one high suitability (potentially maternity) horseshoe roost. Predicted loss of one high suitability (potentially maternity) roost for void dwelling/light sampling bats.
	Apex height within the roof void and the ceiling height will be at least 2.8 m (Bat Mitigation Guidelines ⁴)	To support other bat species such as brown long-eared bats, following best practice guidelines.
	Internal timbers will be rough sawn.	To allow bats to easily grip.
	No loft hatch will be present to allow access between all floors, however an open fly through will be present 0.75 m by 0.75 m (to allow future ladder access)	To allow bats easy access throughout the different habitats within the structure.
	Insulated ceiling, with purlins (or false purlins)	To allow horseshoes to hang freely in these areas.
	Lean-to / outhouse	A minimum of three lean-to structures will be constructed. This will provide at least three 1 m by 2 m, by 2.5 m high compartments (likened to outhouses). These will be open access for lesser horseshoe bats but discourage trespassers (an example would be a locked half door, with a metal grate above). Additionally, at least one large lean-to will be attached to the structure (at least the length of the structure and 5 m in width).

⁴ Mitchell-Janes, A (2004) Bat Mitigation Guidelines. English Nature.

	Southern Quadrant Specifications	Reason for Requirement
	All of these lean-to / outhouses will have internal roosting features for crevice and void dwelling bats species.	
Crevice dwelling features	<p>At least 17 points approximately 20mm high by 50mm wide each leading to a crevice at between 20mm and 50mm deep.</p> <p>All access points will be a minimum of 2m from ground level.</p>	<p>To provide crevice roosting features as compensation for:</p> <p>Loss of BU_1039 and BU_965 (common pipistrelle day roosts).</p> <p>Loss of BU_1042 and BU_987 (soprano pipistrelle day roosts).</p> <p>Loss of BU_653 (common or soprano pipistrelle day roost).</p> <p>The predicted loss of three and predicted permanent disturbance of two low/moderate suitability roosts for crevice dwelling bats.</p> <p>Temporary disturbance of BU_376 and BU_834 (common pipistrelle day roosts).</p> <p>Temporary disturbance of BU_378 (common pipistrelle night/feeding roost).</p> <p>Temporary disturbance of tree 86 (Natterer's day roost).</p> <p>Temporary disturbance of BU_370 (unknown species).</p> <p>The predicted temporary disturbance of two low/moderate suitability roosts for crevice dwelling bats.</p>
Crevice maternity dwelling features	<p>Two crevice dwelling maternity features, each with access points approximately 20 mm high by 50 mm wide each leading to a 50 mm deep and 1 m by 1 m cavity.</p> <p>These will be on a south or south-eastern elevation / roof elevations (and able to receive direct sunlight, with no obstructions) and should be either made from a dark material (i.e. slate) or should be painted black to retain early summer warmth.</p> <p>The access points will be a minimum of 2 m from ground level.</p>	<p>To provide crevice roosting maternity features as compensation for:</p> <p>Loss of BU_1030 (common pipistrelle maternity roost) and BU_987 (soprano pipistrelle assumed maternity roost).</p>
Cool tower	<p>Earth floor, made from breeze block (or similar), within the centre, or toward the north of the structure (no light should be able to penetrate the cool tower walls).</p> <p>This will be sealed with the exception of one access point that is 0.75 m wide by 0.5 m high. The structure will be approximately 2 m wide and 2 m in length, and at least 2 m tall.</p> <p>It will have rough sawn timber internally for hanging bats as well as at least five crevices for roosting bats.</p>	<p>To provide hibernation features for large numbers of bats as compensation for the predicted loss of a hibernation roost for larger numbers of bats.</p>

Horseshoe night roosts

- 2.3.25. It is predicted that two low/moderate suitability lesser horseshoe bat roosts in the eastern quadrant will be lost as a result of the Scheme (within unsurveyed/partially surveyed structures). In the southern quadrant it is predicted that one low/moderate suitability lesser horseshoe bat roost will be lost, one low/moderate suitability lesser horseshoe bat roost will be permanently disturbed and one low/moderate suitability lesser horseshoe bat roost will be temporarily disturbed.
- 2.3.26. It is proposed that these roosts can be compensated for adequately with five horseshoe bat night roosts, two in the eastern quadrant and three in the southern quadrant.
- 2.3.27. The detailed design of the horseshoe night roosts will be undertaken post-planning, to inform the final bat licence application, but will be based on the design parameters set out in Table 2-3 below, which are based on providing features suitable for small numbers of horseshoe bats and follow designs from the Vincent Wildlife Trust⁵ and the lesser horseshoe bat night roosts in the Forest of Dean⁶. Photographs of these designs are included in Appendix B. The precise locations of the horseshoe night roosts will also be agreed post-planning.

Table 2-3 Compensatory Horseshoe Night Roost - Roost Requirements

	Features	Reason for Requirement
General construction	Permanent structure	To ensure permanent roosting features
	Bat access to be at least 0.75 m wide by 0.5 m high, located a minimum of 1 m from ground level	To provide sufficient access for horseshoe bats
	The internal void must be at least 1.2 m wide and at least 2.2 m ³	To provide a sufficient void for horseshoe bats
	The roost must be protected from a one in five year flood event	General requirements to support roosting bats in perpetuity
	There must be an internal ridge board or at least similar for bats to hang from within the void	To ensure sufficient roosting features for hanging bats

Crevice dwelling bat roost structures

- 2.3.28. Three crevice dwelling bat roost structures are proposed in the northern quadrant. In this quadrant, two high suitability (potentially maternity) roosts for crevice dwelling bats are predicted to be lost. In addition, 12 high suitability (potentially maternity) tree roosts for crevice dwelling bats are predicted to be temporarily disturbed, although this is an extremely precautionary approach⁷. As all of these high suitability bat roosts are predictions only, and these are extremely precautionary, it is considered that the favorable conservation status of these crevice dwelling bats will be maintained with provision of three maternity roosts as compensation.
- 2.3.29. All of the other roosts to be affected within the northern quadrant are low/moderate conservation value or low/moderate suitability roosts of crevice dwelling species (loss of a common pipistrelle day roost in BU_972, loss of a soprano pipistrelle day roost and a common pipistrelle day roost in BU_981, predicted loss of three roosts (one in a tree and two in structures), predicted permanent disturbance of one roost, predicted temporary disturbance of two roosts), and the compensatory features will provide at least 30 crevice bat roosting features across the three structures.

