

Interim guidelines for the conservation management of urban grassland water voles

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1. Introduction

The urban populations of fossorial water voles living in grassland habitat (hereafter, grassland water voles) in Glasgow and North Lanarkshire are considered to be of national significance and are the focus of these guidelines. These populations are considered to be highly vulnerable to local extinction through habitat loss and fragmentation because of development. These guidelines have been produced to outline current best practice for the conservation management of grassland water voles in order to minimise impact from development and are relevant for planners, developers, ecological consultants and land managers.

This document summarises the most up to date information on the ecology and management of grassland water voles and is intended to be used in combination with existing information available from Scottish Natural Heritage, the Water Vole Mitigation Handbook and local authority planning policies (references are provided at the end of this document). Mitigation guidelines largely follow current best practice as outlined in the Water Vole Mitigation Handbook and have been adapted for grassland water voles where necessary.

These guidelines will be subject to review as further information is gathered and may be amended. The review will be carried out annually based on new information available including licence returns, records submitted to the Local Biological Record Centre and the annual Water Vole Knowledge Exchange event. It is envisaged that these guidelines and the review process will be incorporated into the Seven Lochs Water Vole Conservation Action Plan.

2. Legal protection for water voles

Water voles are protected by the Wildlife and Countryside Act 1981 (as amended). This protection is currently restricted to a water vole's place of shelter in Scotland. However, it should be noted that full protection to cover the animal is proposed.

It is an offence to intentionally or recklessly:

- damage, destroy or obstruct access to a water vole burrow and/or place of shelter
- disturb a water vole while it is occupying its burrow and/or place of shelter

3. Specific information for grassland water voles

3.1 Habitat preference

Grassland water voles favour neutral grasslands such as parks, road verges, gardens and vacant and derelict land characterised by long grass and low input management regimes. They can also be found in marshy grassland. They favour un-compacted soil in order to dig extensive burrow systems which can be shared by more than one adult water vole. Burrow systems have been

found to be shallow (5-60cm depth) and as such are easily damaged, although nest chambers can be found to a depth of 100cm. Glasgow and North Lanarkshire hold populations of both grassland and wetland water voles and the two are believed to interact to some degree. It is likely that water voles living in grasslands are afforded considerable protection from predation by American mink but they are vulnerable to predation from domestic pets, foxes and avian predators such as gulls and carrion crows. For more information: <https://academic.oup.com/iue/article/3/1/jux007/4097929>.

3.2 Grassland water vole distribution and wider meta-population

Grassland water vole distribution is well understood in the north-east of Glasgow but less well recorded in North Lanarkshire. Typically their distribution is widespread but limited to a highly fragmented network of grassland patches. It is believed the grassland water voles function as a meta-population i.e. the population is maintained by frequent dispersal between habitat patches. The average dispersal distance is 75m in open grassland but this distance is likely to be far less in heavily fragmented areas with roads and buildings. Successful dispersal is dependent on the distance between habitat patches and number of barriers encountered therefore suitable grassland habitat with connecting corridors between vole colonies must be retained and, where possible enhanced. The meta-population must be viewed as a functioning single unit to prevent isolation and ring-fencing of water vole colonies. Key sites and dispersal corridors will be identified in an upcoming spatial study by the University of Glasgow available by late 2019.

4. Development and water voles

As a Species of Principle Importance for Conservation water voles should be a key consideration for the Planning authority and developer and their presence on site must be taken into account at the earliest stages of planning. Any development or works **within 10m*** of a water vole burrow and/or place of shelter requires a site-specific licence from Scottish Natural Heritage before any works, including site investigations, can proceed. It can take up to 3 years from initial water vole surveys to starting work on site and it is essential to factor in adequate time to fulfilling licensing requirements.

There are a number of important factors that must be taken into account at the planning stage if works are likely to impact on grassland water voles:

- Grassland water voles should be retained within their current geographical distribution
- Grassland sites with key water vole colonies will not be suitable for development
- Key dispersal corridors of suitable habitat should be retained and/or created (minimum width 10m)
- The number of suitable grassland sites currently available as receptor sites is severely limited and within Glasgow is anticipated to reach full capacity in 2019. For relocation to proceed after this point in Glasgow, grassland habitat will need to be created to produce suitable receptor sites. These receptor sites should be within the grassland water voles current distribution
- Receptor sites should be an area of permanent grassland habitat which will not be subject to future development and agreed with the relevant land owner

*This may increase to 20m as we gather further information on the water vole burrow system.

