Welsh Government

M4 Corridor around Newport

December 2016 Environmental Statement Supplement Appendix SS10.7 Draft Water Vole Mitigation Strategy

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1 Introduction and Background

1.1 Introduction

1.1.1 This mitigation strategy sets out the proposals for the mitigation of likely effects on water voles during construction of the new section of motorway proposed as part of the M4 Corridor around Newport (M4CaN) Scheme (the 'Scheme'). It would form the basis of the Water Vole Method Statement that would be prepared and agreed with Natural Resources Wales (NRW) in advance of construction.

1.1.2 This strategy has been developed in consultation with NRW, and consultation would continue through the development of the method statement.

1.1.3 This mitigation strategy has been informed by the results of water vole surveys undertaken in 2014 and 2015 to inform the Environmental Impact Assessment (EIA) of the Scheme. Results of these surveys are reported at Appendix 10.8 and 10.24, respectively, of the March 2016 Environmental Statement (ES).

1.1.4 Due to the mobile nature of water voles, the Water Vole Method Statement would need to be informed by pre-construction surveys, which would be completed as described in this strategy *so as to ensure up-to-date habitat quality, availability and species presence/ absence data are taken fully into account*. The final method statement would include a location-specific method of working for each waterbody where water vole activity has been recorded.

1.2 Legislation and policy

The Wildlife and Countryside Act (WCA) 1981 (as amended)

1.2.1 In the UK, water voles are listed in Schedule 5 of the Wildlife and Countryside Act (WCA) 1981 (as amended) and are fully protected under Section 9. It is an offence to:

- Intentionally kill, injure or take any wild water vole. 9(1)
- Possess or control any live or dead wild water vole or any part of, or anything derived from, such an animal. 9(2)
- Intentionally or recklessly damage or destroy any structure or place which any wild water vole uses for shelter or protection. 9(4)(a)*
- Intentionally or recklessly disturb any such animal while it is occupying a structure or place which it uses for that purpose. 9(4)(b)
- Intentionally or recklessly obstruct access to any structure or place which any wild water vole uses for shelter or protection. 9(4)(c)
- Sell, offer or expose for sale, or have in possession or transports for the purpose of sale, any live or dead wild water vole, or any part of, or anything derived from, such an animal. 9(5)(a)
- Publish or cause to be published any advertisement likely to be understood as conveying that you buy or sell, or intend to buy or sell, any of those things 9(5)(b)

**A place of shelter or rest is generally considered to be a burrow and/or nest constructed within a burrow*.

Exceptions to the above

1.2.2 It is legal to tend a sick or injured water vole with the sole intention of releasing it when no longer disabled, or to kill a seriously disabled water vole that has no reasonable chance of recovering (10(3)(a)&(b)).

Licencing

1.2.3 Licences are issued by NRW to permit acts that would otherwise be illegal. They must be issued under the purpose for which the proposed activity is being carried out. There are only a limited number of purposes for which licences may be issued by NRW under the WCA 1981, and NRW do not currently issue licences for "development". However, the WCA 1981 does provide a defence against the above listed offences where the action is the incidental result of an otherwise lawful operation (e.g. action permitted under planning or similar consent) and could not reasonably be avoided (10(3)(c)).

Use of the incidental result defence

1.2.4 This defence) allows the carrying out of lawful operations from which some harm to the species would arise in terms of the listed offences as an incidental result of actions that could not reasonably have been avoided.

1.2.5 However, such a defence is only sustained if, as far as is reasonable, appropriate action is taken to safeguard the animals and their places used for shelter and protection. Ultimately, only a court can decide what is reasonable and to what extent adverse impacts might have been reasonably avoided and, therefore, if an offence has been committed. As this defence is open to interpretation, it is noted that NRW's policy is not to recommend sole reliance on this defence.

1.2.6 Therefore, in order to help minimise the impact of works on water voles and the potential need to rely on the defence of incidental result, this mitigation strategy has been developed with regard to best practice guidelines published in Strachan *et al*. (2011) and Dead et al. (2016) in consultation with NRW. Discussions have also been held with the Gwent Wildlife Trust. The Water Vole Method Statement would be agreed with NRW prior to the commencement of works.

Animal Welfare Act 2006

1.2.7 The Animal Welfare Act 2006 relates to all vertebrates (excluding man). Under Section 4 (1) of the Act a person commits an offence if:

(a) an act of his, or a failure of his to act, causes an animal to suffer,

(b) he knew, or ought reasonably to have known, that the act, or failure to act, would have that effect or be likely to do so,

(c) the animal is a protected animal, and

(d) the suffering is unnecessary.

1.2.8 Protected species as referred to in this legislation (see point (c) above) are different from species protected under the WCA (1981), or indeed the Conservation (of Habitats and Species) Regulations 2010, and are described under Section 2 of the Act as being:

- of a kind which is commonly domesticated in the British Isles;
- under the control of man whether on a permanent or temporary basis; or

- not living in in a wild state.

1.2.9 Taking the above into account, protected species in relation to this mitigation strategy would be any water voles that would be trapped and held for any period of time.

1.2.10 In addition, under Section 4 (2) of the Act, a person commits an offence if:

(a) he is responsible for an animal,

(b) an act, or failure to act, of another person causes the animal to suffer,

(c) he permitted that to happen or failed to take such steps (whether by way of supervising that person or otherwise) as were necessary in all the circumstances to prevent that happening, and

(d) the suffering is unnecessary.

1.2.11 The need to comply with relevant codes of practice is covered under Section 14 of the Act. With regard to this *Draft Water Vole Mitigation Strategy*, it is considered that these are:

- Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016) *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series).* Eds. Fiona Mathews and Paul Chanin. The Mammal Society, London.
- Strachan, R., Moorhouse, T. & Gelling, M. (2011) Water Vole Conservation Handbook (third edition). WildCRu: Oxford.

Natural Environment and Rural Communities Act 2006

1.2.12 Under Section 40 of the Natural Environment and Rural Communities Act 2006, the Welsh Government must '*in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity*'.

1.2.13 Section 42 of the Natural Environment and Rural Communities (NERC) Act 2006 requires the Secretary of State to publish lists of habitats and species of principal importance for the conservation of biodiversity in Wales. Water voles are listed under Section 42.

1.2.14 Without prejudice to the duties under Section 40, the Assembly must:

'*(a) take such steps as appear to the Assembly to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or*

(b) promote the taking by others of such steps.'

Planning Policy Wales (Edition 5, November 2012)

1.2.15 Under the Planning Policy Wales (Edition 5, November 2012) and associated series of Technical Advice Notes, including TAN5 "Nature Conservation and Planning", water voles are a material consideration in determining a planning application. The policy also states that a key principle of development should be to deliver a net gain for biodiversity.

Biodiversity Action Plans and the Post-2010 Biodiversity Framework

1.2.16 The UK Biodiversity Action Plan (BAP), published in 1994, was replaced in 2012 by the Post-2010 Biodiversity Framework; both documents list water vole as a Priority Species.

1.3 Background to development

1.3.1 The new section of motorway would be approximately 24 kilometres in length and would provide three lanes in both directions between Junction 29 of the M4 at Castleton and Junction 23 of the M4 at Magor. After leaving the existing M4 motorway at Junction 29, the new section of motorway would pass eastwards to the south of Duffryn before crossing the Rivers Ebbw and Usk to the south of the A48 at Newport Docks. The new section of motorway would then continue to the south of the Solutia chemical works and the Tata Steel site at Llanwern before passing to the west of Magor and re-joining the existing M4 at Junction 23.

1.3.2 In addition to the junctions at Castleton and Magor, two new junctions would be provided along the route of the new section of motorway, at Newport Docks and at Glan Llyn.

1.3.3 New or diverted lengths of highway, public rights of way and private means of access would be provided to replace those affected by the Scheme.

1.3.4 The local highway network would also be realigned at ten locations, and new overbridges would be constructed at Church Lane, Lighthouse Road, New Dairy Farm, Nash Road and North Row.

1.3.5 Road drainage would discharge into a series of water treatment areas, comprising attenuation lagoons and reed beds, along the new section of motorway. These water treatment areas (WTAs) would attenuate and treat the collected surface water prior to discharging it into existing watercourses.

1.3.6 Approximately two thirds of the route for the proposed new section of motorway crosses the Gwent Levels, an area of reclaimed coastal marshes adjoining the Severn Estuary, comprising the Wentlooge Levels to the west of Newport and Caldicot Levels to the east. The Gwent Levels are low-lying with an elevation typically between 5 – 6 metres above ordnance datum (AOD).

1.3.7 The Gwent Levels are dissected by an extensive network of tide-locked freshwater drains, locally known as reens. A number of designations apply to the Levels, including a number of Sites of Special Scientific Interest (SSSIs). In addition, the River Usk is designated nationally and internationally for its nature conservation value. At the location of the proposed crossing, the river is designated as a SSSI and Special Area of Conservation (SAC).

1.4 Proposed construction schedule

1.4.1 For the purposes of this strategy it is assumed that full access to the Scheme would be available from 1st July 2018 when the proposed 42-month construction phase of the M4CaN Scheme would commence. Early works would include the construction of the haul road for access and early construction of replacement watercourses and temporary WTAs. Main construction is expected to commence during late 2018. The new road is expected to be operational by autumn 2021.

1.4.2 Following from construction, there would be a five-year habitat and planting maintenance period under the contract, expected to continue until autumn 2026.

1.5 Water vole surveys

Surveys undertaken in 2014 and 2015

1.5.1 The 2014 and 2015 water vole survey reports are presented in detail in Appendices 10.8 and 10.25, respectively, of the M4CaN ES. A summary is provided below.

Survey areas

1.5.2 A desk study was undertaken for the M4CaN Scheme and a surrounding 2 km-wide buffer zone.

1.5.3 The 2014 field survey area covered the route of the 2007/2008 proposed M4 corridor and a 500 m wide surrounding buffer zone. The width of the buffer zone allowed for potential changes to the footprint of the proposed scheme. In 2015, due to the fact the footprint of the proposed scheme was more fixed in both extent and location, the survey area was reduced, in consultation with NRW, to cover the footprint of the 2015 scheme and a 250 m wide surrounding buffer zone.

Purpose and aim of surveys

1.5.4 The purpose of the surveys was to:

- identify historic water vole activity in the area;
- assess the suitability of habitat surveyed for water voles; and
- identify signs that could confirm the presence of water voles.

Survey methodologies

Habitat Suitability Assessment

1.5.5 Habitat suitability assessments for water voles were undertaken in 2014 and 2015. The assessments comprised an evaluation of features of each waterbody (listed below) whilst considering the species-specific habitat requirements of water voles. Factors considered were:

- Rate of water flow.
- Bank profiles.
- Degree of shading from overhanging trees or scrub.
- Extent of suitable emergent and bankside herbaceous vegetation for shelter, food and nesting material.
- Degree of cattle poaching (i.e. extent of damage to banks from trampling by cattle).
- Levels of site disturbance (e.g. proximity to public rights of way, farm vehicle access tracks or road traffic).
- Potential for the waterbody to dry out.

- Suitability of bank substrates for burrowing.
- Water quality.

1.5.6 Table 1 below presents the criteria used for the assessment of habitat quality.

Table 1: Methodology for the Assessment of Habitat Suitability for Water Voles

Habitat Suitability	Hydrology	Food Availability	Shelter Requirements
High	Slow flowing water course around 1-3 m wide and 1 m deep.	Abundant growth of both emergent and herbaceous vegetation.	Moderately steep banks, minimal shading by trees and scrub.
Moderate	A variation of slow-flowing optimal conditions and sub-optimal conditions such as fast flowing or very shallow sections.	Optimal feeding conditions inter-spersed with sub-optimal conditions, as described for low habitat suitability.	Watercourse partially shaded, with open areas providing suitable conditions.
Low	Fast flowing water, widely fluctuating levels, prone to seasonally drying out.	Little to no suitable food. Heavily poached by livestock.	Heavily shaded by overhanging trees or scrub, shallow banks.
Negligible	Little to no water.	No suitable food sources.	Overgrown and 100% shaded.

Presence/absence survey

1.5.7 The presence/absence survey methodology was based on guidance published in Strachan *et al.* (2011) and was in accordance with standing advice issued by Natural England (2014), which defines which survey activities may be undertaken within the current framework of legal protection without the need for a licence.

1.5.8 Each waterbody within the survey area was surveyed for the following signs of water vole activity:

- faeces/droppings;
- latrines;
- feeding stations;
- burrows;
- lawns;
- pathways; and
- footprints.

1.5.9 Droppings are the most distinctive field sign and indicate recent water vole presence. Therefore, a detailed search of the bankside vegetation was undertaken at each suitable waterbody until a latrine or dropping was found; thereafter, 10 m point checks were performed.

Survey Results

1.5.10 Results of the desk study are shown on Figure 1. Only one record of water voles was reported to the west of the River Usk, in a pond to the south of the A48(M) in Castleton. The record was dated the 30 October 2014, and noted the presence of feeding signs and a latrine. All other records were to the east of the River Usk, primarily focussing on the GWT's Magor Marsh reserve in the Whitewall Common area, and spreading south and west to Elver Pill Reen (Figures 1c and 1d).

1.5.11 Results of the field surveys confirmed the presence of water voles at the locations shown on Figure 2 (with habitats supporting burrows marked in purple and those without burrow recorded shown in yellow).

1.5.12 The results of the 2014 surveys reported water vole activity in 126 of the 1442 waterbodies surveyed, ranging from a lake to a river, streams, reens and ditches. Water vole signs were mainly recorded along managed watercourses with good bankside vegetation cover.

1.5.13 The results of the 2015 surveys reported water vole activity in 19 of the 58 waterbodies surveyed. The majority of the waterbodies where water vole signs were recorded were reens and field ditches to the south of Llandevenny, with the only other area of water vole activity being recorded to the east of Tatton Farm, in a small ditch adjacent to Julian's Reen.

Survey Limitations

1.5.14 The following survey limitations prevented surveys of those waterbodies shown, on Figure 3, as never having been surveyed. Limitations included:

- dense vegetation that prevented access to a waterbody;
- permission to access waterbodies was not granted by land owners;
- health and safety concerns, including the presence of farming stock, steep banks and high water levels;
- poaching of banks of waterbodies by animals removed field signs; and/or
- precipitation removing field signs.

1.5.15 However, overall survey coverage was good, and it is considered that results of the surveys present a realistic picture of the distribution of water voles across the survey area.

1.6 Works that would Impact Water Voles

1.6.1 Construction is expected to be completed over a 42-month period, with haul road construction commencing in July 2018. This Water Vole Mitigation Strategy refers to works that could have an impact on water voles, as listed below.

- Construction of temporary haul road with watercourse crossing points.
- In-filling of watercourses and other waterbodies.
- Establishment of temporary works compounds.
- Establishment of temporary storage areas (equipment, vehicles, materials including soil, etc.).

- Construction of temporary batching plants.
- Excavation of temporary borrow pits.
- Construction of Water Treatment Areas (temporary and permanent).
- Construction of drainage systems.
- Construction of temporary access roads (construction).
- Construction of access/slip roads (permanent).
- Construction of over-bridges.
- Construction of culverts on reens and main watercourses.
- Construction of the new section of the motorway.
- Lighting (including construction phase and operational phase).

1.6.2 The likely impacts of the above works could include:

- habitat loss and severance;
- displacement of individual water voles;
- disruption to the movement and dispersal of water voles;
- population fragmentation due to habitat loss and/or disruption to movement; and
- potential injuries or fatalities (as a direct result of construction or indirect result of habitat loss and/or displacement).

1.6.3 The potential magnitude of these impacts without mitigation is described below.

1.7 Potential Impact of Proposed Works *without* Appropriate Mitigation

Short-term impacts: disturbance

1.7.1 During construction, there is the potential for disturbance of water voles within and immediately adjacent to the construction site due to increases in human presence, noise and/or vibration expected during construction, as well as a result of light spill from some parts of the site.

1.7.2 The movement of water voles along watercourses could be temporarily obstructed by construction works along the Scheme and, therefore, breeding success during the construction phase could be affected.

1.7.3 Due to the proximity of water voles to the construction site, temporary short-term disturbance of habitats of value to water voles by airborne and run-off pollutants could also potentially occur during the construction period.

Short-term impacts: displacement

1.7.4 Water voles could be displaced by construction along watercourses where they are known to be present. Should a water vole be displaced into another's territory this could result in territorial disputes.

Short-term impacts: injury or fatalities

1.7.5 Construction could result in direct physical injury or fatalities to water voles. In addition, construction could result in the displacement of water voles from the construction site. Water voles are highly territorial, and if individuals are displaced into the territories of others, injuries or fatalities could result from aggressive territorial disputes.

Long-term impacts: habitat loss

1.7.6 Taking into account the 2014 and 2015 survey results, the lengths of watercourses where water vole burrows have been recorded which would be lost to construction through in-filling or culverting (temporarily and permanently) are listed below. Estimates of the number of female home ranges that could be affected are also provided, taking into account the fact that a female water vole's home range is typically between 50 and 150 m of watercourse length (Dean *et al*. 2016).

West of the River Usk

- Percoed Reen WV10/12, Figure 2a/b: 197 m – between 1 and 4 female home ranges affected.

East of the River Usk

- Monk's Drain WV48 (and adjacent ditch), Figure 2d: 239 m – between 1 and 5 female home ranges affected.
- Middle Road reen WV75, Figure 2d: burrows located outside working area, watercourse 227 m - possibly only 1 overlapping female home range affected (only very small overlap into area where burrows were recorded).
- WV100, Figure 2d/e: 96 m – between 1 and 3 female home range affected (the area is relatively densely populated so potential to have smaller home range sizes).
- WV110, Figure 2e: 20 m – part of 1 female home range affected.
- WV126, Figure 2e: 85 m – approximately 1 female home range affected.
- WV135, Figure 2e: 126 m – between 1 and 3 female home ranges affected.

1.7.7 In addition, the lengths of watercourses which would be lost to construction (temporarily and permanently) where signs of water vole activity (but no burrows) have been recorded are listed below:

West of the River Usk

- WV17, Figure 2b: 74 m - approximately 1 female home range affected.

East of the River Usk

- WV44, Figure 2c: 236 m - between 1 and 5 female home ranges affected.
- WV50, Figure 2c: 146 m - between 1 and 3 female home ranges affected.
- WV72, Figure 2d: activity recorded *outside* working area, watercourse 80 m - 1 female home range *may* be affected.
- WV80, Figure 2d: 312 m – between 2 and 6 female home ranges affected.
- WV111, Figure 2e: 255 m – between 1 and 5 female home ranges affected.

- WV119, Figure 2e: 97 m – between 1 and 2 female home ranges affected.
- WV125, Figure 2e: 125 metres - between 1 and 3 female home ranges affected.
- WV130, Figure 2e: 38 m - approximately 1 female home range affected.
- WV131, Figure 2e: 16 m – approximately 1 female home range affected.
- WV138, Figure 2e: 82 m – approximately 1 female home range affected.

Long-term impacts: fragmentation and isolation

1.7.8 The Scheme would result in the creation of a potential barrier to the movement of water voles between watercourses to the south and north of the new road, which could result in reductions in home ranges and/or adversely affect dispersal patterns. This in turn could impact upon an individual's breeding success and, therefore, a population's long term viability.

1.7.9 GWT reported to RPS during a meeting on the 11 October 2016 that the results of their ongoing activity surveys confirm that water voles are dispersing to the north of the Scheme, and the following watercourses located along the Scheme appear to be especially important habitat corridors:

- Monk's Ditch Reen;
- Cock Street Reen;
- Middle Road Reen; and
- Mill Reen.

Post-development interference impacts

1.7.10 Pollution and potential flooding impacts during the operational phase could have an adverse effect on the ability of water voles to use affected watercourses across the Levels.

Predicted scale of impact

1.7.11 Taking into account the results of 2014 and 2015 surveys, the location and extent of the new section of motorway and, in particular, habitat loss and severance and the potential for injuries or fatalities, without mitigation, the effect of the Scheme on the local water vole population is assessed as being of moderate significance.

1.7.12 However, with the mitigation measures described below, the likely significance of effect on water voles would be slight adverse, largely due to the temporary disruption to the local population during the construction phase. Over time, as the new watercourses, SSSI mitigation areas and WTAs continue to mature, and the animals' familiarity with the Scheme (and in particular the culverts) develops, the long term adverse effects are likely to diminish further. Significantly, the total amount of water vole habitat will not have decreased (indeed it will have increased) and the ability of the population to expand further into currently-unoccupied territories will be unaffected

2 Mitigation Measures

2.1 Introduction

2.1.1 The principal aims of this *Water Vole Mitigation Strategy* are to ensure that:

- sufficient habitat would be available to support the local water vole population on a long-term basis; and
- the local water vole population would be able to maintain itself on a long-term basis as a viable component of its natural habitat.

2.1.2 In addition, the strategy aims to provide a net gain with regard to water vole conservation in the area, particularly through the enhancement of existing, and re-creation of lost, watercourses in the SSSI Mitigation Areas (see Appendix SR10.35 Figure 2 to this report and to the *revised SSSI Mitigation Strategy*).

2.1.3 This draft strategy has been informed by the results of the 2014 and 2015 water vole surveys. The *Water Vole Method Statement* would be informed by the 2014/2015 surveys as well as pre-construction surveys to be undertaken in 2017 and immediately prior to and during construction.

2.1.4 The mitigation has been developed with regard to best practice guidelines published in Strachan *et al.* (2011) and Dean *et al.* (2016).