⁵ <https://www.vwt.org.uk/downloads/lesser-horseshoe-night-roost-design/>

⁶ Lesser Horseshoe Bat Night Roosts - Forest of Dean - Bat Conservation Trust (bats.org.uk)

⁷ Assuming that all trees that have not been surveyed in full have bat roosts to the value of the roosting suitability. For example, trees with high suitability for bats, that have not been surveyed in full, have been assumed to be maternity (high conservation value) bat roosts.

- 2.3.30. Two crevice dwelling bat roost structures are proposed in the southern quadrant. In this quadrant, two high suitability (potentially maternity) roosts are predicted to be lost and one high suitability (potentially maternity) tree roost is predicted to be temporarily disturbed, although this is extremely precautionary as described above. As all of these roosts are predictions only, and as these are precautionary numbers, it is considered that the favorable conservation status of these crevice dwelling bats will be maintained with two compensatory maternity roosts.
- 2.3.31. All of the other roosts to be affected within the southern quadrant are low/moderate suitability roosts of crevice dwelling species (predicted loss of seven tree roosts and predicted temporary disturbance of ten tree roosts) and are predicted bat roosts only. It is considered that the favorable conservation status of crevice dwelling bats will be maintained with the provision of at least 20 crevice bat roosting features across two structures.
- 2.3.32. The detailed design of the crevice dwelling bat roost structures will be undertaken post-planning, to inform the final bat licence application, but will be based on the design parameters set out in Table 2-4 below, which follow a similar design to the bat tower at Ravenglass Railway in Cumbria⁸. Photographs of this design is included in Appendix B. The precise locations of the crevice dwelling bat roost structures will also be agreed post-planning.

Table 2-4 Compensatory Crevice Dwelling Bat Roost Structure- Roost Requirements

	Features	Reason for Requirement
General construction	Permanent structure at least 1.5 m by 1.5 m and at least 3 m tall (to the apex)	To ensure permanent roosting features
	At least ten access points approximately 20 mm high by 50 mm wide each leading to a crevice at between 20 mm and 50 mm deep. All access points should be a minimum of 2 m from ground level.	To provide at least ten roosting features for roosting bats per structure
	At least one access point approximately 20 mm high by 50 mm wide each leading to a crevice 50 mm deep that is approximately 1 m by 1 m (to allow for a large number of bats to congregate). This will be on a south or south-eastern elevation (and able to receive direct sunlight, with no obstructions) and will be either made from a dark material (i.e. slate) or painted black. All access points will be a minimum of 2 m from ground level.	To provide at least one roosting feature per structure for a maternity roost. Dark materials/ black paint will attract heat and ensure the feature is warmed for a maternity colony
	The roost will be protected (with height of void) from one in five year floods	General requirements to support roosting bats in perpetuity
	Internal crevices will be made from rough saw materials that allow bats to grip within the roost	To ensure sufficient roosting features within the structure for crevice dwelling bats
	The structure will include a pitched roof, that is tiled	To mimic roof roosting features

⁸ <https://www.bats.org.uk/our-work/buildings-planning-and-development/roost-replacement-and-enhancement/case-studies/bat-tower-at-ravenglass-railway-cumbria>

Tree roosting feature

- 2.3.33. Tree roosting features will be created from sectionally felled trees that would be lost as a result of the Scheme, where they have high potential/confirmed roost features. The tree limb with bat roost features will be strapped onto a retained tree to preserve the roosting features in the locality. An example is shown in Figure 2-1 below.



Figure 2-1 Example of a tree roosting feature

- 2.3.34. Four tree roosting features will be created as follows:
- One feature will be created in the northern quadrant to compensate for loss of tree 496, a barbastelle transitional roost.
 - One feature will be created in the eastern quadrant to compensate for loss of BU_610, a noctule day roost.
 - Two features will be created in the western quadrant to compensate for temporary disturbance of trees 576 and 578, both noctule day roosts.
- 2.3.35. Further opportunities for creation of tree roosting features will be explored on site.

Artificial bat boxes

- 2.3.36. Sixteen artificial bat boxes are proposed as follows:
- In the northern quadrant – one maternity bat box to compensate for the predicted temporary disturbance of one maternity roost for crevice dwelling bats; five bat boxes to compensate for the loss of BU_1039 (an unknown species day roost), loss of BU_963 (a soprano pipistrelle day roost), and temporary disturbance of BU_1034 (a common pipistrelle day and mating roost and a soprano pipistrelle mating roost).
 - In the eastern quadrant - three hibernation bat boxes to compensate for the predicted loss of two hibernation roosts for low numbers of bats and temporary disturbance of BU_638 (a common pipistrelle hibernation roost).
 - In the southern quadrant – five hibernation bat boxes to compensate for the predicted loss of one hibernation roost for low numbers of bats; predicted permanent disturbance of one hibernation roost for low numbers of bats; predicted temporary disturbance of one hibernation roost for low numbers of bats;

predicted permanent disturbance of one low/moderate conservation significance roost for void dwelling/light sampling bats; and temporary disturbance of BU_378 (a brown long-eared hibernation roost). One maternity bat box to compensate for the predicted loss of one maternity roost for crevice dwelling bats.

- In the western quadrant – one bat box to compensate for the predicted temporary disturbance of one low/moderate suitability roost for crevice dwelling bats.

2.3.37. Bat boxes will be made up of the following bat boxes (or similar):

- Large multi chamber Woodstone bat box.
- 2F Schwegler bat box.
- 1FF Schwegler bat box with built-in panel.
- 1WQ Schwegler summer bat roost (maternity bat box).
- Causa maternity bat box (maternity bat box).
- 1FW bat hibernation box (hibernation).

2.3.38. All will be located at least 3 m from ground level, and a bird box will be mounted in a similar location to avoid the bat boxes being used by birds. Exact location of the bat boxes will be agreed during detailed design.