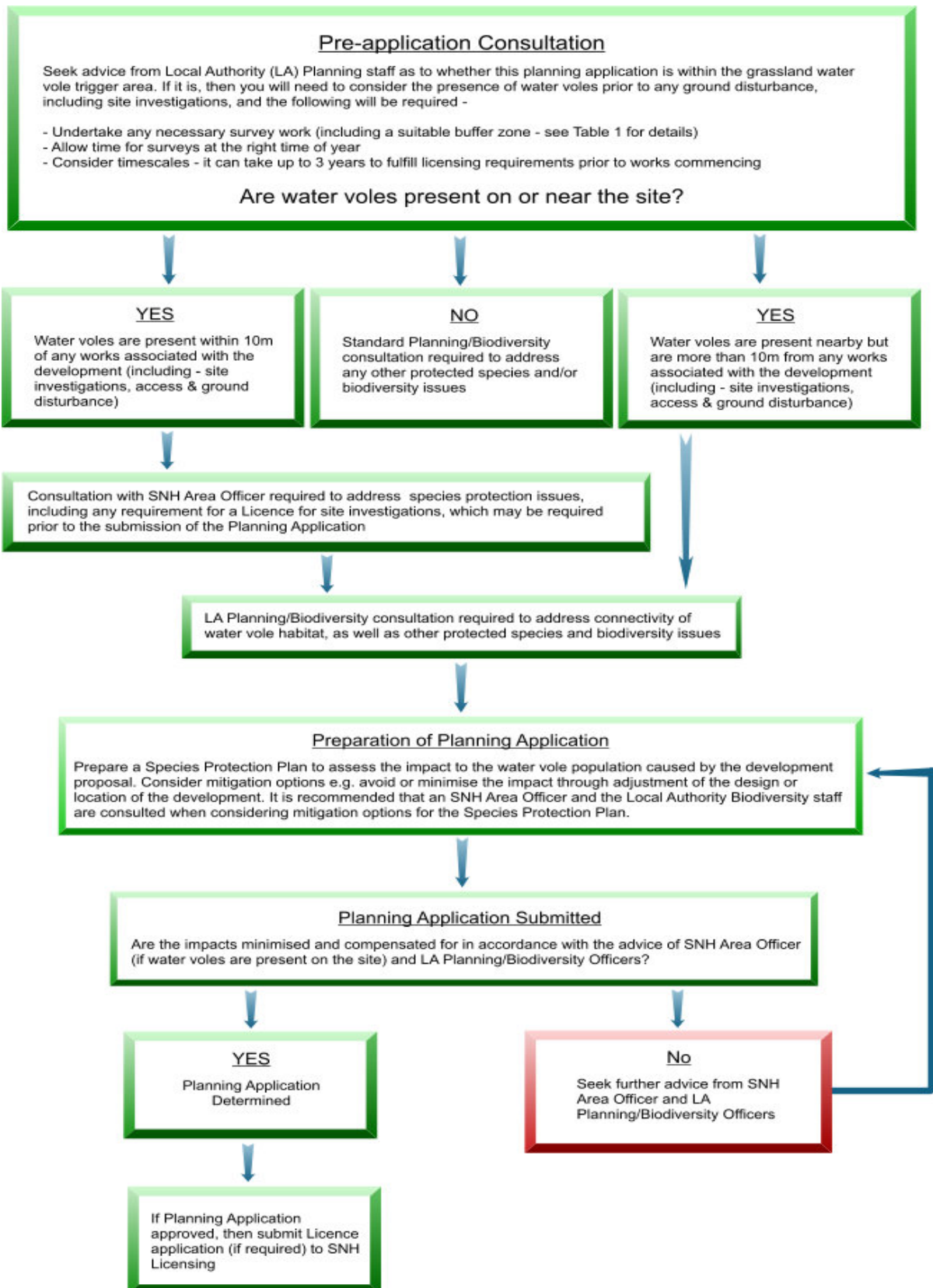


Fig 1: A summary of the steps in the planning process and the key consultation requirements for water voles impacted by development

4.1 Are grassland water voles present?

A precautionary approach is recommended when considering the likelihood of a grassland site being occupied by water voles within the Glasgow and North Lanarkshire area – water voles can occupy areas <5m² and it should be assumed that they are present even if there is only a small area of suitable water vole habitat within the development site.