Health and safety

2.1.5 Health and safety measures relating to all works described in this mitigation strategy (and the subsequent water vole method statement) would be the primary responsibility of the Contractor. The ecologist(s) would be required to produce a site-specific risk assessment for all works carried out under the method statement. Specific assessment of risk, and measures to protect against Leptospirosis, would be included.

2.1.6 In addition, the biosecurity risk assessment and safe system of works attached at Annex 1 would be signed and adhered to by all those involved in the work, and would be updated as necessary in response to changing site conditions.

2.2 Mitigation Measures Covered by this Mitigation Strategy

Summary of mitigation measures

2.2.1 The proposed mitigation measures may be summarised as follows:

- Pre-construction surveys.
- Retention of watercourses wherever practicable.
- Mink control programme, where required, prior to the commencement of any works that would result in the displacement or translocation of water voles to areas where mink control is not currently being undertaken.
- Works to be completed under an ecological watching brief, as described in this strategy.

- Pollution prevention measures to be set in place for the pre-construction, construction and operational phases of the Scheme, in order to protect retained and newly-created waterbodies.
- Prior to the displacement or translocation of water voles from the construction area, installation of temporary culverts (up to 12 metres in length) along watercourses supporting water voles in order to provide access for the construction of the haul road.
- Enhancement of waterbodies, including those in the SSSI Mitigation Areas (see Figure 2) to benefit water voles.
- Creation of replacement watercourses along the Scheme (Figure 2) as access is gained through the construction of the haul road. Installation of water vole exclusion fencing to prevent access to replacement watercourses until the end of construction in an area (including the installation of operational fencing).Where appropriate, habitat manipulation between 15 September 2018 and 30 November 2018 and, if required, between 15 February 2019 and 15 April 2019, in order to deter water voles from entering working areas and to displace animals into surrounding favourable habitat prior to construction in an area (e.g. strim/brush-cut bank-side vegetation in the working area and a surrounding buffer zone).
- On-going strimming of bank-side vegetation, following the displacement or translocation of water voles where present, in order to continue to deter water voles from returning or entering the works area prior to construction.
- Where appropriate, between 15 September 2018 and 30 November 2018, trapping of water voles from waterbodies within the construction site, and transfer into temporary captivity at Bristol Zoo until receptor sites have reached favourable condition.
- Where appropriate, between 15 September 2018 and 30 November 2018 and, if necessary, between 15 February 2019 and 15 April 2019, the trapping of water voles from waterbodies within the construction site and translocation to favourable receptor sites.
- Construction of permanent culverts following the displacement or translocation of water voles. A proportion of these to have internal mammal ledges installed at high water level for use by water voles in order to help minimise the impact on water vole movement across the new section of motorway and any potential for habitat severance and population fragmentation.
- Population and habitat monitoring following displacement/translocation of water voles, and following habitat creation/enhancement, for a period of five years post-construction, in order to evaluate the effectiveness of mitigation and the potential need for additional measures to be set in place.

Note: the above measures would be undertaken in accordance with the requirements of any other NRW licences for protected species (i.e. including licences for great crested newts and hazel dormice).

2.2.2 Further details of the proposed mitigation measures are provided in the following sections.

Pre-construction surveys

2.2.3 Watercourses within the M4CaN land take boundary and a surrounding 100 m-wide buffer zone would be surveyed between mid-April/early May and September 2017 inclusive, following the methodology described above for the 2014 and 2015 surveys.

2.2.4 The purpose of the survey would be to identify any new signs of water vole activity and changes in watercourse use across the survey area.

2.2.5 During surveys, locations of water vole burrows would be recorded (where possible, GPS locations would be recorded) as well as any signs of activity at the burrows. Signs that burrows are inactive include dry, cracked soil around the entrances, indicating water voles have not been passing through, and vegetation is pushing through the soil around the entrance, indicating no regular disturbance or grazing by water voles.

2.2.6 Additional signs of water vole activity would also be recorded, including:

- Lawns
- Feeding stations
- Droppings and latrines
- Footprints
- Pathways
- Water vole sightings

2.2.7 Some water vole signs can be similar to signs of other species and, therefore, care would be taken to identify multiple signs, where present. Where it is not possible to cover all parts of a watercourse (e.g. due to inaccessibility resulting from steep banks or dense vegetation), floating rafts would be installed, which are often used by water voles as latrine sites and, therefore, can be a useful presence/absence survey method.

2.2.8 Results of the surveys would inform the *Water Vole Method Statement* (essentially the detailed description of how this strategy will be implemented), as described in Section 2 below.

2.2.9 In addition, prior to the start of construction in an area (i.e. from July 2018 onwards) a further repeat of the water vole activity surveys would be undertaken along watercourses to be affected by the works. The aim of these surveys would be to identify any new signs of water vole activity, including new burrows, in order to inform any necessary amendments to the *Water Vole Method Statement*. Where water voles are present, surveys of connecting watercourses located outside the construction site may also be undertaken in order to assess their value as potential receptor sites into which any water voles may be displaced (as described in this strategy).

Retention of watercourses

2.2.10 In order to reduce the habitat loss and impact on watercourse flow along the Scheme, wherever practicable, reens that would be crossed by the new road would be retained and culverted. Culvert locations are shown on Figure 2.

2.2.11 Culverts would be installed in accordance with a detailed method statement and the Construction Environment Management Plan (CEMP). The CEMP would include the need to work in accordance with the *Water Vole Method Statement*.

Installation of temporary culverts for construction of the haul road

2.2.12 Haul road construction would commence from July 2018. Water voles are known to utilise culverts under roads (Dean *et al.*, 2016), therefore, in order to gain access for the construction of the haul road, and to minimise the impact on water vole movement of haul road construction and enabling works, temporary short culverts would be installed in watercourses at the start of construction in an area (i.e. from July 2018). This would be prior to the main displacement/translocation of water voles from a watercourse. The process is described below (whilst the detail of the proposed sequencing of the installation of temporary culverts for the haul route is provided in the revised *Buildability Report*, appended to the ES Supplement).

- The ECoW and Contractor would agree and mark out on site the location of watercourse crossing points (generally along the northern edge of the Scheme) to avoid active water vole burrows by at least 3 metres, where practicable. Where it is necessary, culverts could be reduced in length to no less than 5 metres. If burrows could still be affected, there may be a need to displace water voles for construction of the temporary culverts, but this will be avoided, if at all possible.
- Culvert pipes would be set at a sufficient level to provide good air flow and visibility above high water/summer penning levels. This would encourage use by water voles and thus minimise the potential impact on water vole movement and population/habitat fragmentation.
- A protective buffer zone would be established along the banks of a watercourse around any active burrows until water voles have been displaced/translocated from the area (e.g. incorporating a bankside protection zone of approximately 5-6 metres from the top of the banks) in order to prevent compaction or direct damage to any burrows. The zone would exclude all excavations, repeated tracking of heavy vehicles/machinery and long-term storage of soils.

  Note: the above measures would take into account the need to consider other species that might be present, as well as any requirements of NRW licences for protected species (i.e. including NRW licences for great crested newts and hazel dormice, and measures to protect fish and breeding bird nests).

2.2.13 The early construction of the haul road (i.e. from July 2018) would enable early excavation and establishment of replacement watercourses, which would be used as receptor sites for water voles, once confirmed by the ECoW to be in favourable condition.

Installation of permanent culverts

2.2.14 Permanent culverts would replace temporary culverts along reens to be retained, or realigned. Permanent culverts would be installed following the displacement/ translocation of water voles from the watercourses (as described below).

2.2.15 The Water Vole Conservation Handbook (Strachan *et al*., 2016) states that '*culverting does not seem to provide a major problem to water vole movement or fragmentation*', although it also says that '*length may present a problem to water vole daily movement and dispersal*'. Dean *et al.* (2016) reported personal observations of water voles utilising culverts with the following profiles:

- Box culverts of 30-35 m length with a headroom above normal water level of at least 1 m; and

- Circular culverts of 1200 mm diameter, up to 10 m length and with at least 300 mm headroom above normal water level.

2.2.16 Water voles may also utilise ledges provided above high water level along the interior wall of a culvert in order to travel through the length. However, it is unclear as to whether or not these features are a requirement (Dean *et al.* 2016).

2.2.17 The Scheme would include culverts along the length of the new road, including along watercourses of potential value to water voles, as shown on Figure 2.

2.2.18 Although the culverts across the new road would be greater than 35 metres in length, the diameter would also be considerably greater than 1200 mm (i.e. diameters would be at least 1800 mm).

2.2.19 In addition, where practicable and where there are no health and safety constraints, internal ledges would be installed along the interior of reen bridges/culverts at high water-level (i.e. those greater than 1800 mm in diameter), as shown on Figure 2. It is expected that these culverts would include those listed below, which include those reported by GWT as being of value with regard to water vole dispersal to the north of the Scheme.

- Middle Road Reen Diversion (Figure 2e), as recommended by GWT;
- Monk's Ditch Reen (Figure 2d), as recommended by GWT;
- Mill Reen culvert (Figure 2f), as recommended by GWT; and
- Percoed Reen culvert (Figure 2a), due to the presence of water voles.

2.2.20 With regard to Mill Reen culvert, proposals would include an extension of the existing culvert in order to accommodate the new section of motorway that would run over it. The existing culvert is approximately 61 metres long. The extension would be similar in form and appearance to the existing structure, and the final length would be 135 metres. However, this would have a clear span of 6 metres and height of 4 metres above the right of way that would pass beneath it. A ledge would be provided along the culvert, which could be utilised by water voles.

2.2.21 Where practicable, and where health and safety requirements permit, mammal ledges could also be installed along culverts on Tatton Farm (Figure 2c) in order to help water voles move between the farm and the rest of the Levels to the south of the new road.

2.2.22 The final list of culverts to have ledges installed along them would be confirmed in the *Water Vole Method Statement.*

2.2.23 Installation of the permanent culverts would not commence until the ECoW has confirmed that no ecological constraints remain, including water voles. Permanent culvert installation is expected to commence in late 2018.

2.2.24 The majority of permanent culverts would be constructed on a half-and-half basis (i.e. constructing half of the culvert, relocating the haul road to the other side of the corridor then constructing the other half of the culvert) to maintain a haul route access through the site.

2.2.25 Typically, the permanent culverts would be founded on driven piles. For areas of band drain and surcharge embankment construction, it is preferable to install the permanent culverts prior to the surcharging period.

2.2.26 Alternatively, the permanent box culverts would be installed after the surcharging period. This option would only be considered where driven pile foundations cannot be installed until after the surcharging period has completed.

Creation and enhancement of waterbodies

Habitat loss and replacement

2.2.27 Taking into account the results of the 2014 and 2015 water vole surveys (Figure 2), the Scheme would result in the loss of 21 watercourses/sections of watercourse, and one reed bed on Tata Steelworks land, where signs of water vole activity have been recorded. For the purpose of this section, this habitat loss includes watercourses to be permanently culverted, as although these watercourses would remain connected to adjacent watercourses, and therefore would provide continued habitat connectivity, they would no longer provide burrowing or foraging habitat.

2.2.28 It should be noted that although the works compound at Duffryn (the *Temporary Construction Land* on Figure 2b to the north-east of watercourses WV9, WV13 and WV14) incorporates a pond where water vole activity has been recorded in the past, the pond would be retained, and measures would be set in place to prevent damage or disturbance to the pond, including any potential pollution impacts.

2.2.29 As listed under Section 1.7 (*Long-term impacts: habitat loss)* above, watercourse losses would comprise:

- to the west of the River Usk – approximately 197 metres of watercourses with water vole burrows;
- to the west of the River Usk – approximately 74 metres of watercourses without water vole burrows;
- to the east of the River Usk - approximately 792 metres of watercourses with water vole burrows; and
- to the east of the River Usk – approximately 1,262 metres of watercourses without water vole burrows.

2.2.30 In addition, reed bed loss would cover 6.59 hectares (of which 3.19 hectares would be permanent loss), and 14 watercourses where signs of water vole activity have been recorded would be at risk of damage or habitat loss during construction, owing to their proximity to the Scheme.

2.2.31 As explained in the revised *Reen Mitigation Strategy* (Appendix S2.1 to the ES Supplement), the above watercourse losses, combined with all other watercourse losses along the Scheme, would amount to approximately 2,755 metres of reens and 9,373 metres of field ditches to be in-filled or culverted for construction.

2.2.32 Therefore, in order to mitigate this loss of habitat, replacement watercourses would be constructed along the route of the Scheme. Proposals would include the replacement of lost watercourses with a total of 2,826 metres of new reen and 10,594 metres of new field ditches, as shown on Figure 2. This equates to a loss:replacement ratio of 1:1.06 for reens and 1:1.08 for ditches (effectively 1:1). This ratio is a result of concerns expressed by NRW that the original greater replacement proposals (7,610 metres new reens and 11,800 metres new ditches) could have adverse effects on the hydrology of the Levels.

2.2.33 In addition, the *revised SSSI Mitigation Strategy* includes the re-excavation of some 5,865 metres of former ditches at Maerdy Farm and Caldicot Moor (see Appendic SR10.35 Figure 2b/c of the *revised SSSI Mitigation Strategy*, appended to this report). Management would take into account the requirements of water voles, as described under *Favourable conditions for water voles,* below*,* and would be detailed in the *Mitigation Area Management Plans*.

2.2.34 Taking into account the ditch construction proposed for the SSSI Mitigation Areas*,* the ratio of ditch loss:construction would increase to 1:1.76.

2.2.35 Figure 2 shows the location of replacement field ditches in relation to known water vole activity in order to illustrate the value of their location as potential receptor sites for displaced or translocated water voles.

2.2.36 New Water Treatment Areas (WTAs) would also be constructed along the Scheme (as shown on Figure 2 and described in the *revised EMP* (Appendix SR10.35 Figure 2.6 to the ES Supplement)). These would include 9.4 hectares of additional ponds and 9.9 hectares of reedbeds, which would equate to a loss:construction ratio of 1:1.5. The primary purpose of WTAs is to process run-off from the new road and, therefore, they are not considered as an integral part of this draft strategy; however, they would be of potential value to water voles and can therefore be considered a potential enhancement.

Construction of replacement watercourses

2.2.37 Replacement watercourses would be constructed along the northern and southern boundaries of the M4CaN corridor, as shown on Figure 2. The watercourses would be connected to retained watercourses located outside the Scheme boundary, but would be separated from the new road drainage and Water Treatment Areas (WTAs) so as to prevent pollution impacts.

2.2.38 It is proposed that watercourses that would form realigned reen sections would be excavated to 2 m depth and approximately 5.7 m width at the surface. The slope of the banks would be approximately 1 in 1 (as recommended in Strachan *et al*. 2016) and would include flat ledges/berms of 0.7 m width. With regard to replacement ditches, it is expected that excavations would be to 1 metre depth and 2.5 m width, with bank slopes of again 1 in 1. The ditches would be connected to the nearest main reens. However, continuing advice with regard to final watercourse specification would be sought from NRW.

2.2.39 The detailed methodology for constructing all watercourses would be included in the CEMP (based on the *Pre-CEMP*, Appendix 3.2 to the ES). All works would be timed to minimise the impact on soils (i.e. works would avoid periods of heavy or prolonged rainfall, snow or frost, and vehicles would not be tracked across waterlogged soils).

2.2.40 The construction of the haul road from July 2018 would provide access to enable the excavation of the replacement watercourses prior to the commencement of main construction in an area.

2.2.41 In order to help ensure replacement watercourses become established to favourable condition as early as possible, replacement watercourses would be excavated prior to the in-filling of watercourses along the Scheme, and suitable turf and silts would be stripped from the banks and margins of ‘donor’ watercourses and immediately relocated to the replacement watercourses, in order to minimise handling and drying time.

2.2.42 Watercourses to be in-filled, that do not support water voles, would be in-filled from July 2018. However, where water voles are present, they would need to be displaced, or trapped and translocated to temporary captivity or favourable receptor sites, prior to the commencement of infilling (as described below). Infilling would not commence until the ECoW has confirmed the absence of ecological constraints, including water voles.

2.2.43 Suitable turf and silts for translocation to replacement watercourses would be identified through pre-construction botanical surveys undertaken by an appropriately experienced surveyor. The purpose of the surveys would be to identify watercourses of high value as donor sites due to the presence of plant species of conservation interest and high species diversity, as well as watercourses that should not be used as donor sites (e.g. due to the presence of invasive plants). The results of the surveys from 2014 and 2015 would also inform the selection of donor sites.

2.2.44 Should weeds begin to dominate, or re-growth be slow to establish along replacement watercourses, banks could be seeded (with NRW approval) with an appropriate wildflower/grass seed mix comprising species typical of the area (as confirmed through previous aquatic macrophyte and NVC surveys (ES Appendices 10.4, 10.14, 10.20 and 10.29)) and the pre-construction surveys.

2.2.45 Prior to infilling, the watercourses would be bunded at either end and water would be pumped into adjacent channels directly, or via the Scheme's water treatment system, as described in the *Buildability Report*.

2.2.46 The pumping out of watercourses would be carried out in accordance with the requirements of any NRW great crested newt licence.

2.2.47 Prior to connecting the wetted replacement watercourses to adjacent retained watercourses, water vole exclusion fencing would be installed across the watercourse connection points where water voles are known to be present in the surrounding area, in order to help prevent the animals from entering the replacement watercourses prior to the completion of construction.

2.2.48 Water vole exclusion fencing would be removed following the completion of construction in an area (including the removal of the earth bund around the construction site and installation of operational boundary fencing) and prior to the relocation of any water voles from captivity into the replacement watercourses.

Creation and enhancement of watercourses within SSSI Mitigation Areas

2.2.49 Figure 2 shows the location of the SSSI Mitigation Areas (i.e. Maerdy Farm, Tatton Farm and Caldicot Moor) in relation to the Scheme and known water vole activity.

2.2.50 Proposals for these areas are detailed in the *revised M4CaN SSSI Mitigation Strategy*, which is being developed in consultation with NRW. Agreement for measures proposed in the strategy would be obtained from NRW prior to the commencement of works.

2.2.51 Appendix SR10.35 Figure 2a to the *revised M4CaN SSSI Mitigation Strategy* (the figure is appended to this report for ease of reference) shows the location of habitat enhancement and/or management proposals for the SSSI Mitigation Areas. Measures include the re-creation of watercourses that have been lost (due to agricultural intensification) for use by water voles, and the enhancement of existing watercourses for the benefit of water voles (in addition to other species). Measures proposed take into account habitat requirements listed under *Favourable condition for water voles*, below.

2.2.52 Since Tatton Farm is owned by Welsh Government, watercourse enhancement measures on the farm, which would benefit water voles, would be undertaken from 2017, with NRW consent, as part of the Welsh Government's general management of the site. Therefore, these enhancement measures are excluded from the *revised M4CaN SSSI Mitigation Strategy*. However, the long-term management of watercourses on Tatton Farm for the benefit of water voles is included in the strategy.

2.2.53 It is considered likely that re-creation and enhancement works proposed for Maerdy Farm and Caldicot Moor would commence as soon as possible from July 2018, when it is expected that permission to access and undertake works would have been obtained. Habitat enhancement measures at these sites would include:

- clearance of bank-side scrub and hedgerows along the southern banks of watercourses to open them up and allow more light through to banks, margins and water-level in order to encourage the development of more favourable vegetative cover; and
- re-profiling of the sides in order to create steep banks with ledges/berms as feeding platforms and latrine sites.

2.2.54 With regard to any watercourses confirmed to be in favourable condition for water voles (as defined under *Favourable condition for water voles*, below), that are located within the SSSI Mitigation Areas and sufficiently far from the construction site to ensure construction works do not present a risk of injury or fatality to water voles or a risk of damage to their burrows (e.g. approximately 6 metres from construction areas), it is expected that (during appropriate weather conditions) water vole translocations into these locations could take place between:

- 15 September 2018 and 30 November 2018, or earlier, with NRW approval; or
- 15 February/1 March (depending on local weather conditions) and August from 2019 onwards.

2.2.55 Once established, long term management requirements for the SSSI Mitigation Areas would be detailed in SSSI Mitigation Area Management Plans. These plans would form part of/inform any tenancy agreement for the sites.

Favourable conditions for water voles

2.2.56 No watercourse would be used as a receptor site for displaced or translocated water voles until the ECoW has first confirmed that the habitat is in favourable condition for the species.

2.2.57 Watercourses with the following conditions could be considered to be in favourable condition:

- no water voles inhabit the receptor site - however, the site is close enough to other watercourses where water voles are present and there is good habitat connectivity between the watercourses so that interactions can occur;
- water-levels are at least 0.5 metres in depth;
- holds water throughout the year;
- have slow, stable flow rates;
- banks are stable, have a profile of approximately 1:1 along at least one bank, are higher than high-water level, and comprise suitable substrate for burrowing;

- have a good dense cover of tall bankside, marginal and emergent vegetation (covering around 20% of the surface area of the wetted channel or a wide marginal fringe), with a diverse structure.;
- have a good dense cover of tall ground vegetation at least 2 m (and ideally up to 5-6 m) from the top of the banks; and
- have good habitat connectivity to other favourable habitat in the nearby surrounding area.

2.2.58 For plants to take root, one bank may have a gentler slope, or banks may include ledges/berms. Some bankside scrub/hedgerows could be present as water vole cover and a foraging resource; however, this should ideally be located along the northern bank in order to allow light through to the watercourse and encourage the development of grassland and aquatic/semi-aquatic plants.

2.2.59 In addition to the above conditions, North American mink would need to be confirmed absent, or an effective long term control programme would need to be established prior to the use of any watercourse as a receptor site. Mink control measures are described under *Mink control* below.

Mink control

2.2.60 Mink control would form part of the Water Vole Method Statement, which would be included in the Scheme's Commitments Register.