2.4. Measures to avoid/reduce impacts of habitat fragmentation and loss of foraging and commuting habitat

Lighting

2.4.1. Lighting is proposed along both sides of the A4019 from the Gallagher Retail Park (the eastern extent of the Scheme) to Junction 10 but incorporates two dark corridors to the east and west of Uckington as shown in Appendix A. This includes a 92 m section to the east of Uckington extending east to the West Cheltenham Fire Station, and a 150 m section west of Uckington extending west to Cooks Lane. The section to the east of Uckington will align with the compensatory bat roost structure within the eastern quadrant and the dark corridor proposed as part of the North West Cheltenham Development Area and two bat 'hop-overs.' The section to the west of Uckington will align with another bat 'hop-over.' Hop-overs are described below.

2.4.2. The proposed speed limit largely remains the same as the existing speed limit on the A4019, although it is proposed to decrease from 50 mph to 40 mph from just west of Uckington and continuing towards the east (application document TR010063 – APP 6.2 section 2.5.53). The reduction in speed limit has allowed for the luminaires to be reduced from 15 lux to 10 lux.

2.4.3. The northern and southern Link Road junctions will be lit, as well as Junction 10 itself, but the Link Road and the M5 corridor will not be lit. The lighting comprises 12 m tall luminaires which will be 10 lux, and louvers will be installed on each luminaire to reduce back spill.

2.4.4. Due to the species of bats confirmed around the Scheme, including a number of those considered to be light averse such as *Myotis* sp, brown long-eared and horseshoe bats, light spill from street lighting on all commuting and foraging habitat will be less than 0.2 lux⁹, wherever possible. This has been achieved in the majority of locations. The exception is along the A4019, which is discussed in the paragraphs below.

2.4.5. Lux levels are predicted to be greater than 0.2 lux along hedgerows parallel to the A4019. However, within the lighting model it is not possible to account for the impact of barriers such as vegetation or bespoke back guards on the light spill and therefore the hedgerows may be lit to 0.2 lux or lower but it is not possible to know this until

⁹ Bats and artificial lighting in the UK: Guidance Note 08/18. Bat Conservation Trust and the Institution of Lighting Professionals. 2018

construction. If required, lux levels could be reduced further by taller hedgerows at the detailed design stage to provide a wider dark corridor for commuting bats.

- 2.4.6. Along the stretch of the A4019 east of the Fire Station, leading into Cheltenham, the predicted lux levels show that the planting adjacent to the road will be lit to 10 lux as the hedgerow is very close to the carriageway here. Therefore, it is unlikely that even with mitigation measures the lux levels at this hedgerow could be sufficiently reduced to be suitable for light averse bat species. This stretch is currently utilised by low numbers of bats likely associated with roosts supporting low numbers of bats along the A4019 here on the northern side of the road. However, these roosts will be lost as a result of the Scheme, and the compensatory bat roost structure will be located just to the west within a dark corridor that connects to suitable unlit habitat within the wider area. This stretch of the A4019 will therefore become even less important to bats that it currently is, and alternative commuting routes via hedgerows north of the A4019 and gardens south of the A4019 will remain unaffected by the Scheme.
- 2.4.7. Taking into account the lighting design for the Scheme which includes numerous areas that will remain unlit, the reduced light spill in lit areas, the dark corridors along the A4019 which align with hop-overs and dark corridors in the wider landscape, as well as the Withybridge (A4019) Underpass (discussed below) bats will be able to safely cross the A4019 and commute throughout the Scheme area and the wider landscape.
- 2.4.8. Analysis of the predicted lux levels has shown that all identified roosts (including those retained and protected and those at risk of temporary or permanent disturbance) will experience lighting below 0.2 lux as a result of the lighting design. Therefore, there is negligible risk of roost abandonment as a result of increased light levels and no additional mitigation is required.

Landscape Planting

- 2.4.9. Existing vegetation will be retained as far as possible. In particular, within areas of land temporarily required for topsoil storage or compounds, boundary features such as hedgerows will be retained. Any retained vegetation will be clearly demarcated with no allowance of vehicles or storage of materials within these areas. The root zones and canopies of trees and areas of woodland to be retained will be protected during construction.
- 2.4.10. The landscape design includes an area of farmland to the south east of the motorway junction (referred to as the flood storage area) which will be transformed into an area supporting wetland habitats surrounded by woodland, scrub and species-rich grassland, whilst also fulfilling its role as a flood storage area. The area will incorporate a permanently wet area, plus ephemeral wet grassland pools. The embankments along the Link Road will be planted with blocks of woodland and hedgerows with trees. The A4019 planting comprises hedgerows and trees to the north and south, as well as trees within the central reserve and areas of species rich grassland. The focus of the planting around the junction itself and along the motorway is blocks of woodland and linear belts of trees and shrubs, along with areas of species rich grassland. Attenuation basins and ditches will be sown with wet grassland and marginal planting.
- 2.4.11. The habitat creation will result in a net increase in broadleaved woodland, hedgerow planting and the creation of species-rich grasslands, shrubs and scrub. These new habitats are likely to support an abundance of invertebrate prey providing foraging habitat for bats. The creation of strong linear planting features such as hedgerows, hedgerows with trees and woodland, will provide a network of habitat features to ensure that bats can move around the landscape.
- 2.4.12. During the construction phase there will be vegetation loss, particularly around the motorway junction and adjacent to the M5 just north of the River Chelt culvert, which could affect bats' ability to commute and forage in those areas.
- 2.4.13. Vegetation removal during reprofiling of the motorway embankments along the M5, north of the River Chelt, will result in the temporary loss of a key bat commuting feature. There will be no alternative route, so mitigation will be provided to ensure a continuous feature from the retained woodland vegetation west of the flood storage area leading

south to the River Chelt on the eastern side of the M5, and the equivalent on the western side of the M5. Mitigation would be in the form of temporary linear flight paths whilst the planted vegetation establishes. This could be the installation of Heras fencing panels with hessian attached, wind-break fencing, noise fencing, palisade fencing or dead hedging. This will be determined during detailed design.