Grassland water voles do not follow the linear distribution as typically seen in their riparian counterparts and as such a grassland site must be surveyed in its entirety. The scale of survey depends on the impact of the development:

Table 1: Size of development and survey requirements (recommended values adapted from The Water Vole Mitigation Handbook)

Size of impact	Surveys required	Desk Study
Small (<150m ²)	Footprint and 75m zone around development	2km
Medium (150m ² -5000m ²)	Footprint and 100-200m zone around development	2-5km
Large (>5000m ²)	Footprint and 200-500m zone around development	5km

The desk study should include gathering the most up to date records from the local Biological Records Centre (biological.records@glasgowlife.org.uk) and other water vole reports from the area. Satellite images can also be useful in identifying areas of suitable water vole habitat within the survey zone in order to focus survey efforts. Grassland water vole distribution is well recorded in Glasgow and available online as a [Trigger Map](#) which highlights their known current distribution with a buffer zone. More detailed maps highlighting key water vole sites and connectivity are being developed and should be available by the end of 2019.

4.2 Grassland water vole surveys

4.2.1 Time of year

Two surveys should be carried out to determine presence and assess population size. These should be carried out 2 months apart between April-Oct (May-June and July-Sep are the recommended survey periods). Field signs are mostly identical in wetland and grassland populations ([Appendix 1](#)) although there are notable exceptions i.e. soil mounds are more frequently encountered and a reduction in above-ground field signs in spells of dry weather. If surveying at an unfavourable time of year and burrows are encountered, it should be assumed water voles are present even if there are no obvious signs of activity as they may still be underground.

A licence is not required for surveys providing it is unlikely there will be any disturbance, damage or destruction of burrows/place of shelter.

4.2.2 Estimating water vole density

Estimating water vole density from above ground signs can prove difficult because of the high degree of seasonal variation in field signs. Research so far indicates a weak linear relationship between the number of field signs relative to the number of water voles (Table 2). Field signs are likely to show strong clustering rather than being evenly spread across a site therefore it is useful

to produce a map showing field sign density across the site as well as calculating the percentage of the total area of occupied water vole habitat. If calculating the exact number of water voles on site refer to Section 6.2.

Table 2: Estimating grassland water vole density from field signs

Grassland water vole density	Number of burrows entrances (open/blocked) per m²
High	>5
Medium	2-4
Low	1

4.2.3 Grassland water vole survey report requirements

The survey report must include:

- At least one map showing all field signs relative to the development proposal including all ground investigation work and access
- Water vole density estimates and calculation of percentage of site occupied by water voles
- Habitat information (e.g. Phase 1 Habitat survey) and an assessment of habitat quality (i.e. area, ground conditions, dominant vegetation and cover, connectivity to adjacent sites/proximity to dispersal corridors, predation and disturbance)
- Details of the experience levels of the surveyors relating to grassland water voles
- It would be helpful to pass on all records to the Biological Records Centre to keep information on water vole distribution as up to date as possible
- Survey reports will be considered valid up to one year old, although additional surveys may be required if there are any significant changes ie cessation of grass cutting.

4.3 Mitigation hierarchy

If water voles are present and impacts cannot be avoided a species protection plan (SPP) is required to be completed in conjunction with the SNH Works Affecting Water Vole licence application. The SPP should assess the level of impact of the proposed development on water vole and how it will be minimised through mitigation (Section 4.3.2). It is expected that planning permission will be secured prior to a licence application being submitted to SNH. A draft SPP can be submitted if still awaiting planning permission.