2.2.61 Mink control measures are currently being undertaken across the Levels to the east of the River Usk as part of the Gwent Wildlife Trust's water vole conservation strategy. The Scheme would continue to collaborate with GWT in order to ensure mink control is sufficient, or to contribute to the control programme as required to the east of the River.

2.2.62 Currently there is no mink control to the west of the River Usk, and if this remains the case, a programme would be implemented as part of the Scheme. The Scheme would undertake mink control along all watercourses into which water voles are to be displaced or translocated within the operational boundary of the Scheme, including the SSSI Mitigation Areas.

2.2.63 Watercourses to be included in the mink control programme would be informed by pre-construction surveys as well as the surveys completed in 2014 and 2015.

2.2.64 In advance of the commencement of mink control, the proposed locations of mink rafts would be agreed with NRW.

2.2.65 Mink control would be undertaken between August and April, with the most effective time to trap being from August to November and February to March. Mink control would commence in July 2018. Displacements and translocations of water voles would be carried out after the commencement of mink control. Water voles would not be released into a receptor site until results of mink monitoring and control confirm that mink are absent from the receptor area and on-going mink control has been established.

2.2.66 Rafts would be constructed as described in the Game and Wildlife Conservation Trust's (GWCT) guidelines (see Annex 2). Rafts would be fitted with physical excluders in order to prevent otters from becoming trapped.

2.2.67 Surveyors will be appropriately trained and experienced (for example, surveyors who have attended an appropriate course run by the Game and Wildlife Conservation Trust (GWCT) or the British Association for Shooting and Conservation (BASC)).

2.2.68 Rafts would be monitored at least every two weeks. During this period, no traps would be set on the rafts; however, a 'tray' containing a standard mixture of clay and sand would be installed on the raft and this would be monitored for signs of mink presence (i.e. footprints).

2.2.69 Once signs of mink are recorded, traps would be set on the same raft and monitored on a daily basis.

2.2.70 Should a mink (or grey squirrel) be trapped, it would be disposed of in a humane way. All other trapped animals would be released as soon as practicable. Humane dispatch would involve the use of an air weapon (licenced as necessary), as advised by the GWCT on page 6 of the guidelines (see Annex 2).

2.2.71 If a mink is not trapped for a period of between 7 and 10 days, the trap would be removed, and the raft would be returned to monitoring mode until signs of mink activity are recorded again, at which time the trap would be returned and the 7-10 trapping period would continue again.

2.2.72 During survey visits, surveyors would make note of the following information for each mink raft installed: trap location; how the trap is set; number of mink trapped; signs of mink presence; signs of water vole presence.

2.2.73 All information recorded during the trapping surveys would be forwarded to GWT (in order to inform their ongoing mink control and water vole conservation project), to the local records centre, and to NRW.

Displacement of water voles

2.2.74 Since the water voles along the M4CaN Scheme form part of a larger local population that inhabits watercourses across the Gwent Levels, and the majority of the watercourses across the Levels are well connected, displacement of water voles would be suitable, though only under the following circumstances:

- Where habitat loss (temporary or permanent) or habitat disturbance (temporary or permanent) would be no more than 50 m* of a water vole's home range (on each side of the same watercourse), or 30 m where the density of the water vole population is large (i.e. more than one latrine per 5m of bank); and/or
- Where adjoining sections of retained/undisturbed watercourses (within the same home range, where possible) contain habitat favourable to water voles**, or favourable habitat could be created prior to displacement.

** This distance could be increased slightly, with the agreement of NRW (the previous version of the guidance allowed displacement over up to 200 m of bank). Should more than one displacement be required along any one watercourse in any one year, the displacement locations should at least 500 m apart. If this is not the case, a translocation methodology would be undertaken.*

*** Favourable habitat would be confirmed by the ECoW. No displacement would take place until the ECoW has confirmed the receptor site is in favourable condition. Should habitat not be favourable prior to displacement, either displacement would be delayed until after habitat is in favourable condition during the appropriate time of year for a*

displacement, or voles would be taken into captivity, as described under Temporary Captivity*, below, until favourable habitat is available.*

2.2.75 Results of pre-construction surveys would identify watercourses where displacement measures could be suitable, as well as suitable receptor sites. The locations for displacement would be agreed in advance with NRW.

Timing of displacement

2.2.76 Taking into account the construction schedule (i.e. commencement on site in July 2018, with main construction works commencing in late 2018), should receptor sites and weather conditions be favourable, and with NRW approval, water voles could be displaced into adjacent retained favourable watercourses between 15 September 2018 and 30 November 2018, prior to the commencement of infilling or permanent culverting of a watercourse known to contain water voles.

2.2.77 In addition, should the main construction activities in an area be delayed until spring 2019, and permanent culverting or infilling of watercourses not be required until late spring/summer 2019, then displacement of water voles could be undertaken between 15 February 2019 and 15 April 2019.

2.2.78 Displacement would only be undertaken during suitable weather conditions, that is, when maximum day-time temperatures are approximately 5^0C or above.

Vegetation clearance

2.2.79 The following procedure would be implemented for the vegetation clearance element of the displacement process:

- Ecologists would undertake surveys of waterbodies in order to locate any water vole burrows and mark them out on site (e.g. using bamboo canes as marker posts close to but taking care not to block entrances or damage burrows).
- In addition, ecologists would survey for any other potential constraints to displacement (e.g. the presence of nesting birds). Should additional constraints be identified, ecologists would provide appropriate instructions and oversee site works as required in order to prevent a breach of legislation, or other protected species licences, and to prevent unnecessary damage or injury to habitats or species.
- No habitat containing an active bird nest would be removed until it is confirmed by the ecologist that any young have fully fledged and left the nest. Measures to protect active nests would be instructed by the ECoW, and would include the establishment of a protective buffer zone (e.g. 5 metres in width), within which no access would be permitted, no works would be undertaken and no scrub would be cut during this period.
- Bank-side vegetation would be mowed/strimmed/cut with brush cutters within the boundaries of the works area and at least 3 metres from the top of the banks of a waterbody. The work would be undertaken under the direction and supervision of ecologists. Care would be taken to avoid damage to banks and any water vole burrows present. Management would commence from the centre of the working area and move outwards, or in the direction of the retained habitat, in order to enable any animals that might be present to escape the area ahead of the works.

- Cut vegetation would be removed from the banks and disposed of by appropriate means (e.g. to a suitable compost site located away from the banks of the watercourse).
- Ecologists would survey any water vole burrows that might be present, and remove any cut vegetation that might be blocking entrances.
- Ecologists would also remove latrines or feeding remains from within the managed area in order to help identify any new signs of water vole activity that might emerge after habitat management.
- No further displacement works would be undertaken for a period of five days.
- Following five days of no disturbance, ecologists would re-survey for signs of water vole activity. Should no signs of activity be recorded, a destructive search of burrows would be carried out as described below and in accordance with recommendations described in Dean et al. (2016).
- Should signs of water vole activity be identified, the above habitat management measures would be repeated, as necessary, in order to control vegetation regrowth, and monitoring would continue until a period of five days without water vole activity is recorded. A translocation of water voles may be required should water voles continue to return to the works area.

Destructive search

2.2.80 Following successful clearance of the area, a destructive search would be carried out under the on-site instruction and supervision of an appropriately-experienced ecologist. The ecologist would be present in order to instruct contractors, oversee works and capture any water voles that might be disturbed in the process and, if possible, relocate them outside the works area.

2.2.81 The destructive search and reinstatement of habitat would be completed in each location within one day, as described below.

- In addition to the weather requirements listed above, works would be not be undertaken if soils are waterlogged, or during moderate-heavy rainfall.
- Where practicable, hand tools would be used to excavate burrows in preference to mechanical tools.
- Should hand tools not be a practicable solution, excavation works would be undertaken using a mini digger with wide-toothed bucket.
- The mini digger would be used to lift turf and topsoil along the face and top of the banks. Turf and topsoil would be stored on the banks of the watercourses separate from sub-soils, for replacement following the completion of the destructive search.
- Following this initial shallow excavation, the digger would be used to excavate to the full depth of the water vole burrows.
- Any water voles disturbed by the works would be encouraged by the ecologist to move away from the works area and into the retained undisturbed waterbodies. However, in case water voles do not move in the direction required, the ecologist would have a net and suitable gloves to enable the capture and safe handling of water voles. Captured water voles would be transferred by the ecologist to pre-prepared suitable containers containing food (such as apples, carrots and dried rabbit food) and bedding material (i.e. fresh

grass/hay) for temporary housing until they can be relocated to areas outside the clearance area following completion of the destruction search.

- Once burrows have been destructively searched to the satisfaction of the on-site ecologist, remaining bankside scrub of potential value to resting water voles would be uplifted and searched. The digger driver would be instructed by the ecologist to carefully lift roots for the on-site ecologist to search through for any water vole that might be present.
- Within-channel vegetation would then be removed using the digger, or manually.
- Once the ecologist has confirmed the area to be free of water voles, the habitat would be infilled, or culverted if necessary, as soon as practicable. Any captured water voles would be released by the ecologist into adjacent retained sections of the watercourses with favourable conditions (described under *Habitat Suitability Assessment* above), as agreed with NRW.

On-going management to deter water voles

2.2.82 Should it not be possible to commence construction within five days of completing the destructive search in an area, the following measures would be undertaken prior to construction in order to deter water voles from returning to the area:

- repeat scraping or smoothing of the banks using a mini digger, or covering of banks with suitable matting (e.g. Teram) to prevent re-growth of bankside vegetation and prevent burrowing; and/or
- installation and maintenance of water vole exclusion fencing around working areas.

Translocation of water voles

2.2.83 Due to the fact that construction would commence in July 2018, and main construction works are expected to commence in late 2018, it is expected that a trapping exercise of water voles, and translocation into temporary captivity, would be undertaken along the route, prior to the commencement of watercourse infilling and the installation of permanent culverts in late 2018.

2.2.84 In addition, with NRW approval, should favourable receptor sites be available prior to the commencement of watercourse infilling or permanent culverting, a translocation to receptor sites in 2018 could be undertaken. With regard to any water voles that are taken into temporary captivity in 2018, they would be translocated back to receptor sites (i.e. replacement watercourses) but only if:

- they are in favourable condition; and
- on-going works would not present a threat to any water voles or burrows.

2.2.85 The use of replacement watercourses as receptor sites for translocated water voles would not be possible until water vole exclusion fencing has been removed, which would not be undertaken until after the completion of construction works in an area (including the installation of operational fencing). As this is not expected to take place until late 2021, translocations into these watercourses would not be undertaken any sooner than 2022.

2.2.86 However, it is expected that the Scheme would collaborate with GWT with regard to their water vole conservation project across the Gwent Levels and, in particular, with

regard to their proposed habitat restoration and enhancement programme, which aims to create additional watercourses across the Levels that could potentially be favourable receptor sites for water voles.

Timing of translocations

2.2.87 Translocations to receptor sites or temporary captivity would be undertaken between:

- 15 September and 30 November; and/or
- 15 February and 15 April.

2.2.88 Translocations back from captivity to receptor sites would be undertaken between 1 March and 30 August (depending on local weather conditions and the condition of receptor areas). It is considered that a translocation after August may not provide sufficient time for water voles to establish territories, excavate burrows and build sufficient winter food stores to help ensure survival. Furthermore, young water voles would not be released from captivity until they weigh at least 120g, or as otherwise agreed with NRW.

2.2.89 Translocations would only be carried out during suitable weather conditions (i.e. when night time temperatures are above 5^0C and maximum day time temperatures are between 5^0C and 20^0C, avoiding snow, heavy frost and heavy rainfall that could capsize rafts with traps).

2.2.90 Receptor site preparation would commence on the SSSI Mitigation Areas from March 2018 (Tatton Farm, if appropriate) or July 2018 (Caldicot Moor and Maerdy Farm). In addition, some beneficial works on Tatton Farm may be undertaken as part of Welsh Government's on-going management in 2017. Taking these timings into account, should favourable habitat and weather conditions be recorded, it may be possible to translocate some water voles to receptor sites on the SSSI Mitigation Areas between 15 September and 30 November 2018. However, due to the need for water voles to establish territories, excavate burrows and build winter food supplies prior to the onset of winter, this time of year is considered to be sub-optimal for translocations, and therefore any translocation to receptor sites (as opposed to captivity) at this time of year would be subject to NRW approval. Should habitat or environmental conditions not be considered favourable and/or NRW approval for a translocation to receptor sites not be granted, water voles would be translocated to temporary captivity.

Setting of traps

2.2.91 Water vole traps would be constructed in accordance with the description provided at Appendix 2 of Dean *et al*. (2016). They would:

- be constructed from 1cm x 1cm steel mesh;
- be approximately 50cm long x 15cm wide x 15cm high;
- contain an aluminium or wooden shelter at one end, approximately 215 mm in length (as shown in Photographs A3 and A4 of Dean *et al*. 2016) and
- contain a simple locking bar fitting that activates on closure.

2.2.92 Traps would be cleaned and disinfected (in accordance with Annex 1), rinsed in clean cold water and dried after use and between sites. They would be prepared with dry straw bedding and a food supply (e.g. half a sweet apple (not cooking apple) and other food such as a carrot). Food would be replaced at least every other day.

2.2.93 Traps would be:

- set at frequencies of at least 1 trap per 5-10 m of bank;
- located adjacent to latrine sites or well-used runs;
- installed on a flattened surface for stability (banks would be flattened to accommodate the traps without causing significant damage);
- set at a slight incline (up to 450 angle) with the covered chamber at a slightly raised height for more protection against possible submersion during minor fluctuating water-levels; and
- secured in position with bamboo/bean canes.

2.2.94 Should it not be possible to install the traps on the banks of a watercourse (e.g. the banks are too steep or the vegetation is too dense), floating platforms would be used to support traps. Traps would be firmly fixed to the platforms, which in turn would be secured in place to the banks with a rope attached to bamboo canes, or similar, to allow movement with changing water-levels. Traps would be set so that entrances would face the banks.

2.2.95 Traps would be numbered, GPS locations would be recorded, and their locations would be marked on appropriately scaled maps, so that traps could be returned to the same location once emptied and cleaned (as it is likely that more than one water vole could be present in an area). Where young have been trapped, more than one trap would be set in the location in order to ensure all siblings are trapped.

2.2.96 Trapping would be ceased after a period of five days during suitable weather conditions without a capture, assuming there are no recent field signs.

Checking of traps

2.2.97 Traps would be checked at least twice a day, between 6am and 10am and between late afternoon and dusk, by an appropriately experienced ecologist. If daytime conditions are warm, a midday check would also be undertaken.

Destructive search

2.2.98 After a period of five days during suitable weather conditions without a capture (and assuming no recent field signs have been recorded), the trapping survey would be concluded and a destructive search would be undertaken, as detailed for the displacement methodology (see *Destructive search* above).

Handling of water voles

2.2.99 When handling water voles, surveyors would wear disposable gloves and/or wash their hands with a veterinary hand wash (e.g. Hibiscrub or similar) before and after handling water voles to prevent transmission of disease.

2.2.100 All ecologists involved with the trapping and handling of water voles would be provided with advice and information relating to the risk and symptoms of leptospirosis, and methods to minimise the risk of infection.

Recording of captures

2.2.101 The sex, age and approximate size/weight of each captured water vole would be recorded by the ecologists for monitoring of the translocated population. In addition, a

record of the trap number and location of capture, date and weather conditions would also be recorded.

2.2.102 Water voles would then be placed by the ecologists into a suitable container (e.g. into their traps or standard rodent laboratory cage) for translocation to the receptor site.

Health screening

2.2.103 In accordance with Appendix 6 to *The Water Vole Mitigation Guidelines* (Dean *et al*. 2016) veterinary advice would be sought for any animal that appears in poor health. Dean et al. (2016) describe signs of poor condition as "... *diarrhoea, being underweight, having open wounds, dental issues (e.g. an obvious abscess or overgrown teeth), significant fur loss or skin infection, noticeable harsh breathing, discharge, a heavy ectoparasite load or tumours"*.

2.2.104 A health screen would not be undertaken for displaced or translocated animals unless they are obviously in poor health; however, if more than 10% of trapped individuals die prior to release, every effort would be made to preserve the cadavers, and veterinary advice would be sought.

2.2.105 If bovine tuberculosis (TB) is reported at the site of capture, water voles would not be translocated to areas/farms where no record of TB has been reported.

Soft release

2.2.106 Water voles would be released into receptor sites using a soft release methodology.

2.2.107 Only juvenile sibling water voles (of a similar weight that have been trapped in the same location), or a mother with young, would be held in groups through this soft release procedure; all other water voles would be kept and released individually. Should pregnant females be trapped, they would be held in a cage located in a quiet, dark location, and a cover of hessian would be placed over the cage.

2.2.108 Two types of release pen would be used, depending on local conditions, as described below and in Appendix 4 of Dean *et al*. (2016).

2.2.109 Both types of temporary holding pen/cage would consist of standard laboratory cages (approximately 58cm long x 37cm wide x 18cm deep for short term captivity, or larger for longer term captivity) with stainless steel lids and side bars approximately 1cm apart. They would be secure against intrusion by humans and animals as well as against escape by water voles.

Pens without a base

2.2.110 Pens without a base would have a sheet of cardboard (5mm thick) over the ground which water voles would be able to gnaw through in order to excavate burrows into the banks of the watercourse without leaving the safety of the pen.

2.2.111 Predator-proof lids would be installed in order to enable food and bedding to be supplied on a daily basis.

2.2.112 Pens would be located: away from public footpaths and public rights of way; adjacent to the watercourse edge/top of the bank; close to or in areas of tall vegetation; and sunk into the ground to a depth of at least 25cm. Therefore, the structure of the bank at the location of release would determine whether or not this type of pen would be suitable. In addition, pens should be well shaded to prevent over heating of water voles,

which would make open watercourses in the Gwent Levels unsuitable for this type of pen.

2.2.113 Where conditions are suitable, the pens without bases would be located above high water-level so as to prevent flooding, as water voles can choose to remain in the pen for a considerable period of time. The high water-level would be dependent on the time of year, and NRW's water level management programme at that time of year, which would be confirmed with NRW prior to commencement of this method.

2.2.114 Suitable designs for these pens are shown in Photographs A6 and A7 in Appendix 4 of Dean *et al*. (2016) and are described in Box 9E, page 112, of the Water Vole Conservation Handbook (Strachan *et al*. 2011).

Complete pens/cages

2.2.115 Complete cages are appropriate where it is not possible to sink the pen into the ground and where it would be necessary to hold water voles for longer periods (e.g. until ground vegetation has developed sufficiently to provide good ground cover).

2.2.116 Complete pens/cages include bases to prevent water voles from burrowing out, with a baffle fitted at the front of the cage to allow water voles to leave the cage once set in place (as shown in Photograph A8 of Dean *et al*. 2016).

2.2.117 Complete cages would be secured in position adjacent to the watercourse edge/top of the bank, close to or in areas of tall vegetation, above high water-levels and away from public footpaths or access areas. They would be partially covered with tarpaulin or equivalent for shelter.

2.2.118 For short-term holding, following an initial caged period of 5 days, baffles would be fitted to enable water voles to leave. Cages would be retained on site for a period of at least 4 days following this in order to allow water voles to return for shelter and food if required. The fitting of baffles could be delayed for a longer period should the situation be required (e.g. until ground vegetation has developed sufficiently to provide good ground cover and foraging habitat).

Resources for penned/caged water voles

2.2.119 Water voles in pens without bases would be provided with food and bedding for a period of 8 days. Water voles in complete cages would be provided with food and bedding for a period of 5 days, and then, following the fitting of baffles on the sixth day, fresh food would be provided for an additional period of 3 days.

2.2.120 Bedding would comprise a straw bale (approximately 1/6 of a bale), which would be replaced on a weekly basis.

2.2.121 Food (which would consist of at least a quarter of an apple, half a carrot and cut external vegetation) would also be provided on a daily basis. Should water voles be held in complete cages for longer than 6 days, the daily food supply would include a small bowl of dry alfalfa-rich rabbit food and drinking water (e.g. provided in a rabbit drinking bottle clipped on the side of the cage).

2.2.122 Shallow metal trays (e.g. 60cm long x 30cm wide x 10cm deep) filled with water could be provided as swimming trays.

Maintenance of pens/cages

2.2.123 Pens and cages would be checked on a daily basis by the ECoW or otherwise appropriately experienced ecologist(s). During daily checks, food would be replaced.

2.2.124 Pens/cages would also be cleaned out on a weekly basis, or more frequently if groups of siblings are being held together. Waste bedding would be disposed of appropriately. Only material from the front of the cage would be cleared from cages with pregnant females, and the main bedding area would be left undisturbed to minimise disturbance.

Release of water voles

2.2.125 Water voles would be released individually unless they are a group of siblings, or mother and young, which would be released together.

2.2.126 Any young born in the holding cage would be kept in the cage until they have reached a weight of at least 120g.

2.2.127 Individuals of the same sex would be released at least 40 m apart.

Temporary captivity

2.2.128 The Scheme has consulted with Bristol Zoo with regard to water vole temporary captivity. The zoo is particularly suited to a temporary captive programme due to the fact that they:

- hold a BALAI approval licence;
- have experience of water vole captive breeding and translocations;
- have a team of on-site veterinarians who would be available to monitor the health of the water voles whilst in captivity; and
- are located relatively close to the Scheme, enabling any transfer from site to the zoo to be completed during the day of capture (water voles would be located at Bristol Zoo's "Wild Space", which is located to the north of Bristol and therefore, is readily accessible from the M4).

2.2.129 The "Wild Space" site is an area of farmland owned by Bristol Zoo with ample undeveloped space to care for a population of captive water voles.