- 2.4.14. The River Chelt has been identified as a key commuting route for bats. There will be permanent localised channel shading and loss of riparian habitat associated with earthworks for the construction of the Link Road bridge. However, bats will still be able to commute along the River Chelt as a result of the design of the Link Road bridge (as discussed below). There will also be temporary de-vegetation of the riparian zone in order to facilitate construction of the bridge structure. Temporary linear features will be included here to ensure that any vegetation clearance does not have a negative impact on commuting bats. Therefore, temporary Heras fencing panels with hessian attached, wind-break fencing, noise fencing, palisade fencing or dead hedging will be installed on at least one bank to provide shelter.

Hop-overs

- 2.4.15. Bat ‘hop-overs’ have been included within the landscape design at 11 strategic locations across the Scheme identified as bat crossing points. These comprise tall planting, and the aim is to encourage bats to cross the road at a greater height, and thereby reduce potential collisions with vehicles.
- 2.4.16. As recommended by Natural England, in correspondence dated 29 March 2022, hop-overs will be 6 m tall and include additional planting within the central reservation where feasible, to effectively create hop-overs over two lanes of traffic.
- 2.4.17. Hop-overs will be included along the A4019 and Link Road as follows (and shown in Appendix A):
- At the northern end of Withybridge Lane at the location of crossing point (CP) 8.
 - West of Uckington where a dark corridor will be implemented.
 - East of Uckington at CP6 where a dark corridor will be implemented.
 - West of the fire station along the A4019 at CP7 where a dark corridor will be implemented.
 - Along the Link Road including three north of the River Chelt and two south of the River Chelt.
 - One south of the Link Road, just west of the junction where the Link Road meets the B4634, at CP5.
 - One west of the M5 Junction 10 along Stanboro Lane at CP9.
- 2.4.18. The hop-overs at CP5 and at the northern end of Withybridge Lane will both be 6 m tall, but due to the requirements of the scheme to be lit at the Link Road junctions, both hop-overs will experience light levels between 5 and 10 lux. These hop-overs are therefore less suitable for light averse species of bat but will still be suitable for use by bats such as pipistrelles. At both of these locations, dark corridors are present nearby, just west of CP5 and within the Withybridge (A4019 underpass).

River Chelt Link Road bridge

- 2.4.19. The Link Road will cross the River Chelt, which is an identified key commuting and foraging corridor for bats.
- 2.4.20. The new bridge over the River Chelt was designed in line with Interim Advice Note (IAN) 116/08¹⁰, which although has been withdrawn, is still considered relevant in the absence of up-to-date guidance. It recommends the height specifications of the bridge to ensure that bats can continue to commute beneath it.

¹⁰ National Highways. Interim Advice Note 116/08: Nature Conservation Advice in Relation to Bats. 2008.

- 2.4.21. The River Chelt Link Road bridge will be a clear span structure with set-back abutments (approximately 4 m from the watercourse margin), thereby avoiding direct impacts to the in-channel and bank top habitats. At its lowest point the new bridge is 2.8 m high above the bank of the river (see Figure 2-2 below). This provides sufficient height and width for bats to continue to move safely along the watercourse unimpeded. The bridge will be unlit both from above and beneath the deck, thereby maintaining this dark corridor.
- 2.4.22. Linear planting parallel to the Link Road will direct bats to the River Chelt, where bats can cross safely beneath the clear span bridge structure. Alternatively, hop-over planting is provided in five locations along the Link Road, as described above.

Withybridge (A4019) Underpass

- 2.4.23. Bats including common pipistrelle, soprano pipistrelle, *Myotis* species and noctule were identified crossing the A4019 at the northern end of Withybridge Lane (CP8). Bats identified crossing at heights considered at risk of collision with vehicles included five *Myotis*, six common pipistrelle, one noctule and one soprano pipistrelle. Static bat detectors were deployed beneath the existing A4019 bridge over the M5, on both the east and west of the M5, with peak counts of four bats in a night on the western side and eight on the eastern side. This confirmed that bats are currently commuting beneath the deck of the A4019 bridge between the M5 carriageway and the bridge abutments. Species identified to be crossing here include *Myotis*, common pipistrelle, soprano pipistrelle, greater horseshoe bat and lesser horseshoe bat.
- 2.4.24. The Withybridge (A4019) Underpass will provide mitigation for bats that cross the existing A4019 to the east of the M5, providing a traffic-free route for bats across this road. In line with the IAN 116/08¹¹ the underpass will be 5 m wide and 4 m high to accommodate the species recorded at this location¹². The Withybridge (A4019) underpass will also provide traffic free access for pedestrians and equestrians across the A4019. Lighting will be provided through the underpass, with the lights switched off between sunset and sunrise.
- 2.4.25. The underpass will be constructed from two precast concrete U-sections to provide a clear opening of 4 m height and 5 m width, and with wingwalls and a headwall at either end, and a total length of 55 m. Physical measures will be in place to prevent vehicular access through the underpass.
- 2.4.26. Landscape planting has been designed to guide bats into the underpass and connect with suitable habitat to the north and south of the A4019. To the south, the underpass extends into the flood storage area which will provide optimum foraging habitat for bats. To the north, linear planting extends east and west along the A4019 and M5 embankments, and the underpass connects with a retained hedgerow that extends north.
- 2.4.27. The entrance of the Withybridge (A4019) Underpass and the landscape planting approaching it must not be more than 0.2 lux to ensure that it is suitable for light averse species of bat. This will be achieved by fitting a bespoke back guard on the luminaire columns adjacent to the underpass. Furthermore, an additional structure will be installed extending over the entrance of the underpass. Without these additional measures the lux levels at the approaches to the underpass are 5 lux. It is not possible to assess how much these measures will reduce the existing lux levels by, but based on advice from lighting specialists, it is considered likely that these measures would achieve 0.2 lux. Should 0.2 lux not be achieved, then additional measures will be implemented such as an alternative design to the bespoke back shield or fencing to shield the underpass entrance and approach. This design refinement process will be continued until 0.2 lux is achieved.

¹¹ National Highways. Interim Advice Note 116/08: Nature Conservation Advice in Relation to Bats. 2008.