4.3.1 Species protection plan

It is strongly recommended to begin consultation with the relevant local authority and SNH Area Officer at this stage. The species protection plan must include:

- Information from the water vole survey report (Section 4.2.3) including maps showing water vole distribution across the site and population estimates
- Impact assessment – how will the development impact directly on the water voles on site and what are the implications of the site being developed for the metapopulation as a whole? Full consideration should be given to the impact of direct habitat loss, habitat fragmentation, reduction in meta-population connectivity, mortality risk,

deterioration in habitat quality/suitability, predation from mink/increased predation from domestic predators, as well as increased RTA due to new roads/increased traffic. Grassland water voles can exist at high densities in small areas therefore the area, population density and number of animals impacted must also be considered

- Mitigation measures to avoid or minimise impacts based on the mitigation hierarchy (Section 4.3.2)
- Timescales. It can take up to three years from initial surveys to work commencing on site e.g. can habitat be created in time?
- Summary of any residual impacts once mitigation measures have been taken into account and how licensing requirements will be fulfilled



Fig 2: Juvenile grassland water vole caught as part of a radio-tracking study in Glasgow. Coat colour varies across grassland populations with a mixture of black and brown individuals. (© Robyn Stewart)

4.3.2 Mitigation options

When considering mitigation options it is critical to consider reducing the impacts on grassland water voles at the earliest stage of planning. Designs which avoid or reduce the need for mitigation are the preferred and most cost-effective option. Key considerations at this stage should be identifying if the proposed site is a key water vole site or part of a connecting corridor – this must be determined by contacting the local authority or SNH Area Officer. All mitigation options require post-works monitoring (Section 10).

There are three main mitigation options (displacement is not recommended for grassland water voles):

1. Retaining water voles *in situ*

- This can be achieved by avoiding water vole habitat (include 10m buffer) by repositioning or redesigning development plans
- This option has the lowest impact on water voles and is the most cost-effective option
- Habitat corridors (minimum 10m width) should be created/retained to ensure connectivity to the wider meta-population

2. Relocating water voles on site (moving water voles ideally <100m)

- Water voles can be moved to an area of suitable habitat (existing or new) within the site by trapping and release

- The receptor area should be of an equivalent size (including an additional 10% to allow for expansion) and have clear grassland habitat corridors connecting it to the wider meta-population (minimum 10m width)
- The receptor site should be assessed for suitability, if it has any existing water voles and the number of additional animals it can support (Section 4.3.3)
- If creating new grassland habitat within the site then a timescale of 12-24 months should be factored in
- If the relocation results in water voles being in closer proximity to wetland habitat, the probability of mink predation should be assessed i.e. check records from the Local Biological Records Centre and implement mink monitoring/survey

3. Relocating water voles to a receptor site (moving water voles ideally <1km)

- Water voles can be relocated to a new receptor site within the wider meta-population (ideally within 1km of the development site) by trapping and release
- The receptor site should be of equivalent size to the donor site (including an additional 10% to allow for expansion) and have clear grassland habitat corridors connecting it to the wider meta-population
- The receptor site should be assessed for suitability, if it has any existing water voles and the number of additional animals it can support (Section 4.3.3)
- If creating new grassland habitat within the site then a timescale of 12-24 months should be factored in
- The receptor site must be owned by the developer or an agreement reached with the relevant land owner
- If the relocation results in water voles being in closer proximity to wetland habitat, the probability of mink predation should be assessed i.e. check records from the Local Biological Records Centre and implement mink monitoring/survey

NB Any relocation to a receptor site more than 10km is classed as conservation translocation and is not a recommended method for mitigation for development at present.

4.3.3 Criteria for a suitable receptor site

The following factors should be assessed in order to evaluate the suitability of a receptor site for grassland water vole relocation:

- Size – ideally the receptor site should be equivalent in size to the donor site
- Habitat quality – habitat quality can vary across a site and poorer quality grassland habitat will support fewer water voles. Good quality water vole habitat has well drained, friable soil and is dominated by grasses such as *Holcus lanatus*. Small sections of marshy grassland are acceptable providing they cover <30% of the total area
- Ground conditions – soil depth should be approximately 1m depth and not prone to water-logging or flooding
- Connectivity – connecting corridors should be assessed by measuring the distance to adjacent grassland habitat in order to understand how the receptor site contributes to the wider water vole meta-population. Key connecting corridors should be retained/created at a minimum width of 10m