2.2.130 Bristol Zoo have confirmed their in-principle ability to assist the Scheme, and consultation is on-gong with regard to the development of a detailed method statement for the period of captivity. The method statement would be developed in accordance with *The Water Vole Mitigation Guidelines* (Dean *et al*. 2016), including Appendices 3 and 6, which describe the 'care of captive animals protocol'. The final *Water Vole Method Statement* would include the method statement for captivity and captive breeding.

Health screening

2.2.131 Health screening of individuals trapped for temporary captivity would be undertaken in accordance with Dean *et al*. (2016). As described for translocations (and as described under *Health screen* above), veterinary advice would be sought for any trapped animal that appears in poor health, and if more than 10% of trapped individuals die prior to release, every effort would be made to preserve the cadavers an veterinary advice would be sought.

2.2.132 If water voles are trapped from areas where bovine tuberculosis (TB) has been reported, they would not be returned to receptor sites in areas where no record of TB has been reported.

Fencing

2.2.133 Construction fencing would be installed around the works boundary, and additional water vole exclusion fencing would be installed across connection points between replacement watercourses and connecting watercourse in the surrounding area. This would prevent water voles from entering replacement watercourses until the completion of construction.

2.2.134 Combined, these fences would prevent contractors, machinery and equipment from entering and causing disturbance to areas of value to water voles located outside the works site.

2.2.135 Water vole exclusion fencing would be as specified in Appendix 5 to *The Water Vole Mitigation Guidelines* (Dean *et al*. 2016).

Pollution control measures

2.2.136 Construction would be undertaken in accordance with the Pre-Construction Environmental Management Plan (the Pre-CEMP; Appendix 3.2 to the ES). The Pre-CEMP would include pollution control measures. The final CEMP would be updated prior to construction, and would be agreed with NRW, Monmouthshire County Council and Newport City Council.

2.2.137 Guidelines taken into account in the Pre-CEMP would include:

- Model Procedures for the Management of Land Contamination (CLR11) (Environment Agency and Defra, 2004).
- Groundwater Protection: Principles and Practice (GP13) (Environment Agency, 2013).
- CIRIA Technical Guidance C649: Control of Water Pollution from Linear Construction Projects (CIRIA, 2006).
- EA Pollution Prevention Guidelines (PPG), most notably:
- PPG 1 General guide to the prevention of water pollution.
- PPG 2 Above ground oil storage tanks.
- PPG 3 Use and design of oil separators in surface water systems.
- PPG 4 Treatment and disposal of sewage where no foul sewer is found.
- PPG 5 Work in, near or liable to affect a Watercourse.
- PPG 6 Working at demolition and construction sites.
- PPG 22 Dealing with spillages on highways.

2.2.138 Although the PPGs were withdrawn by the EA in December 2015, this was because the EA ‘no longer provides good practice guidance’. However, the guidelines remain useful.

2.2.139 Other guidance relevant to the construction (and to water voles) which have been taken into account in the Pre-CEMP are listed below.

General measures

- CIRIA C692 Environmental Good Practice on Site (2010).
- CIRIA Working with Wildlife (2011).

Protection of surface and groundwater resources

- CIRIA C648 Control of Water Pollution from Linear Construction Projects (2006).
- Environmental Permitting (England and Wales) Regulations 2010.
- Water Resources Act 1991

Soils

- Environmental Damage (Prevention and Remediation) Regulations 2009
- Environment Act 1995
- Environmental Protection Act 1990

Materials and waste

- Hazardous Waste (England and Wales) Regulations 2005 (as amended)

Noise and vibration

- British Standards Institution (BSI) (1991), British Standard 7445: Description and measurement of environmental noise. Part 2: Guide to the acquisition of data pertinent to land use.
- British Standards Institution (BSI) (1991). British Standard 7445: Description and measurement of environmental noise. Part 3: Guide to the application of noise limits.
- British Standards Institution (BSI) (2014) British Standard 5228: Code of practice for noise and vibration control on construction and open sites. Part 1: Noise + A1:2014.
- British Standards Institution (BSI) (2014) British Standard 5228: Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration.
- British Standards Institution (BSI) (2003). British Standard 7445: Description and measurement of environmental noise. Part 1: Guide to environmental quantities and procedures.
- Part III of the Control of Pollution Act (1974).

Air quality

- Institute of Air Quality Management (2014) Assessment of dust from demolition and construction.
- Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Volume 2.
- Institute of Air Quality Management (IAQM) (2012). Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance.

- Institute of Air Quality Management (IAQM) (2014) Guidance on the assessment of dust from demolition and construction.

2.2.140 The final CEMP would be likely to include:

- **A Pollution Prevention Plan** to minimise risks of contamination during the construction, over and above the protocols and measures outlined in the other strategies and management plans (listed below).
- **Site Waste Management Plan** (SWMP).
- **Soil Handling Methodology** that would follow guidance in Defra's Good Practice Guide for Handling Soils (Defra, 2000) and Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009).
- **Contamination discovery strategy** for managing land contamination identified during construction.
- **Surface Water Management Plan** (SWMP) that would address drainage requirements during pre-construction and construction works. The plan would define water quality criteria and an appropriate monitoring regime.
- **A Groundwater Management Plan** (GMP) for construction.
- **A Pollution Incident Emergency Response Plan**.
- **Remediation Strategy** (Draft strategy is provided at Appendix 11.2 to the ES).

2.2.139 Further details of the proposed pollution control measures are set out in the following paragraphs, and should provide reassurance that sufficient mitigation measures are in place to avoid impacts upon water voles in the surrounding ditch and reen network.

General pollution control measures

2.2.140 Fuel, oil and chemicals would be stored in designated and secure locations within the compounds. The storage area would have an impervious base and a secondary containment such as a bund, to contain any spillages or leaks. The base and bund walls would be impermeable to the material stored and have a capacity to contain at least 110% of the volume stored. The bund would also enclose the ancillary equipment (for example, local fill and draw-off facilities, vent pipes, taps and valves) and have no drain outlets.

2.2.141 Secondary containment for drum storage would be provided by a drip tray, bunded pallet or kerb-bunded area. The capacity would be at least 25% of the total volume of the drums being stored.

2.2.142 Where possible, fuel, oil and chemical storage areas would not be located within 10 metres of a watercourse or 50 metres of a borehole, well or spring, and would be above any flood water level to minimise the risk of a spill entering the water environment. Leaking, damaged or empty drums would be removed from the compounds/working areas as soon as possible, and disposed via a registered waste disposal contractor.

2.2.143 Spill kits (containing sand or absorbent materials) would be kept close to the storage area. Staff would be trained on how to use these kits and once used, the sand/absorbent material would be disposed of via a registered waste disposal contractor.

2.2.144 Refuelling would be undertaken in designated areas on an impermeable surface away from drains or watercourses. All refuelling and bulk deliveries would be supervised, and staff and contractors would receive incident response training. Hoses, valves and pipework would be regularly checked for signs of wear and tear and corrosion.

2.2.145 Security measures would be provided for the storage areas to prevent vandalism and theft. Storage system valves, taps and delivery hoses would be fitted with locks and locked shut when not in use.

2.2.146 Used oils would be stored, transported and disposed of via a registered waste contractor.

Outline Pollution Control and Prevention Plan

2.2.147 The Pollution Control and Prevention Plan would identify all measures to minimise risks of contamination during the construction phase, over and above the protocols and measures outlined in the other strategies and management plans. An Outline Pollution Control and Prevention Plan is provided in Annex E of the Pre-CEMP, and this sets out the procedures for managing a pollution incident.

Outline Groundwater and Surface Water Management Plan

2.2.148 With regard to surface water run-off, the Outline Groundwater and Surface Water Management Plan (OGSWMP) would consider all drainage required during construction and would reference all industry and regulatory pollution prevention guidelines.

2.2.149 The OGSWMP would describe the design of each element of surface water management system required to manage surface water run-off during construction and potential risks to surface waters, including consideration of temporary storage and settlement requirements to manage sediment load of waters.

2.2.150 The OGSWMP would define the water quality criteria to ensure discharge to waterbodies meets regulatory requirements. The OGSWMP would define an appropriate monitoring regime to ensure water quality would be protected to the satisfaction of the regulatory authorities.

2.2.151 Additionally, a site-specific piling risk assessment would be provided, to ensure the most appropriate piling approach and methodology for pile foundations for embankments (above 5 m height) and bridge tower and viaduct pier foundations. The piling risk assessment would minimise the potential for the creation of new pathways and hence cross contamination of waterbodies.

2.2.152 With regard to groundwater, the OGSWMP would reference all relevant industry and regulatory pollution prevention guidelines. The plan would define the nature and approach for groundwater management following its abstraction, including monitoring to determine the acceptability of chemical and physical quality with respect to discharge to the surface water system.

Measures to control polluting discharge from haul road/disturbed areas

2.2.153 All access and egress points from the local highway to the construction works area would be kept clear and, where required, wheel wash facilities would be provided.

2.2.154 Haul roads would be maintained in an adequate condition to ensure they remain fit for use by the appropriate construction vehicles.

2.2.155 During construction, surface water runoff from the embankments would be managed by capture and settlement before being released to the existing reen system. The runoff would be captured in a bunded area in the construction corridor between the main line embankment and the permanent parallel field ditch/replacement reen.

2.2.156 Silt fencing would be also installed where appropriate.

Air quality and dust

2.2.157 The following site-specific measures would be undertaken in high risk areas (where applicable) to reduce dust-emitting activities (as advised by the Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction). Measures would be developed into a Dust Management Plan.

- The name and contact details of the person(s) accountable for air quality and dust issues and the head or regional office contact information would be displayed on notice boards in prominent locations.
- A stakeholder communications plan would be produced.
- A Dust Management Plan would be agreed with the local planning authority.
- All complaints relating to dust and air quality would be recorded. The cause(s) of the complaints would be identified and the appropriate measures to deal with the issue would be taken in a timely manner and recorded. A complaints log would be made available to the local authority as requested.
- Any exceptional incidents would be recorded in a log book, together with details of remediation actions taken.
- Liaison meetings would be held with other high risk construction sites located with 500 metres of the site boundary to ensure plans are co-ordinated.
- Regular inspections would be undertaken to monitor compliance with the Dust Management Plan. Results of inspections would be logged and reported to the local planning authority as requested.
- The frequency of site inspections by the person accountable for air quality and dust issues would be increased during high risk periods, e.g. during prolonged dry or windy conditions.
- The site layout would be planned so that machinery and dust causing activities are located away from receptors (e.g. waterbodies), as far as possible.
- Solid screens or barriers would be erected around key construction compounds or dusty activities. Areas would be enclosed where there is a high risk of dust production.
- Construction practices would avoid generating site run-off of water or mud where possible. Fencing, barriers and scaffolding would be kept clean using wet methods.
- Materials that have the potential to produce dust would be removed from site as soon as possible. Stockpiles would be covered or seeded.

- Engines of stationary vehicles would be switched off. Where practicable, mains electricity or battery power would be favoured over diesel or petrol powered generators.
- A maximum speed limit of 15 mph on surfaced and 10 mph on unsurfaced areas would be imposed, or alternative limits would be agreed with the local authority.
- All cutting, grinding or sawing equipment would be fitted with suitable dust suppression techniques, e.g. water sprays. Non-potable water would be used where possible and appropriate.
- Enclosed chutes, conveyors and covered skips would be used. Drop heights would be minimised and fine water sprays would be used where appropriate.
- Waste would be managed in accordance with the Site Waste Management Plan and burning of waste would be avoided.

Measures specific to demolition

- The inside of buildings would be soft stripped before demolition.
- Effective water suppression would be set in place during demolition (e.g. use of hand held sprays for more effective direction of water).
- Biological debris would be bagged and removed or damped down before demolition.

Measures specific to earthworks

- Earthworks and exposed areas/soil stockpiles would be vegetated or covered with hessian/mulches as soon as practicable to stabilise surfaces and reduce risk of run-off/wind erosion.
- Covers over areas where earthworks are programmed would be removed only within a reasonable timescale.

Measures specific to construction

- Avoid roughening of concrete surfaces (scabbling) if possible.
- Store sand and other aggregates in bunded areas and do not allowed to dry out.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems.
- Ensure bags of fine powder materials are sealed after use and stored appropriately.

Measures specific to track out

- Use water-assisted dust sweeper(s).
- Avoid dry sweeping of large areas.
- Vehicles with dust generating materials would be covered to prevent escape of materials in transport.
- Instigate significant repairs to the haul road surface as soon as reasonably practicable. Record inspections of haul routes and subsequent actions.

- Install hard surfaced haul routes, which are regularly dampened down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is adequate hard surfaced road between the wheel wash facility and the site exit.
- Access gates to be located at least 10 m from sensitive areas (e.g. watercourses) where possible.
- Construct the haul route in a wet form, dressed with a layer of stones and dampened down as required to reduce dust emissions.
- Monitor dust or dust deposits to ensure that levels do not constitute a nuisance to residents or occupants of local buildings. Record complaints relating to dust/air quality and actions taken. The requirement for physical dust monitoring would be agreed with the local planning authority.

Soils

2.2.158 A Soil Handling Methodology would identify the methods for stripping, handling, storage and replacement of soils in temporary land take areas. The methodology would follow the guidance in Defra's Good Practice Guide for Handling Soils (Defra, 2000) and Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009).

2.2.159 Soil stripping would be confined to areas to the west of Church Lane in Coedkernew, and to the north/east of the railway line at Llandevenny. The impacts on water voles in the Levels are therefore likely to be negligible.

2.2.160 Topsoil and subsoils would be stripped separately according to specified depths. The timing of soil striping and handling operations would avoid periods of wet weather or after heavy rainfall in part to help minimise soil run-off.

2.2.161 Topsoil and subsoil would be stored in separate stockpiles. The stockpiles would be a maximum height of 3 metres (topsoil) and 5 metres (subsoil) and would not be positioned adjacent to watercourses.

2.2.162 The stockpiles would be cordoned off from the rest of the works area and protected from construction activities and traffic. The sides of the stockpiles would be graded to avoid ponding. Once prepared, the stockpiles would be seeded using a standard Rye Grass seed mix to minimise soil erosion and to help reduce infestation by nuisance weeds.

Contaminated land

2.2.163 An Outline Remediation Strategy (ORS) (set out in Appendix 11.2 to the ES) would establish the most appropriate approach for managing the risks posed by potential land contamination. A contamination discovery strategy would address management of land contamination identified during construction.

2.2.164 The ORS is based on initial assessments of land contamination. The final strategy would be informed by additional ground investigations and detailed design. The ORS comprises the following elements:

- the methodology to determine acceptability of land quality and contingency measures required;
- appropriate characterisation and verification monitoring to demonstrate that the measures have been completed; and
- chemical reuse criteria (or Re-use Target Concentrations (RTCs)), including monitoring/verification testing requirements. Precautionary RTCs would be developed for materials to be replaced on borrow pits to ensure groundwater quality and groundwater dependent receptors are not adversely affected by backfilling of these structures. The RTCs would be designed to ensure targets agreed with NRW are achieved.

2.2.165 Where practicable and safe to do so, contaminated materials would be reused in construction. The Remediation Strategy would set out the approach for assessing if the material would be suitable for reuse with or without treatment. The strategy would be implemented using a Materials Management Plan (MMP) prepared in accordance with the Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011). An Outline MMP has been prepared and would be developed during detailed design (see below).

2.2.166 Site workers would be given training on how to identify potential contamination and procedures that should be followed. If previously unidentified contaminated land is encountered, the procedure would require works to be stopped immediately and the area would be secured to prevent access to site workers, plant and equipment and to prevent the spread of contaminants. The local planning authority and NRW would be notified and consulted on the proposed measures to deal with the contamination.

2.2.167 Where it has been agreed by the local planning authority and NRW for works to continue, materials would be managed to minimise the risk of cross contamination. Measures might include the following.

- Avoid stockpiling contaminated soils. If the material must be stockpiled (e.g. for testing) it would be stored on hard-standing or an impermeable layer.
- Stockpiles would be covered to prevent rainwater generating contaminated runoff.
- Additional wheel wash facilities would be provided where necessary and traffic movements minimised to ensure contamination is not spread.

Pollution Incident Emergency Response Plan

2.2.168 A Pollution Incident Emergency Response Plan would be developed in accordance with the guidance set out in the Environment Agency's PPG21: Pollution Incident Response Planning (Environment Agency *et al.,* 2009). The Plan would set out the procedures and measures to deal with the event of a pollution incident, including:

- 24-hour contact details for organisations that may need to be involved during or after an incident (e.g. emergency services, NRW, Newport City Council, Monmouthshire County Council, and Dwr Cymru Welsh Water).
- Chemical and waste inventory, accessible to emergency responders, with up-to-date records of substances on site (including likely quantities and product data sheets). The location of drums, containers or bulk storage vessels would be identified on the site plan.

- Pollution prevention equipment inventory, including equipment and materials to deal with pollution incidents (e.g. spill kits, drain mats/covers, pipe blockers, absorbents) and a list of staff trained in the use of any specialist equipment.
- Site plan, including: access routes; emergency services meeting points; areas/ facilities to store raw materials/products/wastes; watercourses; and site drainage.

2.2.169 Emergency procedures to support the Response Plan would be developed. The procedures would define the circumstances when the plan should be activated and would include: names and contact details of staff trained in incident response; roles and responsibilities; types and locations of emergency response equipment available; procedures for recovering spilled products.

2.2.170 All relevant staff would be trained in how and when to contact the emergency services, NRW and other organisations in the Response Plan.

2.2.171 A copy of the Pollution Incident Emergency Response Plan would be incorporated into the Scheme Health, Safety and Environmental Management Plan (HASEMP) that would be kept in the main site offices.

2.2.172 In the event of an emergency, members of the public would be able to contact the site via the 24-hour helpline.

Light spill

2.2.173 During construction, lighting would be provided as required during periods of normal working hours in autumn and winter and for night time working. As described in the Pre-CEMP (and to be detailed in the final CEMP), construction lighting design would include measures to reduce light spill. Lighting would be inward-facing at all construction compounds, and located to ensure required areas are lit with minimal light spill to surrounding habitats (e.g. by positioning light fittings at low level on posts and directing them towards the most frequently-used areas of work). Inward-facing security lighting would be provided at construction compounds on a 24-hour basis.

2.2.174 A more detailed lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed in advance with the local planning authority, and presented in the CEMP.

2.2.175 Operational lighting would be installed at junctions, as shown on Figure 2. Operational lighting would similarly be designed to minimise light spill. Lighting columns would likely be aluminium with LED luminaires that can be directed more precisely, thereby reducing light spill. Warm white LEDs would be favoured, where practicable.

Biosecurity Method Statement for Site Works, including Ecology Surveys

2.2.176 Works (including surveys and monitoring visits) would be undertaken in accordance with a biosecurity risk assessment and safe system of work, a copy of which is included in Annexes C and D to this strategy. The risk assessment and safe system of work would take into account species-specific guidelines for the management and control of non-native invasive species produced by the Non-Native Species Secretariat and NRW.

2.2.177 Any infected (disease or pest) plants, prunings or timber arisings would be dealt with in accordance with arboricultural best practice and up-to-date best practice guidelines published by NRW.

Operational measures

2.2.178 Operational pollution would be managed in accordance with the Operational surface water run-off strategy (Chapter 16 to the ES) and *Operational Drainage Strategy Report* (Appendix 2.2 to the ES). Some specific pollution control measures that would be included in the above reports would be:

- Vegetation clearance and soil stripping operations would take place as late as possible prior to other works in the area.
- Grass cover would be established over temporary topsoil stores.
- Silt fencing would be installed around the margins of topsoil mounds, and other areas where appropriate, to minimise the sediment load of runoff.

2.2.179 Operational surface water run-off would be directed through grassed verge channels and WTAs comprising attenuation lagoons and reedbeds (Chapter 16: Road Drainage and the Water Environment of the ES).

2.2.180 The flow would be slowed through the grass channels. Run-off would then flow from grassed channels into desilting catch pits before flowing into attenuation basins/lagoons. Water from these lagoons would discharge reedbeds for final treatment before discharging into reens with sufficient capacity to accommodate the increase in flow. Discharges would be above summer penning levels, with flap valves at outfall pipes preventing water from returning to the lagoons.

2.2.181 Discharge rates into the reen system would be within limits agreed with NRW. No water would be discharged into any ponds within the vicinity of the Scheme.

2.2.182 The grassed channels would be dry during dry weather, thus enhancing their pollution removal capability; the channels would be lined with a geo-synthetic clay liner below 50 mm of topsoil to prevent pollutants seeping into the underlying ground. The slow flow of run-off through grass would allow the filtration of sediment, and hydrocarbon residues and organic material would be retained and broken down in the vegetation and upper layers of soil.

2.2.183 The drainage system would provide pollution control measures and cater for a 1 in 100 year storm event plus a 30% allowance for climate change. Any storm greater in magnitude would be considered to dilute pollutants to insignificant levels.

2.2.184 In addition, proposals for the SSSI Mitigation Areas included in the *revised M4CaN SSSI Mitigation Strategy* also include arable reversion to species-diverse grassland, which would reduce pollution from agricultural practices in these areas. Management would be in accordance with Mitigation Area Management Plans, to be agreed with NRW in advance. The final *SSSI Mitigation Strategy* will be included in the commitments register for the Scheme (Appendix R18.1 to the ES Supplement).

Collisions/other traffic incidents on the new road

2.2.185 Where pollutants resulting from collisions or other road traffic incidents cannot be contained at source by best practice containment techniques (such as sand bags, bunding/booms, absorption or *in situ* treatment/neutralisation), they would runoff into

the drainage system of grassed channels, WTAs and attenuation lagoons. These would provide opportunities for the removal or treatment of pollutants before discharge into the reen network.