¹² Nyctaloid were also recorded but generally fly at height, therefore it is likely that these bats passed over the Scheme at height and did not fly underneath the A4019. Furthermore, and partly as a result of this behaviour, Nyctaloid are not significantly affected by lighting. These bats are therefore not considered when determining the requirement for the underpass (Fure, A (2012) Bats and Lighting – six years on. The London Naturalist No. 85).

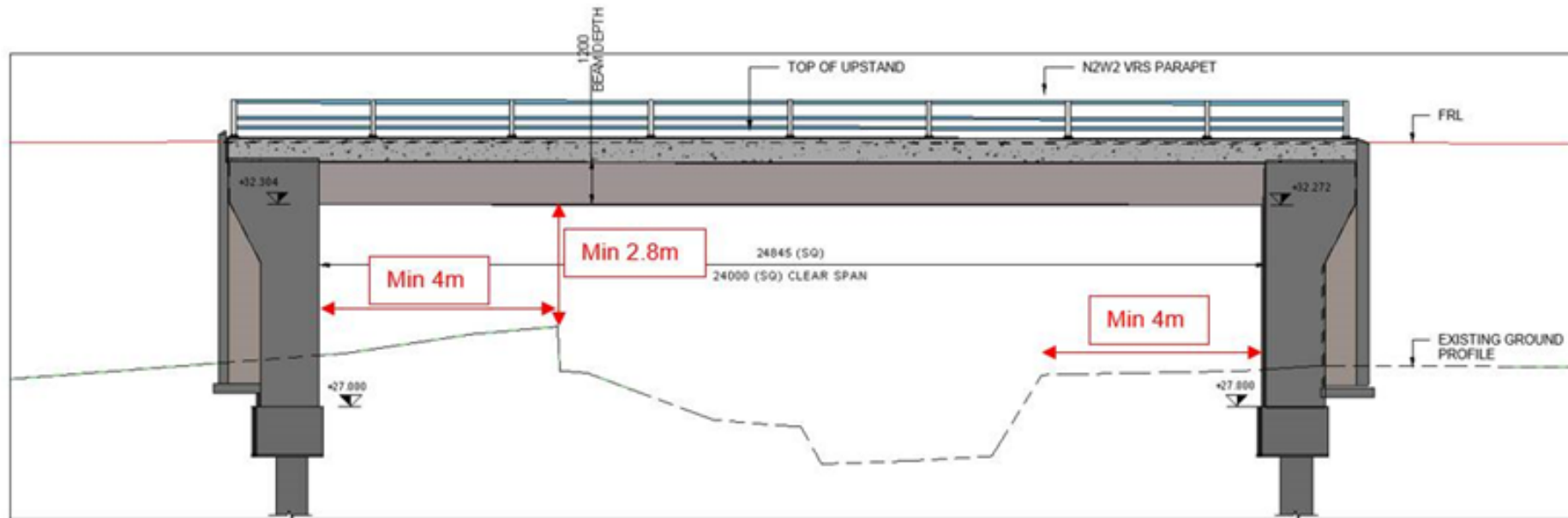


Figure 2-2 River Chelt bridge cross-section

2.5. Pre-construction surveys; mitigation to be implemented during construction; monitoring, management and maintenance

Pre-construction surveys

- 2.5.1. The level of survey appropriate to inform the final Natural England EPS mitigation licence for bats will be agreed with Natural England.

Mitigation to be implemented during construction

- 2.5.2. For all buildings with known roosts that will be demolished, a licenced bat ecologist will be present on site to oversee sensitive demolition and ensure that measures are taken to reduce the likelihood of injury or killing of bats.
- 2.5.3. All other buildings with features suitable to support roosting bats will be demolished under a precautionary method of working. An appropriately licenced Ecological Clerk of Works (ECoW) will oversee the sensitive demolition of the buildings which will include but is not limited to, the sensitive removal of roof and ridge tiles, removal of soffit boxes, as well as any other identified features that may be suitable to support roosting bats.
- 2.5.4. For all trees with known roosts to be felled, a pre-works endoscope survey will be undertaken by a licenced ecologist to ensure that bats are not present prior to felling. All felling works of trees with features suitable to support roosting bats will be carried out using soft-felling techniques.
- 2.5.5. It is recommended for all roosts that the demolition or felling works avoid the most sensitive periods of May to August (breeding) and December to February (hibernation). However, for confirmed hibernation roosts the demolition or felling must avoid the hibernation season (December to February), and for confirmed maternity roosts demolition or felling must avoid the breeding season (May to August).
- 2.5.6. Further detail is included in the draft Natural England EPS mitigation licence for bats, which will be refined for the final EPS mitigation licence.

Monitoring and maintenance

Compensatory bat roosts

- 2.5.7. In line with the bat mitigation guidelines¹³ and the draft Natural England EPS mitigation licence for bats, the monitoring in Table 2-5 below has been recommended. This may be refined in the final Natural England EPS mitigation licence for bats. All monitoring will be undertaken in line with current best practice guidelines.
- 2.5.8. All compensatory bat roosts will be located within land owned by GCC and will be maintained by the licence holder, GCC, in line with the Natural England EPS mitigation licence.
- 2.5.9. The objective of the bat roost monitoring surveys is to confirm use of the compensatory structures or bat boxes and confirm that the internal conditions of the compensatory structures are suitable, including temperature and humidity. Should conditions not be suitable, then remedial measures will be taken.
- 2.5.10. Results of the monitoring will be produced as monitoring reports to Natural England.

¹³ Mitchell-Jones, T. (2004) Bat mitigation guidelines. External Relations Team, English Nature.