- Proximity to wetland habitat – water voles are vulnerable to mink predation if moved to a receptor site <100m from wetland habitat therefore the likelihood of mink being present should be assessed by consulting the Local Biological Records Centre and conducting mink surveys
- Predation levels – water voles are vulnerable to predation by domestic pets. Receptor sites surrounded by housing will be subject to higher predation levels
- Current level of water vole occupation – field sign surveys should be carried out to assess the current level of occupation by water vole. It is possible to use receptor sites which are already occupied by water voles providing it is at low density

Once the suitability of the receptor site has been assessed the next step is to calculate its carrying capacity. Water voles require an area of **204m²** per individual (based on home range minimum requirement of 185m² per animal with 10% included for resilience). If the grassland habitat is of lower quality e.g. over-shading, areas of water-logging, patches of bare ground/moss dominated then this area should be increased to at least 500m².

5. Site management

5.1 Site management

Grassland water voles appear to be attracted to development sites because of the shelter offered by site cabins, areas of soil storage, etc therefore the following recommendations are advised in addition to standard species protection:

- Clear physical demarcation is required of the water vole burrows/place of shelter (including 10m buffer) (Fig 3). This is to prevent vehicles or people disturbing or damaging the water vole habitat. This can be done using water vole fencing (see Section 5.2)
- Site cabins must not be located on soft surfaces because grassland water voles have been recorded burrowing beneath them. It is recommended that site cabins are placed on hardstanding only
- Keeping areas of mown grass short with a regular cutting regime should deter water voles from moving into new grassland areas. (If within 10m of water vole burrows/place of shelter a licence must be applied for from SNH)
- Soil mounds can be recolonised by water voles if left on site. Therefore they should either be removed or treated with herbicide to prevent regrowth of vegetation and monitored regularly
- It is recommended to carry out a security assessment at each site as vandalism can occur. Site security fencing is recommended at trapping and release sites



Fig 3: Site management using both Heras and water vole fencing. During the trapping phase sites should be well managed with clear demarcation between working areas and water vole habitat to minimise trampling and disturbance. (©GCC)



Fig 4: Water vole fencing installed at a depth of 100cm below ground and 50cm above. (© Robyn Stewart)

5.2 Water vole fencing

Water vole fencing is recommended for both the trapping site and the receptor site, but consideration should be given to revisions in design to reduce potential vandalism. Fencing should be buried to a depth of 70-100cm but the height above ground can be variable (minimum 50cm) (Fig 4). Previous projects have had some success with reducing the size/usability of the above ground section of panel which seems to have decreased vandalism. It should also be noted that plastic panelling is not easily available and marine plywood has been used successfully. Any variations in design should be agreed with SNH in advance.

6. Trapping

6.1 Time of year

The recommended dates for trapping in Scotland are 1st March to 15th April. It is strongly recommended that all primary trapping is carried out within this timescale unless there are exceptional circumstances. Exceptional circumstances need to be justified and submitted in writing to the SNH Area Officer prior to any licence/planning applications. Recent studies including one in the south-east of England have shown that autumn trapping was successfully used in riparian water vole relocations, however, until this is investigated fully in grassland populations with sufficient long-term monitoring, autumn trapping will not be recommended.

6.2 Estimating water vole numbers

It is recommended that water vole numbers are calculated using home range size. The average home range size is 500m² and varies from 185-876m² which would provide lower and upper estimates of population size. The social organisation of grassland water voles can vary depending on population density and there can be considerable overlap between individuals at high densities. However, it should be noted that water vole numbers can vary across sites for multiple reasons and the values given above will not provide precise estimates. It should also be noted that

for spring trapping there is an over winter mortality of on average 62% which should be factored in.

6.3 Trapping protocol

Trapping protocols outlined in the Water Vole Mitigation Handbook are applicable to grassland water voles. However, the fossorial behaviour of grassland water voles means they spend a greater proportion of their time underground, particularly when grass is short early in the year. Trapping success can be improved by digging the traps in to the ground near burrow entrances (Fig 5), so that animals can be trapped without having to come above ground (see [Appendix II](#) for an example of this approach being used successfully). It is important to note that water voles can be vulnerable to predation by foxes if trapping over-night and sites should be monitored for fox presence and night trapping suspended if necessary.