2.2.186 As explained in Chapter 16: Road Drainage and the Water Environment of the ES, each WTA would provide sufficient treatment capacity to ensure the discharge would meet Design Manual for Roads and Bridges (DMRB) requirements and regulatory requirements for the protection of the Gwent Levels SSSIs, most notably with respect to heavy metals, organic contaminants and de-icing salt.

Salt from de-icing operations

2.2.187 Salt would be used in the winter months for de-icing the carriageway. Rock salt used would comply with BS3247, and would be stored according to PPG10. Application rates would adhere to Highways Agency guidelines (Highways Agency, 2009).

2.2.188 Saline dilution would occur rapidly during the flow of run-off along grassed channels and WTAs. By the time saline run-off enters attenuation lagoons, salt concentrations would likely be very low.

2.2.189 As explained in Chapter 16: Drainage and the Water Environment of the ES, short term episodic breaches of chloride concentrations may occur during severe winters, where thaws after freezing conditions can release high loads of dissolved road salt to the WTAs. However, under such extreme conditions, dilution from the thawing of snow and ice is likely to dilute in-channel concentrations to negligible levels.

2.2.190 The application of Highways Agency guidelines and surface water run-off management would mean that the salt concentration of water discharging into the reen network would be unlikely to be sufficiently high to cause adverse effects on aquatic ecosystems, including water voles and their habitat.

Ecological supervision

2.2.191 All works described in this *Water Vole Mitigation Strategy* would be taken forward into the *Water Vole Method Statement* and, as described in this report, would be carried out under the on-site instruction and supervision of an appropriately qualified and experienced ecologist (i.e. an ecologist with water vole survey and handling experience).

Monitoring

Population monitoring

2.2.192 Water voles would be monitored during captivity by appropriate staff at Bristol Zoo. Veterinarians based on site would be available to monitor the health of individuals and treat as necessary.

2.2.193 All water vole receptor sites, as well as culverts and dry pipes that are located adjacent to watercourses where water voles are known to be present, would be monitored for water vole activity on an annual basis for a period of five years following the completion of water vole displacement and/or translocation, or as otherwise agreed with NRW. The objectives of these monitoring surveys would be to:

- assess the condition and suitability of retained, enhanced and new habitats for water voles against the targets set out in Table 2 (below);

- identify signs that could confirm the presence of mink;
- identify signs that could indicate the presence and survival of water voles;
- identify whether or not water voles are spreading into adjoining watercourses; and
- determine whether or not water voles are utilising mammal crossings.

2.2.194 Monitoring effort would take into account recommendations published in Dean *et al*. (2016), as described below. Monitoring surveys would follow the guidance provided in Bang and Dahlstrøm (2001) and Dean et al (2016).

Table 2: Population Monitoring Surveys

Description of Works Impact	Purpose of Monitoring	Monitoring Method, Frequency and Duration
Displacement of water voles from 50 m sections of watercourse (or as otherwise agreed with NRW).	To confirm survival of water voles and continued suitability of habitat.	Single annual monitoring visit during the breeding season (ideally late summer/autumn) in order to locate signs to confirm presence and assess habitat suitability. Survey to be repeated at the same time each year (between March and June) for a period of five years post-displacement.
Culvert installation	To determine whether or not water voles are utilising crossing points.	At culverts closest to known water vole populations, annual surveys of activity either side of entrances to crossing points. Where practicable, remote sensor cameras will be set up over a period of 4 weeks in early spring, and 4 weeks in late summer/autumn.
Translocation of water voles.	To confirm survival of water voles and continued suitability of habitat.	Annual monitoring survey in spring and in late summer/autumn in order to locate signs of water vole activity and assess habitat suitability. Survey to be repeated at the same time each year for a period of five years post-displacement.

2.2.195 Annual monitoring visits would be carried out avoiding periods of prolonged heavy rain. During each survey visit, appropriately experienced ecologists would search for signs of water vole activity in reinstated and created habitats, including water vole burrows, latrine sites and droppings, footprints, feeding stations and bankside runs. Surveys would also include an assessment of habitat condition with regard to water vole requirements.

2.2.196 Findings would inform the ongoing management of the retained and created habitat. Should results of monitoring confirm the need to reinstate mink control measures, or significantly amend habitats or habitat management, NRW would be informed in advance of commencement.

2.2.197 Results of monitoring would be reported on an annual basis (or more frequently as requested) to NRW and to the Gwent Wildlife Trust. Records would also be provided to the local biological records centre.

Habitat monitoring

2.2.198 All watercourses to which water voles are displaced or translocated would be monitored for five years post-construction in order to enable any further works required to create favourable conditions to be undertaken as soon as practicable.

2.2.199 In addition, the establishment of vegetation along reinstated and new waterbodies that are to be enhanced to be of potential value to water voles (i.e. replacement watercourses and watercourses on SSSI Mitigation Areas) would be monitored for a period of five years following the completion of the Scheme.

2.2.200 Monitoring would include, as appropriate, the following measures:

- emergent vegetation would be monitored to confirm it has not become too dense and is maintaining the preferred species;
- patchy bank-side growth would be assessed and, as considered necessary, measures would be undertaken in order to ensure good ground cover (e.g. the spreading of silts from other species-rich watercourses, the spreading of an appropriate seed mix, or re-introduction of annual strimming to enable less competitive grass species to become established); and
- should more competitive grasses or weed species become dominant, banks would be strimmed in late summer/early autumn and/or early spring to create a more competitive short sward at the start of the growing season to encourage the establishment of a greater diversity of species.

2.2.201 Bank-side topography would be monitored in case of slumping or erosion, which may render it unsuitable for burrowing. Repairs would be carried out as required; these could comprise reseeding in order to establish good ground cover to hold soils in place, or the installation of temporary stock fencing to prevent damage by trampling.

2.2.202 Drainage function would also be monitored to ensure that banks have stabilised and that drainage is not impaired. Where necessary, the watercourse would be de-silted.

2.2.203 Any ditch management required would be instructed by an appropriately qualified and experienced ecologist, and would be carried out sympathetically in accordance with guidance provided in Strachan *et al*. (2011). Works would be overseen by the ecologist. Liaison would be carried out with NRW, not least because it may be NRW that would carry out the work (depending on the location and nature of the watercourse).

Fence monitoring

2.2.204 Monitoring of water vole exclusion fencing would be undertaken on a daily basis whilst the watercourses are holding water, and at least once a week if watercourses are dry or as soon as practicable after a period of heavy or prolonged rain. The aim of the monitoring will be to ensure any blockages are removed from the fence line and to enable any necessary repairs to be undertaken as soon as practicable.

Pollution control monitoring

2.2.205 Monitoring would be undertaken to:

- ensure that environmental measures have been achieved/are achieving their intended purpose;
- identify successes, failures or weaknesses in the application of those measures;
- identify remedial measures required to achieve environmental requirements;
- inform performance reports required under the contract; and
- ensure environmental commitments set out in the Pre-CEMP and final CEMP are being implemented.

3 Post Development Mitigation Contingencies

3.1 Management measures relating to the long term management of new or replacement waterbodies located within the operational boundary of the Scheme would be contained in the *Environmental, Landscape and Ecology Aftercare Plan* (*ELEAP*). The plan would include watercourse management to benefit water voles. The *ELEAP* would be flexible in order to enable management to adapt to changing baseline conditions to meet the objectives of this draft Water Vole Mitigation Strategy.

3.2 In addition to the *ELEAP*, the management of watercourses of potential value to water voles in the SSSI Mitigation Areas would be detailed in the *SSSI Mitigation Area Management Plans* that would form part of any tenancy agreement.

3.3 The *ELEAP* and the *SSSI Mitigation Management Plans* would be listed in the Scheme's Register of Commitments.

3.4 Results of the population and habitat monitoring surveys would inform the on-going management of the replacement watercourses as described in the *ELEAP* and *SSSI Management Plans*. Results of surveys would be reported to the Welsh Government and the Contractor (and, if requested, to NRW) during both the construction and post-construction phases.

3.5 During the first 5 years following construction, the Contractor would be responsible for the ongoing management and establishment of habitats within the operational boundary of the Scheme, as well as on land obtained for mitigation works (including replacement watercourses located outside the operational boundary of the Scheme) and culverts. Habitat management would be undertaken in accordance with the *ELEAP*. Thereafter, responsibility for on-going maintenance would be passed to Welsh Government's highway maintenance contractor (currently the South Wales Trunk Road Agency, SWTRA). The *Handover Environmental Management Plan* (HEMP) would set out the proposed strategy for the future maintenance and management of the mitigation measures for the following 10 year period.

3.6 NRW would be consulted on both the *ELEAP* and the *HEMP*.

3.7 It is envisaged that habitat management requirements of watercourses within the operational boundary of the Scheme, informed by monitoring surveys, would be confirmed on an annual basis during the 5 year aftercare period. After this, management requirements for land managed by SWTRA (the managing agent during operation) could be confirmed on a two year rotation; however, should adverse factors such as invasive species be recorded, an annual management review would be reinstated until adverse factors have been removed or are no longer a significant concern. Should any adverse factors require significant amendments to the management plans, NRW would be invited to review the amended management plans in advance of their implementation.

4 Timetable of Works

4.1 Table 3 below summarises the schedule of mitigation measures to be set in place for the protection of water voles.

Table 3: Schedule of Mitigation Measures

Mitigation measure	Date/Timing	Description of work
	2017	
Pre-construction survey to inform the *Water Vole Method Statement*	Mid-April/early May – September inclusive	*Survey area*: watercourses within the M4CaN land-take boundary and a surrounding 100 m-wide buffer zone. *Survey methodology*: in accordance with guidelines published in Strachan *et al.* (2011). *Aim*: to identify changes in baseline conditions and inform the final *Water Vole Method Statement*.
	2018	
Pre-construction survey to inform the *Water Vole Method Statement*	Mid-April/early May – September, inclusive, and prior to construction in an area	Survey method as described for the 2017 surveys.
Mink control	From late March/April 2018, where possible (and with land owner permission) OR from July 2018 and prior to displacement/translocation	As required, to undertake mink control along all watercourses where water voles have been displaced or translocated to. To ensure mink are absent from an area prior to displacing/ translocating water voles to the area. Standard methods to be used.
On-going management of watercourses on the Tatton Farm SSSI Mitigation Area.	From July 2018, with the potential to commence from March 2018	Management to benefit water voles (and other species including great crested newts and plants) in accordance with the *revised SSSI Mitigation Strategy*.
Enhancement and on-going management of watercourses on the Maerdy Farm and Caldicot Moor SSSI Mitigation Areas.	From July 2018	Creation and re-profiling of watercourses, removal of bankside scrub to benefit water voles, etc. in accordance with the *revised SSSI Mitigation Strategy*.
Pollution control measures	From a construction start date of July 2018	Set in place pollution control measures for the start of construction.
Fencing	From July 2018	Installation of construction boundary fencing, comprising a post-and-wire fence with stock-proof netting.
Installation of temporary culverts to enable construction of the haul road and enabling works	From July 2018	Where practicable, temporary culverts would be installed in watercourses under the haul road to allow continued access to water voles before the main construction activities.
Creation of replacement watercourses	From July 2018, as soon as practicable after access to an area has been achieved	Excavation of replacement watercourses to the north and south of the new road, including seeding with material from

Mitigation measure	Date/Timing	Description of work
	through the construction of the haul road	donor watercourses.
Installation of water vole exclusion fencing across replacement watercourses.	Prior to connecting replacement watercourses to adjacent watercourses.	Installation of water vole exclusion fencing between replacement watercourses and adjacent watercourses, so as to prevent water voles from accessing replacement watercourses until construction in the area is complete.
Assessment of habitat condition at receptor sites	Prior to displacement / translocation measures in 2018	ECoW to confirm whether or not receptor sites are in favourable condition. No displacement/ translocation to a receptor site until habitat conditions are confirmed to be favourable.
Trapping and translocation of water voles to temporary captivity or favourable receptor sites, with NRW approval	15 September 2018 - 30 November 2018 (during suitable weather conditions)	Intensive trapping of water voles along watercourses where water voles are present and that are to be in-filled, culverted or diverted. Immediate translocation to receptor sites, or to temporary captivity, as appropriate and in accordance with a detailed method statement, pre-approved by NRW.
As necessary (and following NRW approval), displacement of water voles.	15 September 2018 - 30 November 2018 (during suitable weather conditions)	Displacement of water voles from an area into favourable receptor sites. Measures to include: strimming/cutting vegetation along watercourses to be culverted or in-filled; destructive search of the banks; and maintenance of bare substrate prior to infilling. Ecology supervision and instruction required. No displacement until the ECoW has confirmed receptor sites are in favourable condition.
In-filling, culverting and/or diversion of watercourses previously containing water voles	Following translocation/ displacement of water voles to temporary captivity/ receptor areas, and only after approval received from the ECoW to commence	In-filling, culverting or diversion of watercourses where water voles have been trapped out/displaced. ECoW to confirm water vole works complete prior to the commencement of in-filling, culverting or diversion.
	2019	
Captive breeding	2019	Care for and breeding of population in captivity at Bristol Zoo (in accordance with NRW-approved method statement).
Assessment of habitat condition at receptor sites	Prior to displacement / translocation measures in 2019	ECoW to confirm whether or not receptor sites are in favourable condition. No displacement / translocation to a receptor site until habitat conditions are confirmed to be favourable.
As necessary (and following NRW approval), displacement of water voles.	15 February 2019 – 15 April 2019	Displacement of water voles from an area into favourable receptor sites. Measures to include: strimming/cutting vegetation along watercourses to be culverted or in-filled; destructive search

Mitigation measure	Date/Timing	Description of work
		of the banks; and maintenance of bare substrate prior to infilling. Ecology supervision and instruction required. No displacement until the ECoW has confirmed receptor sites are in favourable condition.
Should this be required, additional trapping and translocation of water voles to temporary captivity or receptor sites	15 February 2019 – 15 April 2019	Intensive trapping of water voles along watercourses where water voles are present and that are to be in-filled, culverted or diverted. Captured water voles to be translocated immediately to favourable receptor sites or captivity.
Release of captive water voles in favourable receptor sites	15 February 2019 (depending on local weather conditions) – 31 August 2019	Captive water voles to be soft-released, following NRW approval, into favourable receptor sites (as confirmed by the ECoW).
In-filling, culverting or diversion of watercourses previously containing water voles	Post dispersal or translocation and following approval to commence works from the ECoW	In-filling, culverting or diversion of watercourses from which water voles have been displaced/translocated. ECoW to confirm water vole works have been completed in the watercourse prior to the commencement of in-filling, culverting or diversion.
	2020 – 2022	
Captive breeding	2020-2022	As required, continued care for and breeding of population in captivity at Bristol Zoo (in accordance with NRW-approved method statement).
Assessment of habitat condition at receptor sites	Prior to release of water voles into receptor sites in 2020-2022 (as required)	ECoW to confirm whether or not receptor sites are in favourable condition. No release of captive water voles to a receptor site until habitat conditions are confirmed to be favourable.
Release of captive water voles into favourable receptor sites	15 February 2020-2022 – 31 August 2020-2022 (as required)	Captive water voles to be soft- released, following NRW approval, into favourable receptor sites (as confirmed by the ECoW).
Removal of water vole exclusion fencing	Following construction in an area (including removal of construction bunds and installation of operational fencing)	Water vole exclusion fencing to be removed from replacement watercourses in order to enable water voles to be translocated from captivity into the watercourses and/or to enable water voles from the surrounding area to move in.
Monitoring		
Pollution control monitoring	Throughout construction	Monitoring measures set out in the Pre-CEMP.
Monitoring of fences	From installation until removal	Regular checks of water vole exclusion fencing (daily if watercourses are holding water, or at least once a week if dry) in order to enable any blockages to be removed to prevent impacts on flow and to enable repairs to be undertaken as soon as practicable.

Mitigation measure	Date/Timing	Description of work
Ecology works monitoring	Prior to, during and post construction	Monitoring of all ecology works detailed in the Water Vole Method Statement and reporting by the Ecological Clerk of Works (ECoW) and where necessary, the independent Ecology Auditor.
Population monitoring – post-displacement	March – June, post-displacement and for 5 years post-construction (or as otherwise agreed with NRW)	Single annual monitoring visit during the breeding season (ideally late summer/ autumn) in order to locate signs to confirm presence of water voles and assess habitat suitability.
Population monitoring - culverts	Four weeks in early spring and four weeks in late summer/autumn	At culverts closest to known water vole populations, surveys of activity either side of culvert entrances (using remote sensors, where possible).
Population monitoring - post-translocation	Spring and late summer/ autumn post translocation and for 5 years post construction (or as otherwise agreed with NRW)	Surveys to locate signs of water vole activity and assess habitat suitability.
Habitat monitoring – receptor sites	March – June, post habitat creation (or as otherwise agreed with NRW)	All watercourses to which water voles are displaced or translocated to be assessed to determine whether any further work is required to maintain favourable conditions.
Habitat monitoring – enhancement sites (i.e. not sites into which water voles have been moved)	March – June, for 5 years, post construction (or as otherwise agreed with NRW)	Monitoring of the establishment of vegetation along reinstated and new waterbodies that are to be enhanced for water voles (i.e. replacement watercourses and watercourses on SSSI Mitigation Areas).
Management		
Management of receptor sites	On-going from March 2018 (Tatton Farm) / from July 2018 (elsewhere)	Watercourses in SSSI Mitigation Areas to be managed in accordance with the SSSI Management Plans. Replacement watercourses to be managed in accordance with the ELEAP.

5 Mechanisms for Ensuring Delivery of Post-Development Works

5.1 The Contractor would be responsible for adhering to the requirements of the *Water Vole Method Statement* during the construction and subsequent five-year aftercare period.

5.2 The Welsh Government would be responsible for ensuring the post-development management of new habitats within the operational boundaries of the new road and any land acquired for mitigation works, which will include replacement watercourses outside the Scheme's operational boundary.

5.3 It is anticipated that NRW would manage the reen system within the boundaries of the development site following the five-year aftercare period and post-development.

6 Measures to Ensure Compliance with the Water Vole Method Statement

6.1 The Contractor would be responsible for commissioning an appropriately qualified and experienced Environmental Clerk of Works and an Ecologist/Ecological Clerk of Works (ECoW) who would be responsible for the management and co-ordination, on-site supervision and, where appropriate, direct undertaking of works described in this draft Water Vole Mitigation Strategy and the subsequent Water Vole Method Statement.

6.2 Site inductions and toolbox talks provided to all personnel involved in the development would cover the requirements of the *Water Vole Method Statement*. All contractors would be informed of the need to halt works in an area and notify the ECoW or on-site ecologist(s) if a water vole or (potential) water vole burrow is located during construction, and to await instruction from the ECoW before continuing works in the area.

6.3 A daily record of all works undertaken as described in the *Water Vole Method Statement* would be maintained by the on-site ecologist(s), and these records would be collated by the ECoW and included in the site diary (record of site works undertaken).

6.4 Regular progress updates would be provided by the ECoW to the Contractor, Welsh Government and NRW. Regular Environmental Liaison Group meetings would be held between the Contractor, NRW and other relevant consultees (e.g. GWT) throughout the pre-construction and construction phase, or as otherwise requested by NRW. The ECoW (and ecologist where applicable) would be available to attend these meetings as required or requested. Works undertaken as part of the requirements of the Water Vole Method Statement could be discussed at these meetings.

6.5 The ECoW would be responsible for ensuring an end-of-works report for areas covered by the Water Vole Method Statement is completed and submitted to NRW and the Welsh Government/ Employers Agent for review.

Independent Ecological Compliance Audit

6.6 The Welsh Government would be responsible for commissioning an ecologist to undertake an independent ecological compliance audit of all works described in the *Water Vole Method Statement*.

6.7 The compliance auditing ecologist would undertake auditing site visits as considered necessary to monitor compliance with the *Water Vole Method Statement*. Auditing site visits would be carried out unannounced and/or at short notice, as appropriate.

6.8 The compliance auditing ecologist would report the findings of the audit to the Welsh Government, the Contractor and NRW in a pre-approved format. Reports would be provided on a fortnightly basis, or as otherwise requested or required, and within 24 hours of any potential major non-compliance.

6.9 The independent audit would be included in the Register of Commitments for the Scheme.

Mitigation Contingencies

6.10 A series of measures would be implemented to help minimise the potential occurrence of unforeseen or unintentional events that do not adhere to the requirements of the *Water Vole Method Statement*. These measures would include:

- Site inductions, toolbox talks and site instructions, to include the requirements of this *draft Water Vole Mitigation Strategy* and the subsequent *Water Vole Method Statement*.
- An ecological watching brief for ecology works described in the *Water Vole Method Statement,* to be provided by the ECoW, or otherwise appropriately-qualified and experienced ecologist, to minimise the potential for injury or adverse impacts on water voles.
- Prior to in-filling or blocking-off of watercourses, a pre-construction survey undertaken by an appropriately-experienced ecologist, to confirm the absence of water voles or, if present, to provide advice regarding mitigation measures required.
- Ongoing monitoring of waterbodies where water voles have been displaced or translocated from undertaken by ecologists, as detailed in this draft Water Vole Mitigation Strategy prior to infilling or culverting.
- During construction in an area, regular maintenance checks of any water vole fencing, in order to ensure repairs are made as soon as practicable.
- Post-construction monitoring of water vole activity and habitat establishment along replacement and new watercourses, in order to inform the need for additional mitigation and/or management measures.
- An independent ecological compliance audit to be completed and reported regularly.