Table 2-5 Proposed monitoring of compensatory bat roosts

Roost Type	Monitoring	Methodology
Tree roosting features	A single presence / absence survey undertaken in May to August no earlier than year 2 post development. A check of the condition and suitability of the roost.	Tree climbing survey using an endoscope to assess for suitability and to look for evidence of roosting bats.
Artificial bat boxes	A single presence / absence survey undertaken in May to August no earlier than year 2 post development. A check of the condition and suitability of the roost.	Inspected by the named ecologist or accredited agent using a ladder, high powered torch and an endoscope. Bats may be handled to confirm species.
Hibernation boxes	A single presence / absence survey that must not take place in the hibernation period to avoid waking bats out of torpor.	Inspected by the named ecologist or accredited agent using a ladder, high powered torch and an endoscope. Bats may be handled to confirm species.
Maternity bat boxes	A single presence / absence survey in the maternity period (June to August) in year 1 and year 2 post development.	An emergence or re-entry survey.
Compensatory bat roost structures (including horseshoe night roosts and crevice dwelling structures)	A single presence / absence survey in May to August no earlier than year 2 post development.	Internal inspection by the named ecologist or accredited agent using a high-powered torch, ladder and an endoscope A static bat detector deployed for at least two weeks between December and February in line with the hibernation surveys detailed within the Bat Conservation Trust (BCT) good practice survey guidelines ¹⁴ .

2.5.11. All bat boxes will be maintained for the period specified in the final Natural England EPS mitigation licence for bats. An annual maintenance check will be undertaken in March each year and should the bat boxes show evidence of degradation in this time the bat boxes will be replaced with a like-for-like bat box where possible.

2.5.12. The compensatory bat roost structures will be maintained for the period specified in the final Natural England EPS mitigation licence for bats. and have been designed for longevity of 50 to 100 years, in line with the likely lifespan of roosting features within a building. At each visit, the compensatory bat roost structures will be assessed for necessary maintenance and repair. This could include repairing any damaged security features, the removal of vegetation such as climbing plants that may cause damage or blocking of bat access to features, as well as the replacement of roosting features if they have become unsuitable for use by bats.

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

Landscape Fragmentation

- 2.5.13. Crossing point surveys are recommended to ensure that the mitigation is successful. This will include continuing the methodology for the crossing point surveys as detailed within Section 3.5 of Technical Appendix 7.3 – Bat Survey (application document TR010063 – APP 6.15) and in line with the DEFRA methodology¹⁵.
- 2.5.14. It is recommended that crossing point monitoring surveys are undertaken at key locations, including:
- The River Chelt Link Road bridge.
 - The Withybridge (A4019) Underpass.
- 2.5.15. Other crossing point locations may be considered for additional surveys in agreement with Natural England.

Lighting

- 2.5.16. It is recommended that lux levels are measured in key locations to ensure that 0.2 lux is not exceeded in these areas. Key locations include:
- The entrances of the Withybridge (A4019) underpass.
 - Vegetation parallel to the A4019.
- 2.5.17. It is proposed to measure lux levels in year 1 and year 5 once vegetation is more established.
- 2.5.18. If lux levels are too high, then remedial mitigation will be implemented which may include additional bespoke back guards, further shielding, temporary fencing or taller hedgerows.

¹⁵ Berthinussen & Altringham (2015) Development of a cost-effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure. Defra contract report WC1060. University of Leeds, UK.

Appendices



Appendix A. Schedule of figures included in this application document

Figure reference	Document title	Sheet	Document number	Revision
7-15	Bat mitigation and compensation strategy	1 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000068	0
7-15	Bat mitigation and compensation strategy	2 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000068	0
7-15	Bat mitigation and compensation strategy	3 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000068	0
7-15	Bat mitigation and compensation strategy	4 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000068	0



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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION	
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)	
Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

LEGEND ORDER LIMITS: Red dashed line SCHEME ALIGNMENT: Black solid line ADJACENT MAP SHEETS: Dashed line COMPENSATORY BAT ROOST STRUCTURE: Purple shaded area BAT HOP-OVER LOCATIONS: Purple dot LIGHTING CONTOURS 0.2 LUX: Yellow line 0.5 LUX: Orange line 1 LUX: Red line 5 LUX: Red line 10 LUX: Red line BAT TREE ROOST IMPACT TREE ROOST IMPACT - RETAINED AND PROTECTED: Green circle TREE ROOST IMPACT - TEMPORARY DISTURBANCE: Yellow circle TREE ROOST IMPACT - LOST: Red circle BAT STRUCTURE ROOST IMPACT STRUCTURE ROOST IMPACT - RETAINED AND PROTECTED: Green square STRUCTURE ROOST IMPACT - TEMPORARY DISTURBANCE: Yellow square LANDSCAPE DESIGN LE 1.2: GRASSLAND WITH BULBS: Green pattern LE 1.3: SPECIES RICH GRASSLAND: Green pattern LE 2.1: WOODLAND: Green pattern LE 2.2: WOODLAND EDGE: Green pattern LE 2.4: LINEAR BELTS OF TREES AND SHRUBS: Green pattern LE 2.5: SHRUBS WITH INTERMITTENT TREES: Green pattern LE 2.6: SHRUBS: Green pattern LE 2.8: SCRUB: Green pattern LE 3.1: AMENITY TREES AND SHRUB PLANTING: Green pattern LE 5.1: INDIVIDUAL TREES: Green pattern LE 6.1: WATER BODIES & ASSOCIATED PLANTS: Blue pattern LE 6.2: BANKS AND DITCHES - SOWN WITH WET GRASSLAND: Blue pattern LE 6.4: WET GRASSLAND WITH MARGINAL PLANTING: Blue pattern LOWLAND MEADOWS: Green pattern EXISTING WATERCOURSES: Blue line RETAINED VEGETATION: Brown shaded area EXISTING DWELLING AND GARDEN TO BE RETAINED: Pink shaded area									
ATKINS Member of the SNC-Lavalin Group 5th Floor, Block 5 Shire Hall Bearland Gloucester GL1 2TH Tel: 08000 514 514 www.atkinsglobal.com					Gloucestershire COUNTY COUNCIL				
PROJECT INFORMATION Project Title: M5 Junction 10 Improvement Drawing Title: FIGURE 7-15A BAT MITIGATION & COMPENSATION STRATEGY Project: GCCM5J10 - ATK - EBD Ref: XX - GS - GI - 000068 Original Size: A3 Scale: 1:5,000 Project Ref: 5214106 Sheet: 1 of 4 Rev: P01									