Periods of bad weather (e.g. heavy rainfall, extremes of temperature, etc) and site disturbance can cause water voles to block up tunnel entrances and rarely come above ground particularly when there is little grass cover or when they are at low population density. If there are no captures at all after 5 days of trapping, it may be necessary to commence with digging out the entire burrow system by hand. This must be approved by SNH Licensing before proceeding.

Fig 5: Water vole trap dug into burrow system and covered over with turf. Digging in traps causes both disturbance and damage and therefore requires a licence from SNH. (©Mark Mulqueeny)

6.4 Trapping duration

It can be reasonably assumed that the majority of water voles have been trapped after 5 full days with no new captures. Five clear days are required in order to reduce the risk of water vole injury or fatality caused by machinery. To ensure there are no remaining water voles on the site machinery can be used to strip turf in increments to expose the burrow system. This must be done under supervision by the ecologist/ECOW and a hand net is recommended to assist with the capture of any remaining water voles. It may be necessary to hand dig out the burrow system in areas machinery cannot access (e.g. around trees) (Fig 6).

Once the site has been successfully cleared the area must be left uninhabitable to water voles which can be achieved by vegetation clearance and compaction (Fig 7). For small development sites it may be useful to install a layer of Type 1 aggregate once all topsoil has been removed to provide a physical barrier to prevent water vole burrowing. It is critical that development work should start immediately after water voles have been removed from the site to prevent vegetation re-growth and other water voles from recolonising. If lactating females are captured then trapping should be suspended and SNH contacted. It should also be noted that traps should be purchased that are suitable for animals weighing <100g.

NB Details of the burrow structure including a photograph along with length and depth information should be included in Licence Returns.

6.4 Biosecurity

Biosecurity best practice is encouraged e.g. equipment (gloves, traps, etc) cleaned between sites to minimise cross contamination. Disposable items like handling tubes should be thrown away.



Fig 6: Grassland water vole burrow system dug out by hand (©Laurie Campbell)



Fig 7: Once a site has been designated free of water voles after 5 full clear days of trapping, the area should be made uninhabitable by stripping the turf and compacting the soil with a roller. (©GCC)

7. Water vole release

Water voles must be released into established grassland habitat. The spring trapping timescale (1st March – 15th April) means that the majority of trapped water voles will be adults so these must be released individually. Soft release pens should be placed at least 10m away from adjacent pens with 204m² grassland habitat allocated per individual. It is advisable to release a balanced sex ratio at receptor sites and alternate males and females in release pens to reduce aggression.

The Water Vole Mitigation Handbook outlines best practice for the construction of release pens but past successful releases of grassland water voles have used open-bottomed pens dug down to 15-20cm (Fig 8). Release pens should be provisioned with straw or hay for shelter, food such as carrots, apples, and guinea pig dry food and water. The time taken to dig out varies depending on the individual. Past release efforts have found the majority of water voles dig out within a day but

this varies considerably between individuals and can range from 20 minutes to over 7 days. It may be necessary to bring the release pens in overnight because of the risk of predation or vandalism. Encouraging water voles to dig out of the release pen by hand digging a starter burrow can be beneficial. Release pens should be checked daily and re-provisioned with food if necessary.



Fig 8: Water vole release built out of plywood and chicken wire. Recommended size 45cm x 45cm x 25cm (© GCC)

8. Habitat retention/creation

Habitat creation can take 12-24 months and it is important to factor this into timescales. Grassland water voles show a strong preference for food plants like *Holcus lanatus* and *Juncus effusus* and these should be form a key element of habitat creation. If creating a new habitat a combination of turves and the following water vole plant species mix ([Appendix III](#)) is recommended. Turves can be transplanted to speed up the creation of new habitat.

If enhancing existing grassland habitat additional wildflowers and grasses can be planted or sown to help establish suitable habitat. Drainage issues can be addressed by deep ploughing and/or pan busting or alternatively the ground can be built up above the water table with the creation of small natural looking bunds (Fig 9-11). The area must be assessed prior to any enhancement works proceeding to ensure no other protected species or habitat will be impacted or lost.

The area of habitat creation required is based on the number of animals to be accommodated. Habitat corridors must be a minimum width of 10m and of similar quality.