6.11 The *Water Vole Method Statement* would be flexible, and would need to be able to respond should any of the measures detailed above prove to be insufficient and/or should baseline conditions change. It would be updated to ensure every effort is made to protect water voles and adhere to the Wildlife and Countryside Act 1981 (as amended). The results of monitoring and auditing surveys would inform any amendments required to the Method Statement.

7 Land ownership – Mitigation Sites

7.1 During construction, the Welsh Government would own the freehold of the footprint of the M4CaN scheme and all land acquired for mitigation works during the construction period. The Welsh Government would also have title over the land acquired temporarily for the purposes of construction.

7.2 Post-construction, during the operational phase, the Welsh Government would continue to own the freehold of the footprint of the M4CaN Scheme and all land acquired for mitigation works, including the replacement watercourses outside the operational boundary of the Scheme but inside the boundary of land take.

7.3 Following restoration, land located outside the Scheme boundary (e.g. construction compound sites) would be returned to the relevant landowner.

8 References

Bang, P. and Dahlstrøm, P. (2001) *Animal tracks and Signs*. Oxford University Press, Oxford.

Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016) *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series).* Eds. Fiona Mathews . and Paul Chanin. The Mammal Society, London.

Defra (2000) Good Practice Guide for Handling Soils

Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites

Highways Agency (2009) DMRB Volume 11, Section 3, Part 10. HD 45/09 Road Drainage and the Water Environment

Natural England (2014) Water voles: surveys and mitigation for development projects (updated 2015) (available at: *https://www.gov.uk/guidance/water-voles-protection-surveys-and-licences)*

Strachan, R., Moorhouse, T. & Gelling, M. (2011) Water vole Conservation Handbook (third edition). WildCRu: Oxford.

Figure 1: Desk Study

Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- 1km Search
- 2km Search
- European Water

Note:
All records fall within a 100 m by 100 m grid square or less and have been plotted within the centre of the grid square they were recorded in.

Counts are not shown.

The scheme and search area shown reflects the design at time of survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

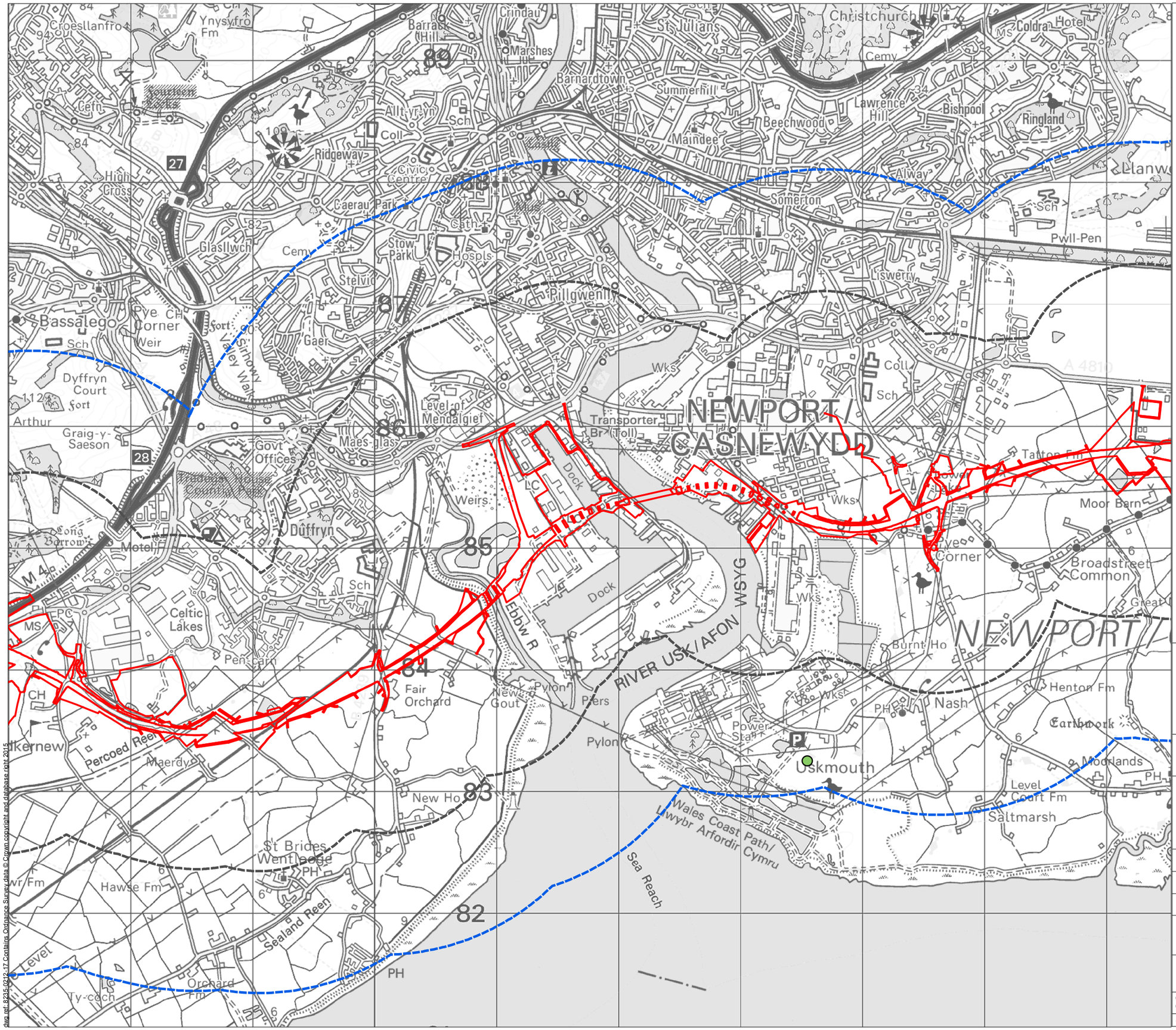
Water Vole Desk Study

Figure: 1a	Revision: -
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:30,000
0 500 1,000 m

N

dwg ref: 8235-0212-17



Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- 1km Search
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Note:
All records fall within a 100 m by 100 m grid square or less and have been plotted within the centre of the grid square they were recorded in.

Counts are not shown.

The scheme and search area shown reflects the design at time of survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

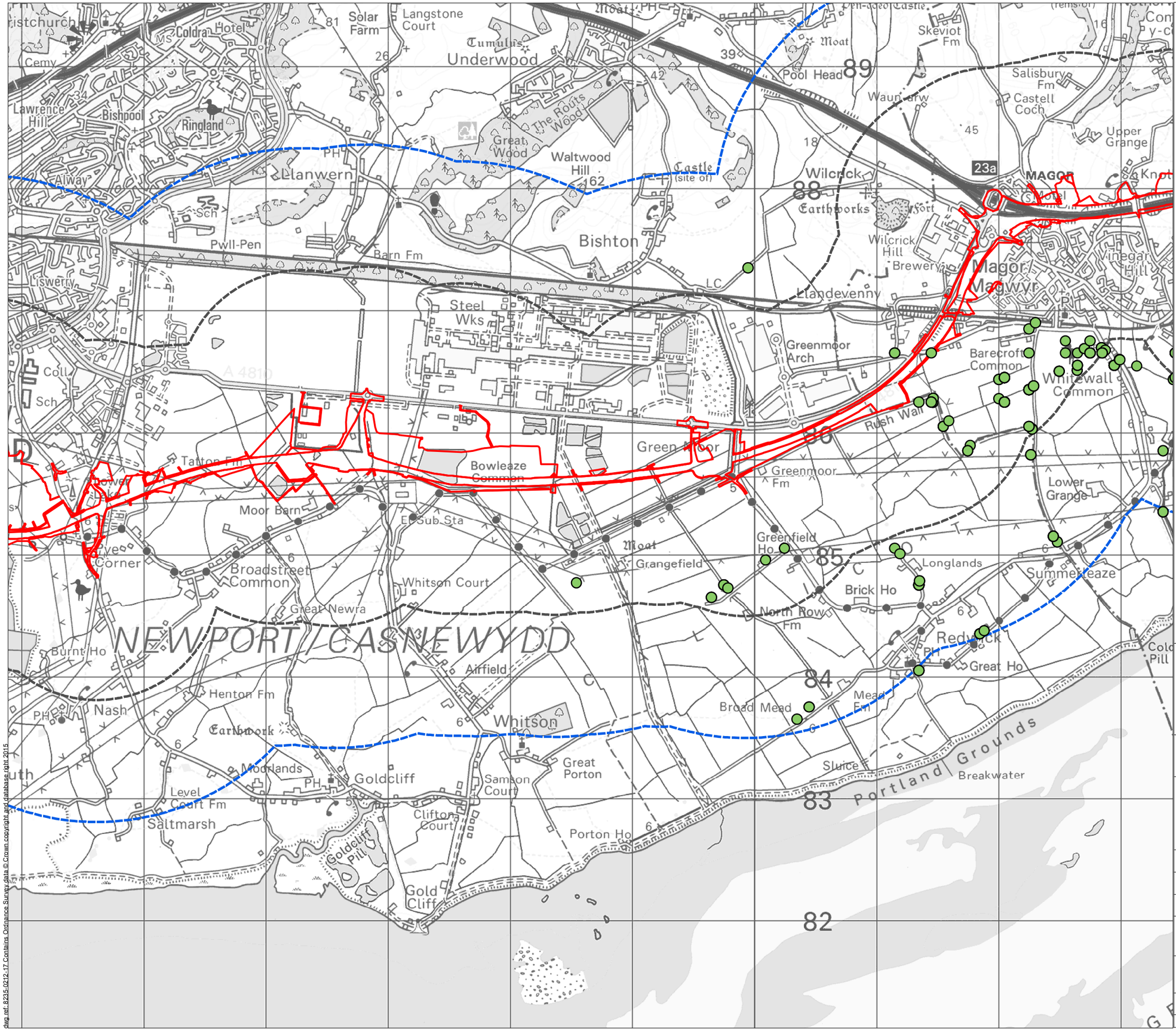
Water Vole Desk Study

Figure: 1b	Revision: -
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:30,000
0 500 1,000 m

N

dwg ref: 8235-0212-17



Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- 1km Search
- 2km Search
- European Water

Note:
All records fall within a 100 m by 100 m grid square or less and have been plotted within the centre of the grid square they were recorded in.

Counts are not shown.

The scheme and search area shown reflects the design at time of survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

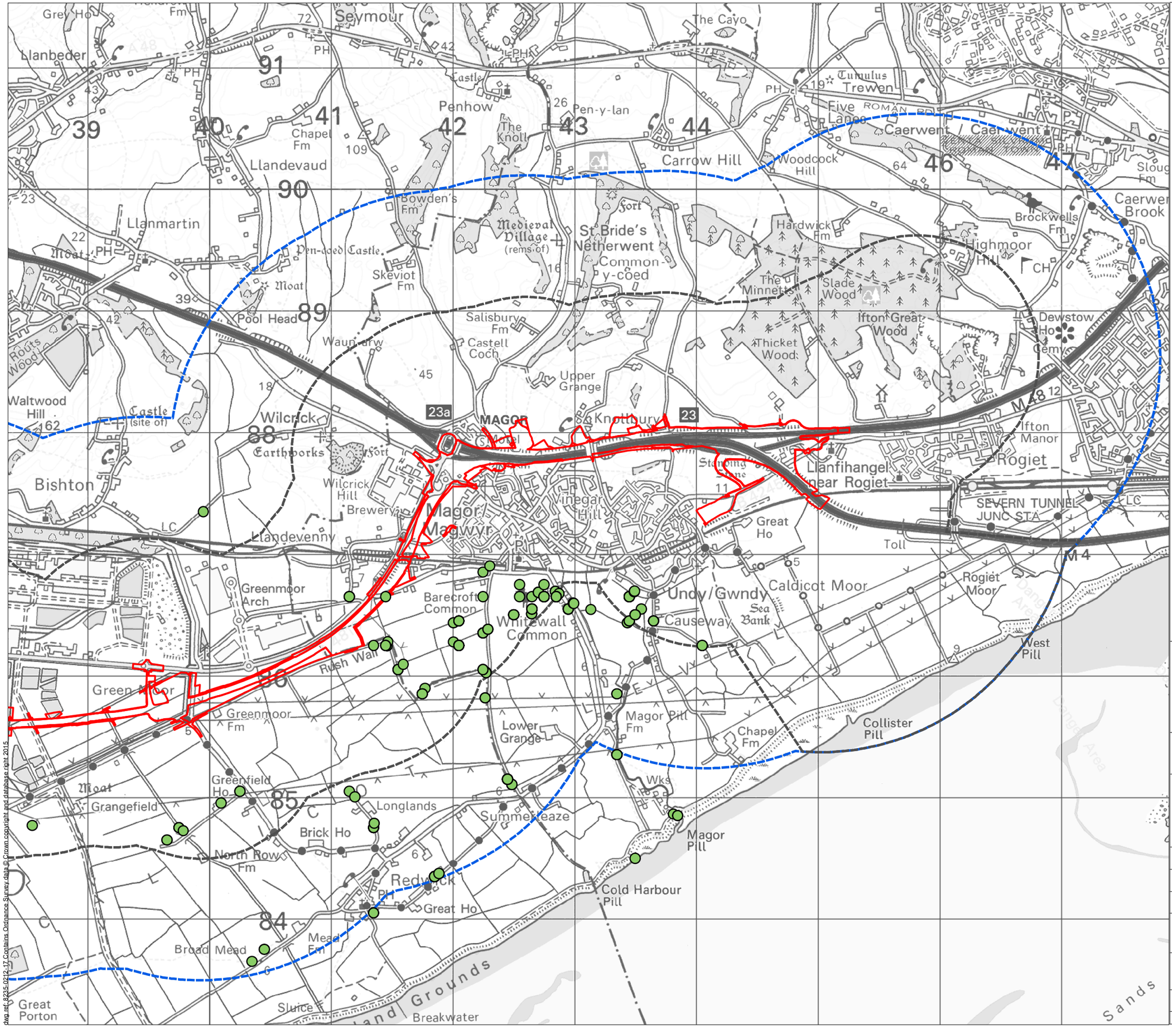
Water Vole Desk Study

Figure: 1c	Revision: -
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:30,000
0 500 1,000 m

N

dwg ref: 8235-0212-17



Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- 1km Search
- 2km Search
- European Water

Note:
All records fall within a 100 m by 100 m grid square or less and have been plotted within the centre of the grid square they were recorded in.

Counts are not shown.

The scheme and search area shown reflects the design at time of survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Water Vole Desk Study

Figure: 1d	Revision: -
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:30,000
0 500 1,000 m

N

dwg ref: 8235-0212-17

Figure 2: Field Survey Results and Mitigation

SMN-0430 ATHENS WAY CULVERT

SMN-0450 ELM CULVERT

SMN-0460 CHURCH LANE CULVERT

SMN-0510 NANT-Y-MOOR REEN CULVERT
Single span pre-cast box culvert
Width:1.8 m
Height: 1.8 m
Length: 30 m
Freeboard height: 0.66 m

WV1 WV2 WV3 WV4 WV5 WV6 WV7 WV8 WV9 WV10 WV11 WV12 WV13 WV14

Maerdy Farm SSSI Mitigation Area

Legend

- Permanent highway land within fenceline, including water treatment areas
- Other permanent land take e.g. mitigation planting.
- Temporary construction land
- Ecological mitigation
- Water Treatment Areas
- 250m Study area
- Indicative location of mammal crossing: 900 mm diameter pipes
- Indicative location of proposed culvert to include a minimum of 200 mm free board above the summer penning level of reens
- Relpacment reen
- Replacment field ditch

2014 and 2015 Otter and Watervole Surveys

- Water vole presence confirmed - no burrows recorded
- Water vole presence confirmed – burrows recorded
- Operational lighting

*Culverts without dimensions are to be confirmed

Study area shown reflects the scheme design at the time of the survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Field Survey Results and Mitigation

Figure: 2a	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:7,500
0 125 250 m

N

dwg ref: 8235-0586-12

SBR-0835 SEA WALLREEN BRIDGE
Single span box culvert.
Width: 4.2 m
Height: 4.5 m
Length: 93.6 m

SMN-0805 PONT-Y-CWCW COMPENSATORY REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 52 m
Freeboard height: 0.45 m

SMN-0800 PONT-Y-CWCW REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 59 m
Freeboard height: 0.45 m

SMN-0810 NEW DAIRY FARM CULVERT

SMN-0680 MORFA GRONW REEN CULVERT
Single span pre-cast box culvert
Width:1.8 m
Height: 1.8 m
Length: 72 m
Freeboard height: 0.2 m

SMN-0550 SDR REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 54 m
Freeboard height: 1.26 m

SMN-0580 PONT-ESTYLL CULVERT

SMN-0730 RAILWAY COTTAGE CULVERT

SMN-0770 OLD DAIRY REEN FIELD ACCESS CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 10 m
Freeboard height: 0.2 m

SMN-0775 OLD DAIRY REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 62 m
Freeboard height: 0.2 m

SBR-0570 PERCOED REEN BRIDGE
potentially with mammal ledge
Single span box culvert.
Width:4.2 m
Height: 2.1 m
Length: 52.4 m
Freeboard height: 0.96 m

WV9 WV11 WV13 WV14 WV10 WV12 WV16 WV18 WV21 WV17 WV15 WV20 WV23 WV22 WV19 WV24 WV25

Maerdy Farm
SSSI Mitigation Area

Duffryn

Legend

- Permanent highway land within fenceline, including water treatment areas
- Other permanent land take e.g. mitigation planting.
- Temporary construction land
- Ecological mitigation
- Water Treatment Areas
- 250m Study area
- Indicative location of mammal crossing: 900 mm diameter pipes
- Indicative location of proposed culvert to include a minimum of 200 mm free board above the summer penning level of reens
- Relpacment reen
- Replacment field ditch

2014 and 2015 Otter and Watervole Surveys

- Water vole presence confirmed - no burrows recorded
- Water vole presence confirmed – burrows recorded
- Operational lighting

*Culverts without dimensions are to be confirmed

Study area shown reflects the scheme design at the time of the survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Field Survey Results and Mitigation

Figure: 2b	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:10,500
0 175 350 m

N

dwg ref: 8235-0586-12

Tatton Farm - mammal ledges to be installed along culverts where practicable and where no health and safety constraints exist

SMN-1305 TATTON FARM ACCESS CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 11 m
Freeboard height: 0.245 m

SMN-1310 JULIAN'S REEN ACCESS TRACK CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 11 m
Freeboard height: 0.245 m

SMN-1245 PYE CORNER CULVERT

SMN-1295 TATTON ROAD CULVERT

SMN-1225 LAKE'S REEN SOUTH ACCESS CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 12 m

SMN-1430 ELLEN'S REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 56 m
Freeboard height: 0.76 m

SMN-1445 Ellen's Reen Diversion Track Culvert
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 11 m
Freeboard height: 0.76 m

SMN-1350 FIELD CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 54 m
Freeboard height: 1.15 m

SMN-1330 TATTON FARM CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 55 m
Freeboard height: 1.15 m

SMN-1300 JULIAN'S REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 56 m
Freeboard height: 0.245 m

SMN-1250 JULIANS REEN FARM ACCESS CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 10 m
Freeboard height: 0.245 m

SMN-1180 PICKED LANE CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 74 m

SMN-1230 LAKE'S REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 56 m
Freeboard height: 0.245 m

SMN-1240 JULIAN'S REEN SIDE ROAD CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 15 m
Freeboard height: 0.245 m

Tatton Farm
SSSI Mitigation Area

WV26 WV27 WV28 WV29 WV30 WV31 WV32 WV33 WV34 WV35 WV36 WV37 WV38 WV39 WV40 WV41 WV42 WV43 WV44 WV45 WV46

Legend

- Permanent highway land within fenceline, including water treatment areas
- Other permanent land take e.g. mitigation planting.
- Temporary construction land
- Ecological mitigation
- Water Treatment Areas
- 250m Study area
- Indicative location of mammal crossing: 900 mm diameter pipes
- Indicative location of proposed culvert to include a minimum of 200 mm free board above the summer penning level of reens
- Relpacment reen
- Replacment field ditch

2014 and 2015 Otter and Watervole Surveys

- Water vole presence confirmed - no burrows recorded
- Water vole presence confirmed – burrows recorded
- Operational lighting

*Culverts without dimensions are to be confirmed

Study area shown reflects the scheme design at the time of the survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Field Survey Results and Mitigation

Figure: 2c	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:9,000
0 150 300 m

N

dwg ref: 8235-0586-12

SMN-1475 GLAN LLYN LINK SAR DITCH CULVERT

SMN-1480 BLACK WALL REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 101 m
Freeboard height: 0.65 m

SBR-1480 MONK'S DITCH BRIDGE with mammal ledge
Single span box culvert.
Width:4.2 m
Height: 2.1 m
Length: 95 m
Freeboard height: 0.7 m

SBR-1640 STEELWORKS DEDICATED REEN BRIDGE
Single span box culvert.
Width: 4.2 m
Height: 4.0 m
Length: 54 m

SMN-1655 ELVER PILL REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 61 m
Freeboard height: 0.935 m

Legend

- Permanent highway land within fenceline, including water treatment areas
- Other permanent land take e.g. mitigation planting.
- Temporary construction land
- Ecological mitigation
- Water Treatment Areas
- 250m Study area
- Indicative location of mammal crossing: 900 mm diameter pipes
- Indicative location of proposed culvert to include a minimum of 200 mm free board above the summer penning level of reens
- Relpacment reen
- Replacment field ditch

2014 and 2015 Otter and Watervole Surveys

- Water vole presence confirmed - no burrows recorded
- Water vole presence confirmed – burrows recorded
- Operational lighting