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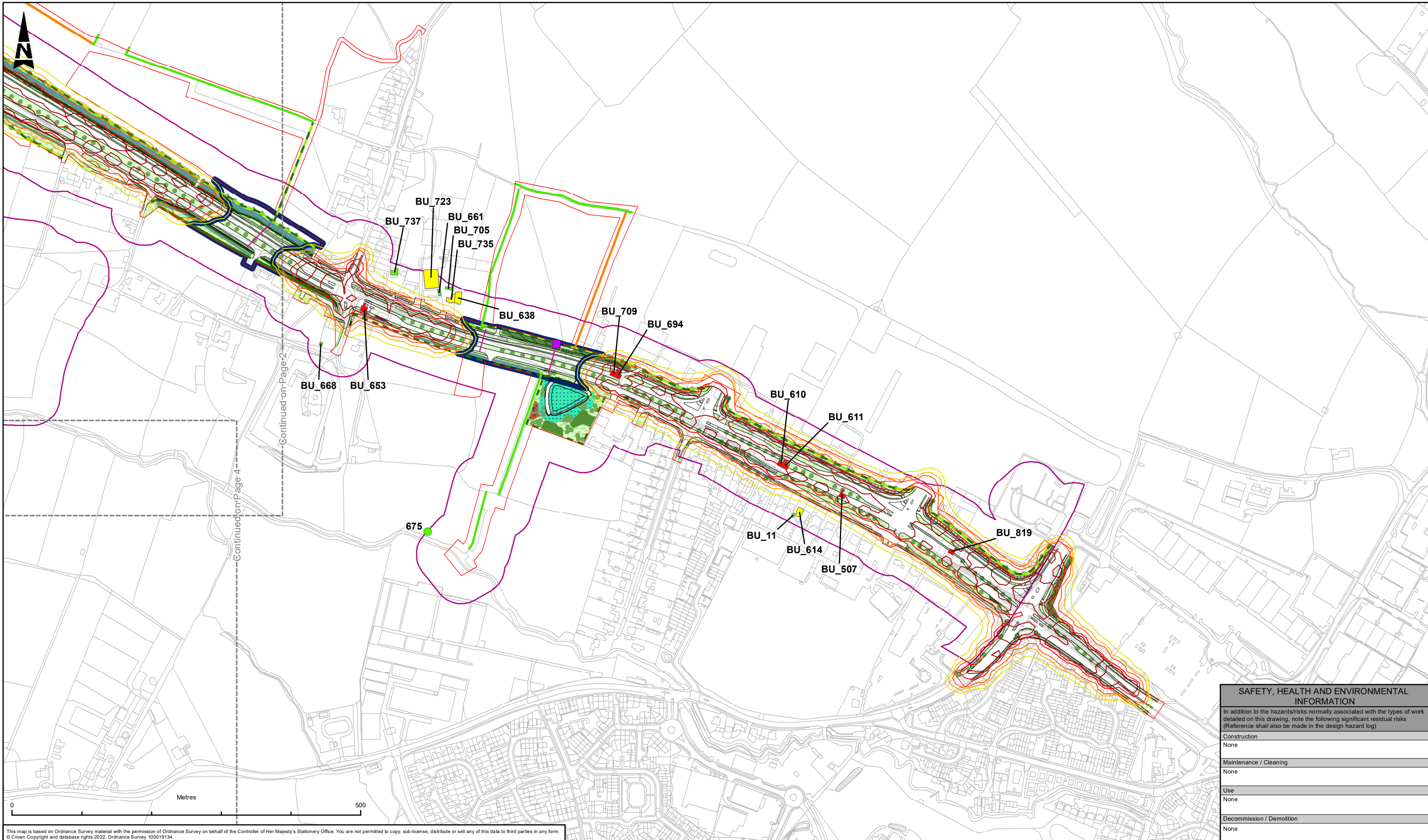
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Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

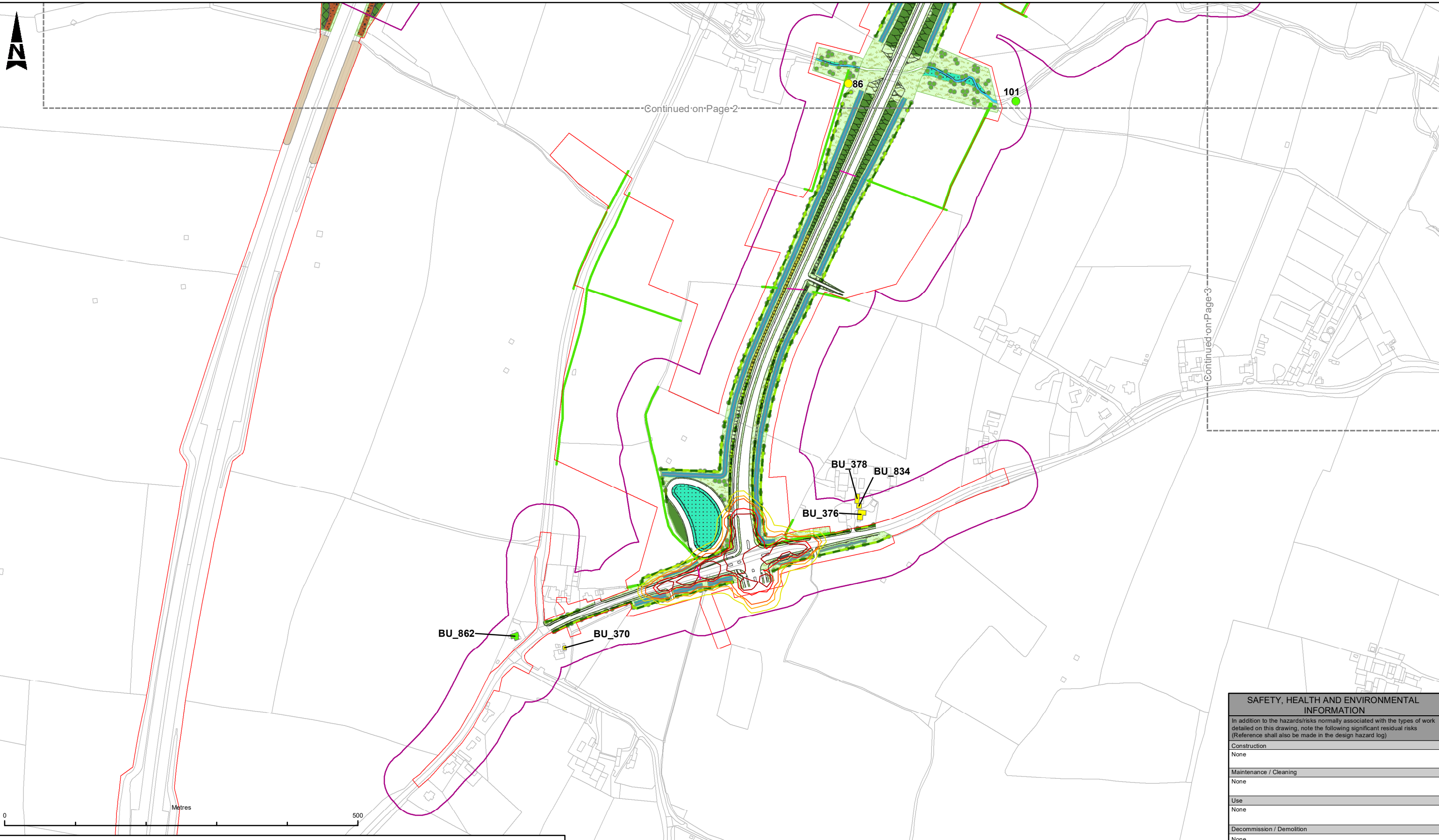
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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION	
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)	
Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