Fig 9: The suitability of grassland habitat can be enhanced for water voles by creating swales to improve drainage (© Robyn Stewart)



Fig 10: Sites with compacted soil can be made suitable for grassland water voles by using equipment such as the Panbuster. The blades slice through the compacted soil layer breaking it up but cause minimal damage to the turf on the surface. This reduces the time required for habitat creation. (© GCC)



Fig 11: Bunds can be created using a mixture of topsoil and subsoil to increase the area of habitat available for grassland water voles. Turves can then be directly transplanted on the bund or it can be seeded with the recommended water vole plant species mix. (© Claire Quinn)

9. Habitat management

Grassland management such as grass cutting requires a licence from SNH because it causes disturbance and has the potential to collapse the grassland water vole burrow system. Perimeter cuts of the edge of sites occupied by water voles also need a licence if within 10m of a water vole burrow and/or place of shelter. Further research is planned for 2019/2020 to better understand effective management of grassland habitat for water voles.

10. Monitoring

Both short-term and long-term monitoring are required to assess the suitability of the mitigation approach adopted and the findings reported back to the local authority and SNH. This will help inform future reviews of these guidelines. Short-term monitoring includes carefully evaluating the success of the approach being used during the works and adjusting if necessary. Longer-term monitoring is also required post-works to confirm the survival of relocated water voles or those left *in situ* as well as evaluate the habitat creation and enhancement measures used. Therefore there must be a commitment agreed with the developer to carry out monitoring for a set period of time dependent on the scale of the impact of the development (refer to Table 3). The Water Vole Mitigation Handbook recommends up to 5 years of monitoring for very large developments.

Table 3: Monitoring requirements for grassland water voles impacted by development

Scale of impact	Mitigation approach	Monitoring
Small (less than 5 water voles affected)	Water voles retained <i>in situ</i>	One survey post-works (preferably the following breeding season during July-Aug) to confirm water voles are still present and breeding. Compare field sign type/counts to pre-development counts.
	Water voles relocated on site	Annual field sign surveys. One post-work survey one month after relocation then repeat surveys during the breeding season (July-Aug) for a minimum of 3 years. Compare field sign type/counts to pre-development counts to evaluate if population is increasing or decreasing.
	Water voles relocated to receptor site (<1km)	Same as above but include habitat assessment along with annual field sign surveys. Habitat quality should be assessed to evaluate the success of habitat enhancement/creation measures and to identify/carry out necessary management.
Medium (6 to 20 water voles affected)	Water voles retained <i>in situ</i>	Annual field sign surveys. Surveys carried out during the breeding season (July-Aug) for a minimum of 3 years. Compare field sign type/counts to pre-development counts to evaluate if population is increasing or decreasing.
	Water voles relocated on site	Same as above but include a field sign survey one month post-works in addition to annual surveys. If habitat enhancement or creation works took place then habitat quality should be assessed to evaluate the success of the measures used and identify/carry out any necessary management required.
	Water voles relocated to receptor site (<1km)	Same as above.
Large (over 20 water voles affected)	Water voles retained <i>in situ</i>	Annual field sign surveys. Surveys carried out during the breeding season (July-Aug) for a minimum of 3 years. Compare field sign type/counts to pre-development counts to evaluate if population is increasing or decreasing.

	<p>Water voles relocated on site</p> <p>Water voles relocated to receptor site (<1km)</p>	<p>Same as above but include a field sign survey one month post-works in addition to annual surveys. If habitat enhancement or creation works took place then habitat quality should be assessed to evaluate the success of the measures used and identify/carry out any necessary management required.</p> <p>Same as above but monitoring to be carried out for a minimum of 3 years but preferably 5 years. It may also be appropriate to undertake micro-chipping and post release trapping to assess survival, breeding condition and juvenile presence in late September of the year of release.</p>
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11. Acknowledgements

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12. Online resources and references

- [SNH advice on status and legislation](#)
- [SNH licensing requirements for water vole](#)
- [SNH water voles – advice for Developers](#)
- [SNH water voles – planning and development](#)
- [GCC Supplementary guidelines for water vole SG7](#)
- [GCC webpage for water vole](#)