*Culverts without dimensions are to be confirmed

Study area shown reflects the scheme design at the time of the survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Field Survey Results and Mitigation

Figure: 2d	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:9,000
0 150 300 m

N

dwg ref: 8235-0586-12

SMN-2010 SOUTH WALES MAINLINE CULVERT

SMN-1980 BARELAND STREET EAST SOUTH CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 37 m

SMN-1970 BARELAND STREET EAST NORTH CULVERT
Single span pre-cast box culvert
Width: 1.5 m
Height: 1.5 m
Length: 25 m

SMN-2010 SOUTH WALES MAINLINE CULVERT

SMN-1750 NORTH ROW SAR CULVERT

SMN-1925 PETTY REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 60 m
Freeboard height: 0.35 m

SBR-1755 MIDDLE ROW REEN BRIDGE
Single span box culvert.
Width: 4.2 m
Height: 2.1 m
Length: 18 m
Freeboard height: 0.2 m

SMN-1940 Rush Wall Reen Culvert
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 12 m
Freeboard height: 0.35 m

SMN-1850 COCK STREET REEN CULVERT
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 60 m
Freeboard height: 0.35 m

SBR-1780 MIDDLE ROAD REEN DIVERSION M4 BRIDGE with mammal ledge
Single span pre box culvert.
Width: 4.2 m
Height: 2.1 m
Length: 56 m
Freeboard height: 0.2 m

SMN-1790 NORTH ROW DRAIN CULVERT

SMN-1720 NEW CUT REEN
Single span pre-cast box culvert
Width: 1.8 m
Height: 1.8 m
Length: 60 m
Freeboard height: 0.2 m

SBR-1770 NORTH ROW MIDDLE ROAD DIVERSION REEN BRIDGE
Single span box culvert.
Width: 4.2 m
Height: 2.1 m
Length: 25 m
Freeboard height: 0.2 m

Legend

- Permanent highway land within fenceline, including water treatment areas
- Other permanent land take e.g. mitigation planting.
- Temporary construction land
- Ecological mitigation
- Water Treatment Areas
- 250m Study area
- Indicative location of mammal crossing: 900 mm diameter pipes
- Indicative location of proposed culvert to include a minimum of 200 mm free board above the summer penning level of reens
- Relpacment reen
- Replacment field ditch

2014 and 2015 Otter and Watervole Surveys

- Water vole presence confirmed - no burrows recorded
- Water vole presence confirmed – burrows recorded
- Operational lighting

*Culverts without dimensions are to be confirmed

Study area shown reflects the scheme design at the time of the survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Field Survey Results and Mitigation

Figure: 2e	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:10,500
0 175 350 m

N

dwg ref: 8235-0586-12

SMN-2120 MAGOR SERVICES CULVERT

SMN-2123 ST.BRIDE'S ROAD CULVERT NORTH

MN-2150 THE BEECHES CULVERT

SMN-2200 KNOLLBURY LANE NORTH CULVERT

SMN-2265 ROCKFIELD LANE NORTH CULVERT

SMN-2280 THE ELMS CULVERT

SMN-2360 LEYS BREAK CULVERT

SMN-2361 BENCROFT LANE CULVERT

SMN-2362 HILL BARN CULVERT

SMN-2365 THICKET WOOD CULVERT

SMN-2410 GREEN FARM CULVERT

SMN-2400 THE OLD COURT CULVERT

SMN-2369 LLANFIHANGEL CULVERT

SMN-2370 REDBARN CULVERT

SMN-2085 BREWERY HOUSE CULVERT

SMN-2087 NEWPORT ROAD CULVERT

SMN-2088 WOODLAND HOUSE CULVERT

SBR-2140M423-23A66 MILL REEN CULVERT
plus mammal ledge
Extension to existing culvert
Width: 6 m
Height: 4 m above ROW
Length: 135 m

SMN-2270 ROCKFIELD LANE SOUTH CULVERT

SMN-2340 STANDING STONE CULVERT

SMN-2346 RETAINING WALL CULVERT

SMN-2339 ALLOTMENT CULVERT

SMN-2359 CALDICOT ROAD CULVERT

SMN-2380ATTENUATION DITCH CULVERT

SMN-2371 COURT FARM CULVERT

SMN-2010 SOUTH WALES MAINLINE CULVERT

WV140 WV139 WV144 WV136 WV145 WV143 WV141 WV142 WV146 WV148 WV147 WV149

Caldicot Moor SSSI Mitigation Area

ll Reen Culvert
st box culvert
8 m
8 m
2 m
ht: 0.35 m

Legend

- Permanent highway land within fenceline, including water treatment areas
- Other permanent land take e.g. mitigation planting.
- Temporary construction land
- Ecological mitigation
- Water Treatment Areas
- 250m Study area
- Indicative location of mammal crossing: 900 mm diameter pipes
- Indicative location of proposed culvert to include a minimum of 200 mm free board above the summer penning level of reens
- Relpacment reen
- Replacment field ditch

2014 and 2015 Otter and Watervole Surveys

- Water vole presence confirmed - no burrows recorded
- Water vole presence confirmed – burrows recorded
- Operational lighting

*Culverts without dimensions are to be confirmed

Study area shown reflects the scheme design at the time of the survey

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Field Survey Results and Mitigation

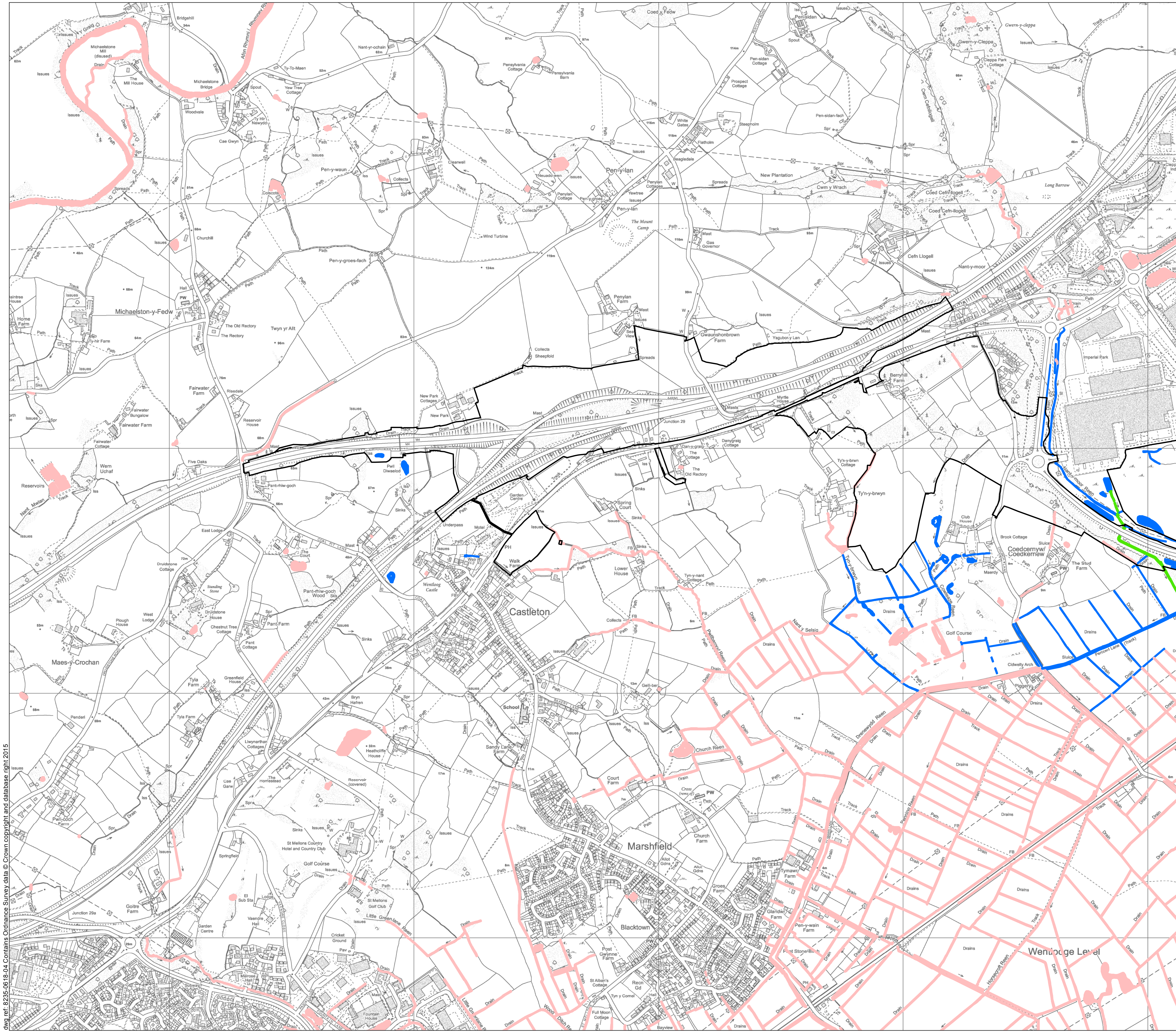
Figure: 2f	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:15,000
0 250 500 m

N

dwg ref: 8235-0586-12

Figure 3: Indicative Water Vole Survey Status



Legend

Limit of Permanent and Temporary Works for New Section of Motorway

Survey status

- 2014 Only
- 2015 Only
- 2014 & 2015
- Never

Llywodraeth Cymru
Welsh Government

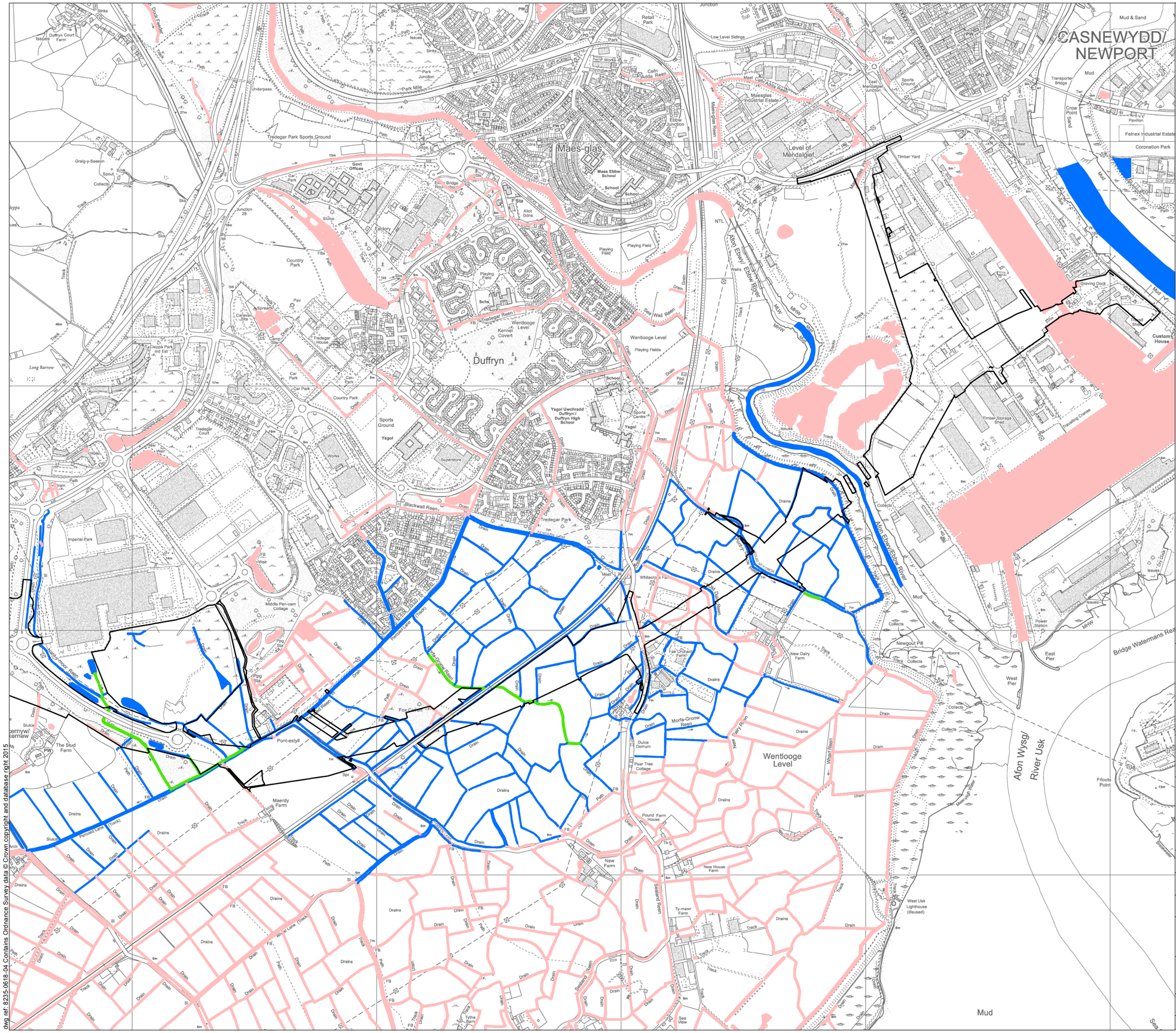
Appendix SS10.7 Water Vole Mitigation Strategy

Indicative Water Vole Survey Status

Figure: 3a	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: MS	Checked: JW

Scale: A3 @ 1:15,000
0 250 500 m
N

dwg ref: 8235-0618-04



Legend

Limit of Permanent and Temporary Works for New Section of Motorway

Survey status

- 2014 Only
- 2015 Only
- 2014 & 2015
- Never

Appendix SS10.7 Water Vole Mitigation Strategy

Indicative Water Vole Survey Status

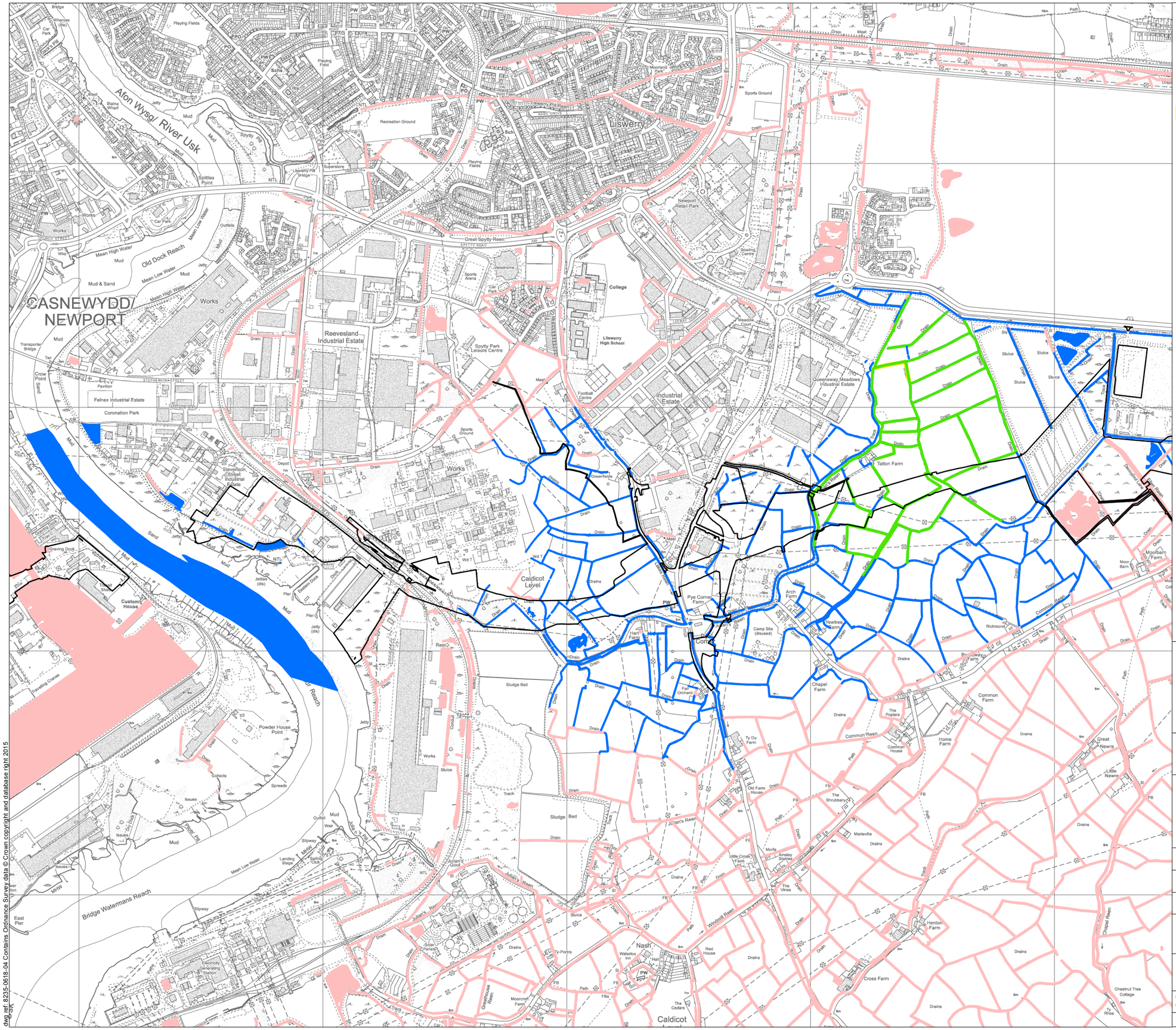
Figure: 3b	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: MS	Checked: JW

Scale: A3 @ 1:15,000

0 250 500 m

N

dwg ref: 8235-0618-04



Legend

Limit of Permanent and Temporary Works for New Section of Motorway

Survey status

- 2014 Only
- 2015 Only
- 2014 & 2015
- Never

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Indicative Water Vole Survey Status

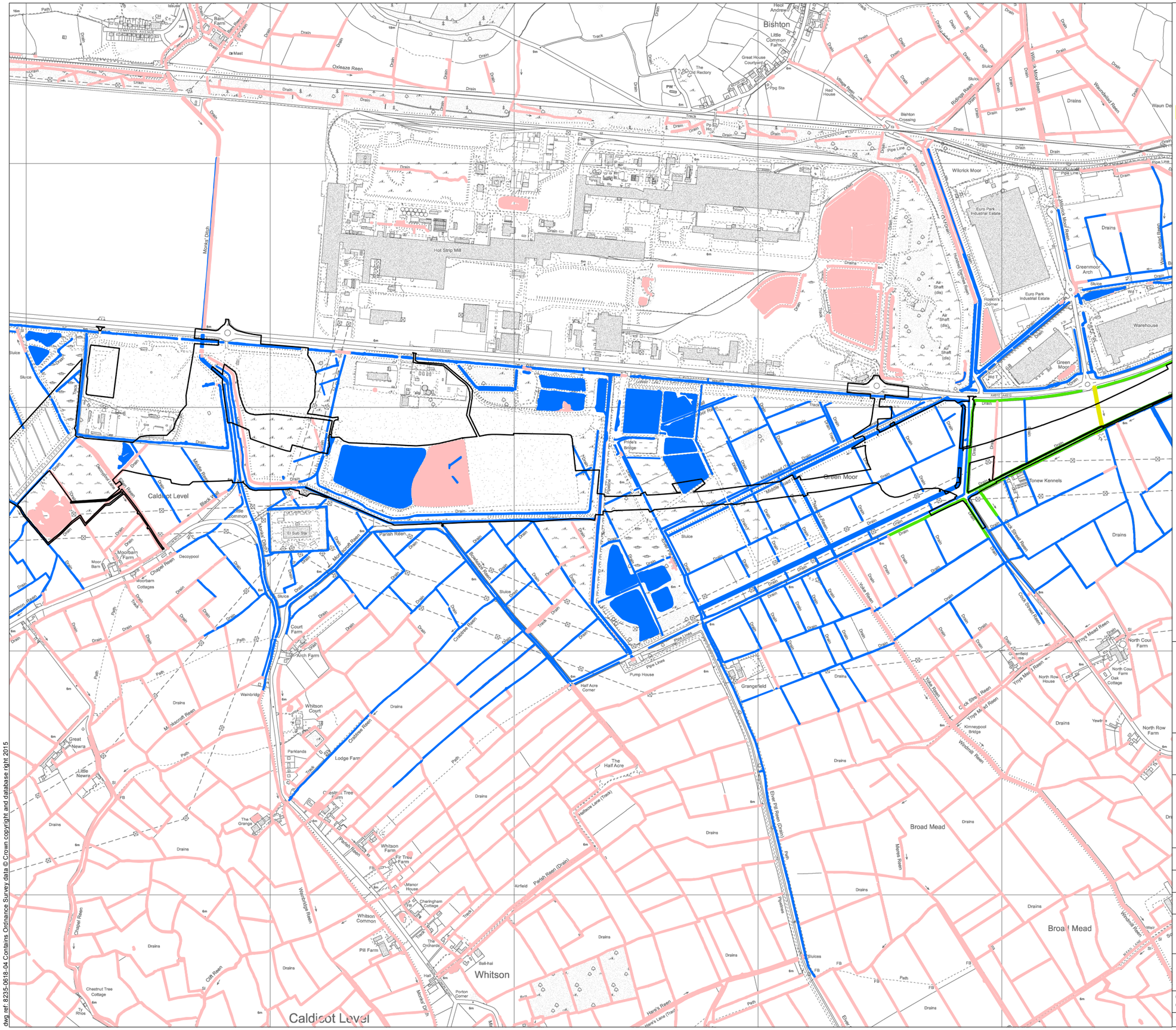
Figure: 3c	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: MS	Checked: JW