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PUBLISHED	A1	P01	EM	AM	JC	TT	25/08/23																						
Client Gloucestershire COUNTY COUNCIL										Project GCCM5J10 - ATK - EBD		Originator XX - GS - GI - 000068		Volume 3 of 4															
Original Size: A3										Scale: 1:5,000		Project Ref: 5214106		Sheet: 3 of 4		Rev: P01													



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LEGEND	
	ORDER LIMITS
	SCHEME ALIGNMENT
	ADJACENT MAP SHEETS
	COMPENSATORY BAT ROOST STRUCTURE
	BAT HOP-OVER LOCATIONS
	0.2 LUX
	0.5 LUX
	1 LUX
	5 LUX
	10 LUX
	DARK CORRIDORS
	ZONE OF INFLUENCE FOR BAT ROOST SURVEYS
	BAT TREE ROOST IMPACT
	TREE ROOST IMPACT - RETAINED AND PROTECTED
	TREE ROOST IMPACT - TEMPORARY DISTURBANCE
	TREE ROOST IMPACT - LOST
	BAT STRUCTURE ROOST IMPACT
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	LE 6.4: WET GRASSLAND WITH MARGINAL PLANTING
	LOWLAND MEADOWS
	EXISTING WATERCOURSES
	RETAINED VEGETATION
	EXISTING DWELLING AND GARDEN TO BE RETAINED

Description	Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
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Gloucestershire
 COUNTY COUNCIL

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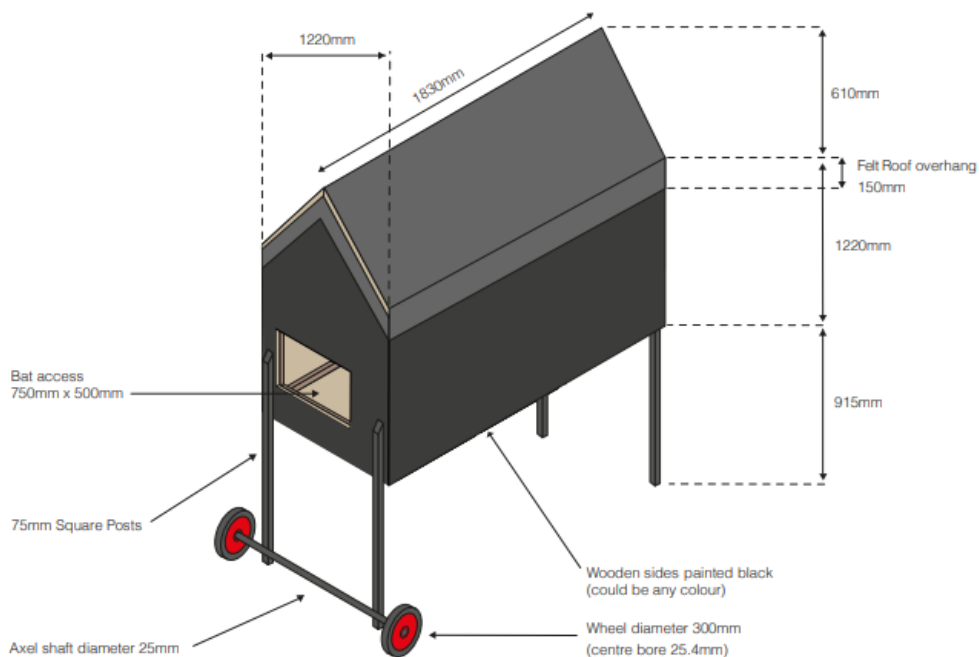
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Drawing Title		FIGURE 7-15A BAT MITIGATION & COMPENSATION STRATEGY	
Project	Originator	Volume	
GCCM5J10 - ATK - EBD	XX - GS - GI - 000068		
Location	Type	Role	Number
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Original Size:	Scale	Project Ref:	Sheet
A3	1:5,000	5214106	4 of 4
Rev:			P01

Appendix B. Compensatory bat roost structures – example designs

Example Lesser Horseshoe Night Roost Design¹⁶



Example Lesser Horseshoe Night Roost Design (Cathedrine Night Roost Design)¹⁷



¹⁶ Example take from the Bat Conservation Trust: Lesser Horseshoe Bat Night Roosts - Forest of Dean - Bat Conservation Trust (bats.org.uk)

¹⁷ Example take from the Bat Conservation Trust: Lesser Horseshoe Bat Night Roosts - Forest of Dean - Bat Conservation Trust (bats.org.uk)

Example Crevice Dwelling Bat Structure¹⁸



¹⁸ Example take from the Bat Conservation Trust: <https://www.bats.org.uk/our-work/buildings-planning-and-development/roost-replacement-and-enhancement/case-studies/bat-tower-at-ravenglass-railway-cumbria>

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