Scale: A3 @ 1:15,000

0 250 500 m

N

dwg ref: 8235-0618-04



Legend

Limit of Permanent and Temporary Works for New Section of Motorway

Survey status

- 2014 Only
- 2015 Only
- 2014 & 2015
- Never

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Indicative Water Vole Survey Status

Figure: 3d	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: MS	Checked: JW

Scale: A3 @ 1:15,000
0 250 500 m

N

dwg ref: 8235-0618-04

Legend

Limit of Permanent and Temporary Works for New Section of Motorway

Survey status

- 2014 Only
- 2015 Only
- 2014 & 2015
- Never

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

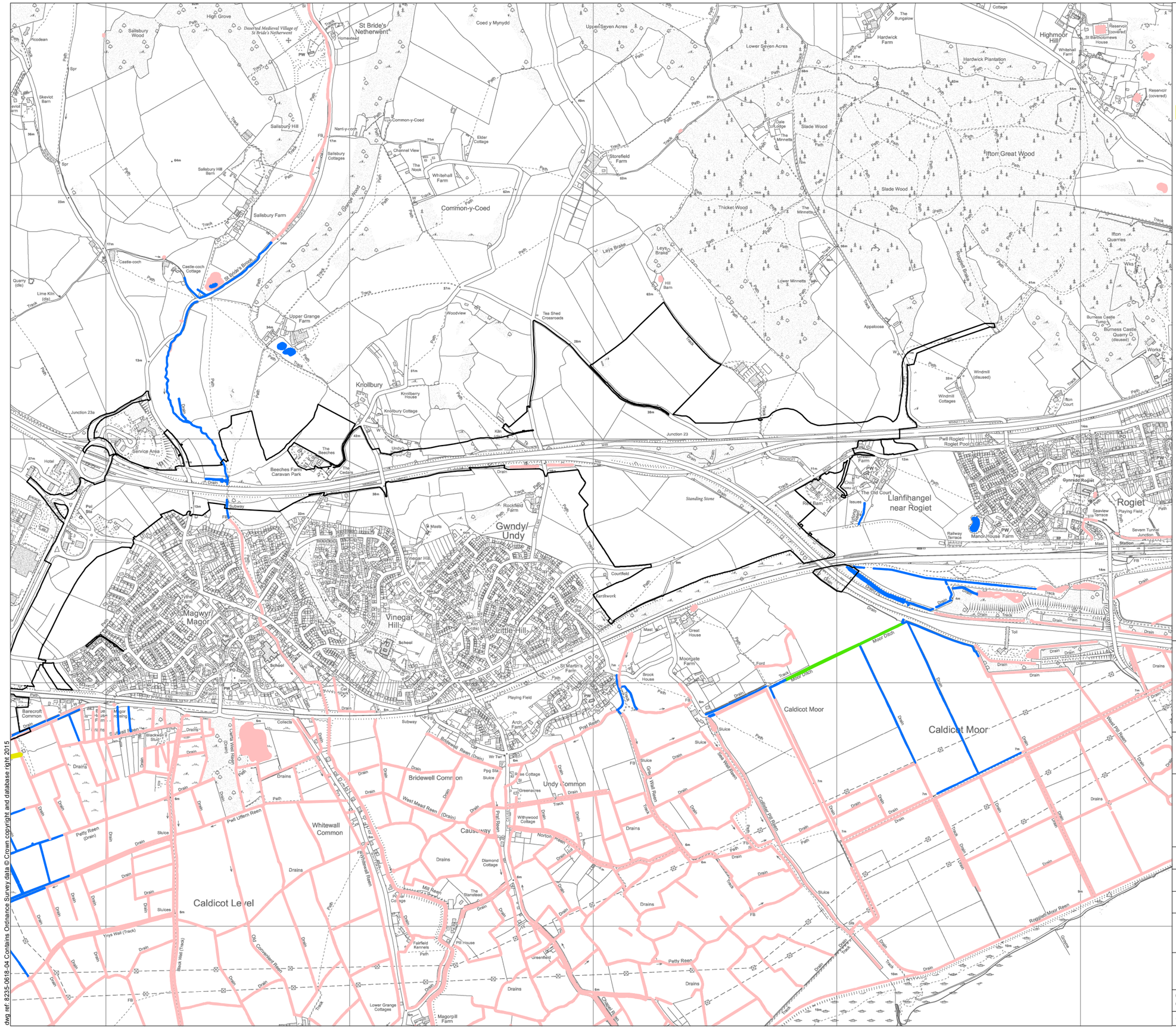
Indicative Water Vole Survey Status

Figure: 3e	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: MS	Checked: JW

Scale: A3 @ 1:15,000
0 250 500 m

N

dwg ref: 8235-0618-04



Legend

Limit of Permanent and Temporary Works for New Section of Motorway

Survey status

- 2014 Only
- 2015 Only
- 2014 & 2015
- Never

Llywodraeth Cymru
Welsh Government

Appendix SS10.7 Water Vole Mitigation Strategy

Indicative Water Vole Survey Status

Figure: 3f	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: MS	Checked: JW

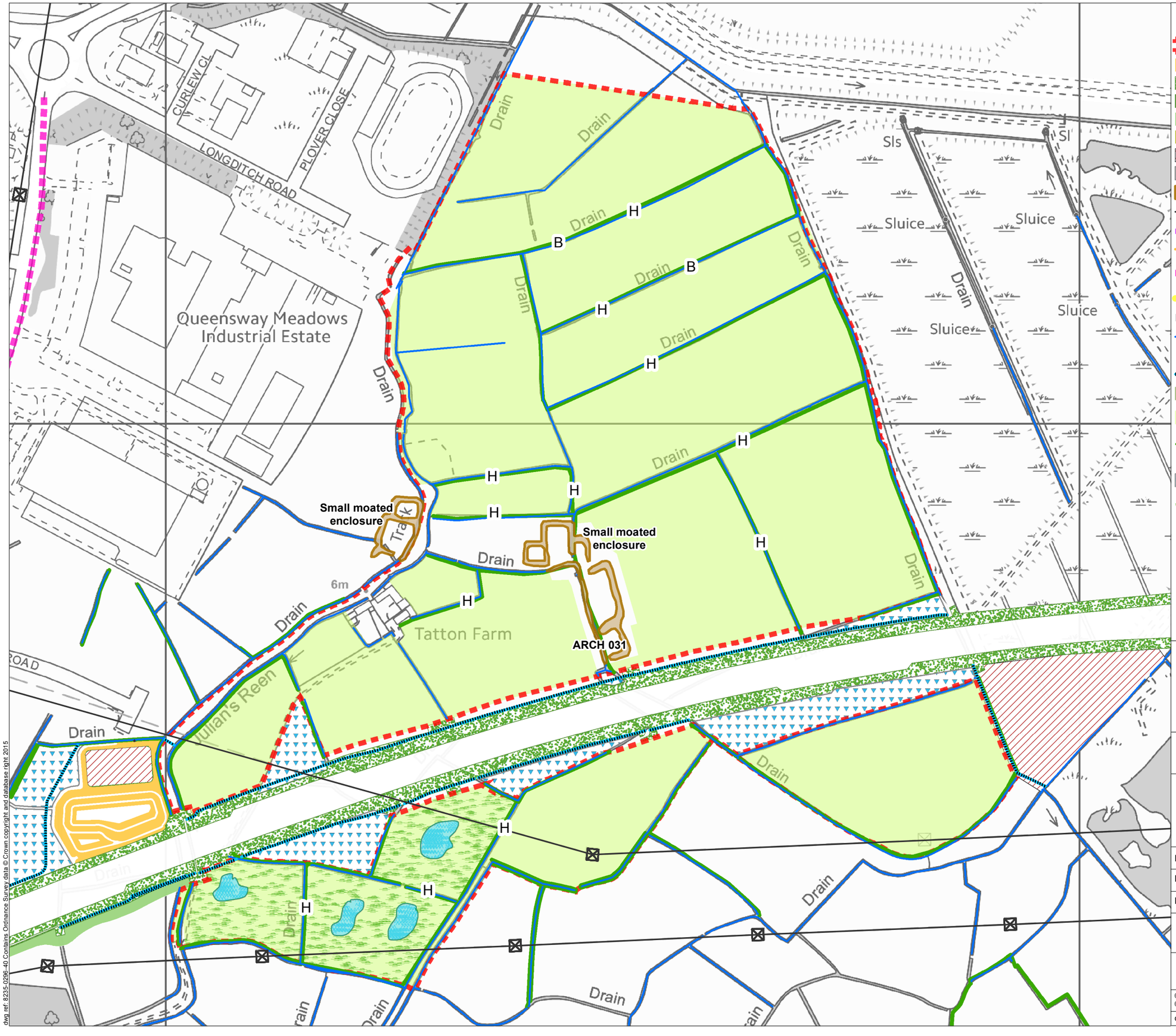
Scale: A3 @ 1:15,000

0 250 500 m

N

dwg ref: 8235-0618-04

Figure 2 from the revised SSSI Mitigation Strategy (Appendix SR10.35): SSSI Mitigation Measures



Legend

- Mitigation Area
- LE1.3 Species Rich Grassland
- LE1.6 Open Grassland
- LE2.1 Woodland
- LE2.4 Linear Belts of Shrubs and Trees
- LE2.6 Shrubs
- LE6.3 Reed Beds
- LE6.4 Marsh and Wet Grassland
- Archaeological Feature
- Overhead line
- Public footpath
- Restricted byway
- Cycle routes available for use by cyclists and/or other Non Motorised Users
- Other routes with public access

Mitigation Measure

- Existing watercourse
- W Watercourse enhancement and/or management
- Replacment field ditch
- Arable reversion to species diverse grassland
- Grassland enhancement including potential replacement/creation of in-field grips
- Hedgerow
- H Hedgerow management
- Lagoons and ponds
- Wetlands
- B Bat roost boxes/ Barn owl nest boxes

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Appendix SR10.35 SSSI Mitgation Strategy

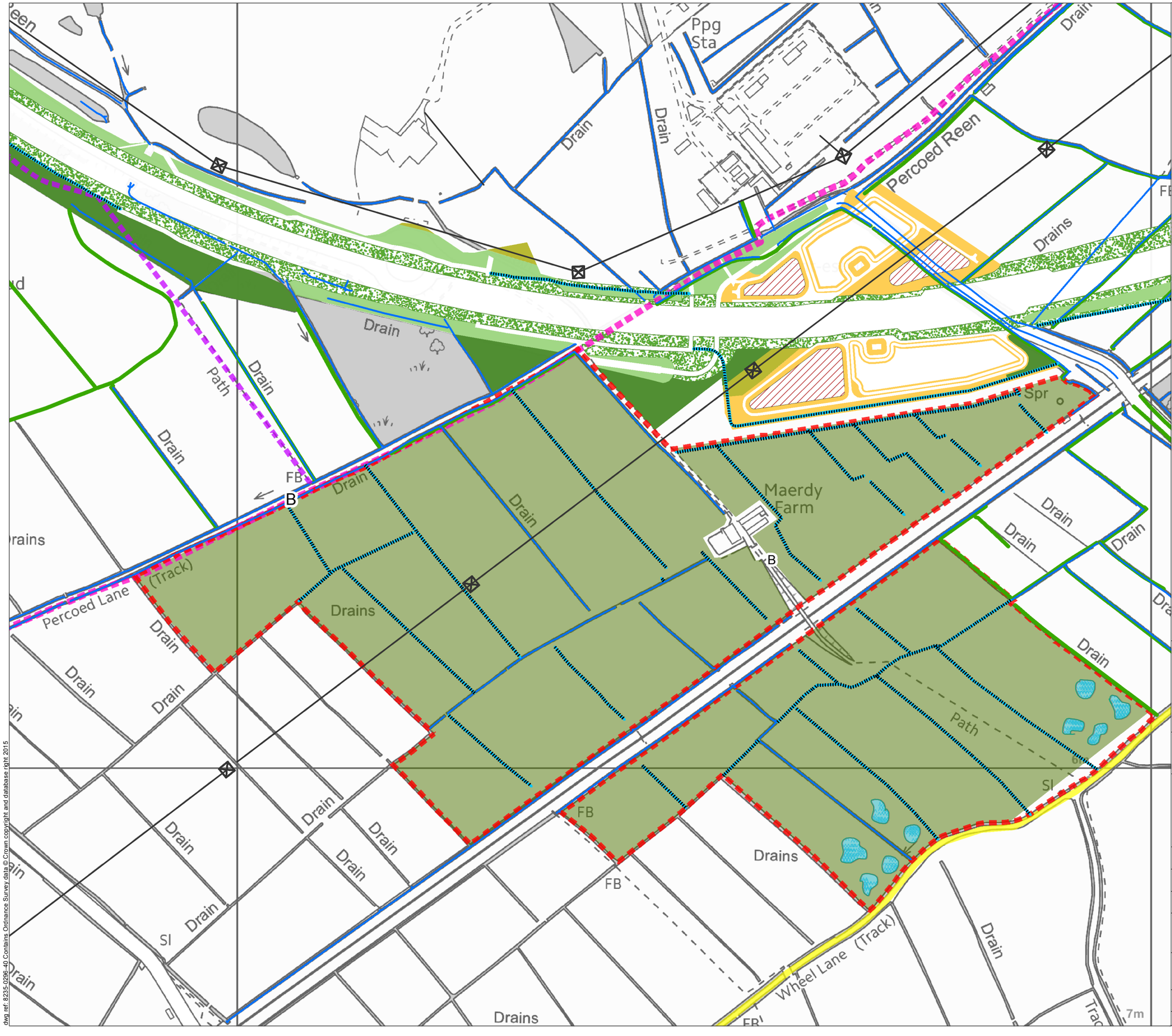
SSSI Mitigation Measures: Tatton Farm

Figure: 2a	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:4,000
0 65 130m

N

dwg ref: 8235-0296-40



Legend

- Mitigation Area
- LE1.3 Species Rich Grassland
- LE1.6 Open Grassland
- LE2.1 Woodland
- LE2.4 Linear Belts of Shrubs and Trees
- LE2.6 Shrubs
- LE6.3 Reed Beds
- LE6.4 Marsh and Wet Grassland
- Archaeological Feature
- Overhead line
- Public footpath
- Restricted byway
- Cycle routes available for use by cyclists and/or other Non Motorised Users
- Other routes with public access

Mitigation Measure

- Existing watercourse
- W Watercourse enhancement and/or management
- Replacment field ditch
- Arable reversion to species diverse grassland
- Grassland enhancement including potential replacement/creation of in-field grips
- Hedgerow
- H Hedgerow management
- Lagoons and ponds
- Wetlands
- B Bat roost boxes/ Barn owl nest boxes

Llywodraeth Cymru
Welsh Government

Appendix SR10.35 SSSI Mitgation Strategy

SSSI Mitigation Measures: Maerdy Farm

Figure: 2b	Revision:
Date: December 2016	Status: AT ISSUE
Drawn: CR	Checked: JW

Scale: A3 @ 1:4,000
0 65 130m

N

dwg ref: 8235-0296-40

Legend

- Mitigation Area
- LE1.3 Species Rich Grassland
- LE1.6 Open Grassland
- LE2.1 Woodland
- LE2.4 Linear Belts of Shrubs and Trees
- LE2.6 Shrubs
- LE6.3 Reed Beds
- LE6.4 Marsh and Wet Grassland
- Archaeological Feature
- Overhead line
- Public footpath
- Restricted byway
- Cycle routes available for use by cyclists and/or other Non Motorised Users
- Other routes with public access

Mitigation Measure

- Existing watercourse
- W — Watercourse enhancement and/or management
- Replacment field ditch
- Arable reversion to species diverse grassland
- Grassland enhancement including potential replacement/creation of in-field grips
- Hedgerow
- H — Hedgerow management
- Lagoons and ponds
- Wetlands
- B — Bat roost boxes/ Barn owl nest boxes

Llywodraeth Cymru
Welsh Government

Appendix SR10.35 SSSI Mitgation Strategy

SSSI Mitigation Measures:
Caldicot Moor

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Annex 1: Biosecurity Risk Assessment and Safe Systems of Works

Welsh Government

M4 Corridor around Newport

Biosecurity Risk Assessment and Safe Systems of Work: ECOLOGISTS – FOR ALL SURVEYS AND SITE VISITS

M4CaN-DJV-EBD-ZG_GEN-AX-EN-0051

At Issue | December 2016

Note: The content of this document should be updated as required in order to take into account potential changes to best practice recommendations and potential new records of ecological constraints on site.

1 Biosecurity Safe System of Works

Ecologist Contact Details

M4CaN Ecological Clerk of Works (ECoW):

Name: TO BE CONFIRMED
Mobile: TO BE CONFIRMED
Email: TO BE CONFIRMED

Principal Licenced Ecologist named on the NRW licence (should one be required):

Name: TO BE CONFIRMED
Mobile: TO BE CONFIRMED
Email: TO BE CONFIRMED

General Good Practice

1.1 General good practice to be followed during all site visits:

- Arrive at the site with clean footwear, equipment and vehicle(s).
- Before leaving the site remove mud, plants and other materials from boots, vehicles and equipment using a stiff brush where necessary.
- Keep access routes to a minimum and whenever practicable, follow existing tracks.
- Whenever practicable, park on areas of hard-standing.
- Restrict the amount of equipment you take onto site to the minimum required.
- Whenever practicable, AVOID:
- driving through wooded areas;
- areas with known plant disease;
- livestock areas;
- contact with potentially infectious material e.g. *Rhododendron*, a primary host plant of *Phytophthora* diseases, especially when wilted/dying (i.e. showing signs of infection); and
- areas of known *Chytridiomycosis* infection, known crayfish plague and other diseases or pathogens.
- Schedule multiple site visits so that sites of greatest risk with regard to invasive species, diseases or pathogens are visited at the end of the day.
- If you do come into contact with potentially infectious material (e.g. dead amphibians, crayfish, dying *Rhododendron*) you must:
- **make a note of findings and the location** of material (take photographic records of plant material);
- **notify the ECoW** of findings as soon as practicable;

- **dispose of or thoroughly disinfect with an appropriate disinfectant* all external clothing and footwear** (e.g. Virkon ® broad spectrum disinfectant (1% solution or 10g/l)*, or Propeller™ disinfectant if addressing a *Phytophthora* infection); and
- dispose of powder-free disposable gloves appropriately.

** Virkon ® broad spectrum disinfectant (1% solution or 10g/l)* or, for Phytophthora infections, Propeller™ disinfectant. All disinfectants should be used and disposed of in accordance with manufacturer and product label instructions and should not be disposed of in waterbodies. Take care to ensure all soil is removed prior to treatment and disinfectant has dried/evaporated before leaving or entering site. Take care so as to ensure no disinfectant enters a waterbody.*

If Bovine Tuberculosis is known to be present in an area, a suitable effective disinfectant should be used such as Trigene © (Virkon is ineffective in this case).

1.2 When carrying out a survey of ponds and watercourses:

- **clean boots** (using a hard bristle brush if necessary) **and disinfect** (away from waterbodies to prevent potential pollutant incidents) **all equipment that might come into contact with water using Virkon ®** suitable for wetland habitat (1% solution or 10g/l) **prior to each survey visit and at the end of the survey**, or appropriately **dispose of equipment between sites**;
- **appropriately dispose of powder-free disposable gloves between site visits**; and
- ensure **vehicle tyres and wheel arches are cleared of mud, plants and other organic material before leaving each site and at the end of the survey**. Leave removed material on site.

1.1 Detailed Survey Requirements

Amphibian - Chytridiomycosis disease

1.1.1 Amphibian *Chytridiomycosis* disease is caused by a fungus called *Batrachochytrium dendrobatidis.* It is generally considered that the fungus can be transported to new locations via the movement of materials that have come into contact with waterbodies or the movement of amphibians themselves. The disease can also be transferred between amphibians.

1.1.2 Therefore, when handling animals the following measures should be set in place.

- Avoid contact with dead or dying amphibians or other fauna.
- Wear appropriate protective clothing which can be easily disinfected or disposed of at the end of each survey visit.
- If disinfecting, equipment and boots that might come in contact with water should be thoroughly treated with Virkon ® suitable for aquatic habitats before leaving each site and allowed to dry completely before being re-used. Prior to disinfectant, equipment and boots should be cleaned of mud, plants and other materials using a hard bristled brush.

- When surveying waterbodies using bottle traps, consider using different bottle traps for each waterbody or between each waterbody, take care to remove all organic material and disinfect with Virkon ® for aquatic habitats and allow to dry.
- Avoid using bottle traps in waterbodies with *Chytridiomycosis*.
- Equipment to be re-used should be wrapped in plastic bags and stored in plastic boxes in vehicles.
- Wear disposable, powder-free gloves that should be disposed at the end of each survey visit.
- Hands should be wiped thoroughly with disinfectant alcohol wipes or 70% alcohol solution between each site visit.
- Field clothes can be disinfected by washing at 50^{o}C.

1.1.3 Should any dead or dying animals be located, their symptoms and location should be reported to the ECoW as soon as practicable.

1.1.4 Where practicable **captured animals should be temporarily kept in individual containers** so as to minimise the potential spread of disease and **individuals from different water bodies should never be kept together**, to prevent the potential spread of disease between different groups or populations.

Invasive Plant Species

Invasive aquatic plant species

1.1.5 The following invasive plant species are potential risk species in Wales.

- Canadian waterweed (*Elodea Canadensis*)
- Curly waterweed (*Lagarosiphon major*)
- Floating pennywort (*Hydrocotyle ranunculoides*)
- Least duckweed (*Lemna minuscula*)
- New Zealand pygmy weed (*Crassula helmsii*)
- Nuttall's waterweed (*Elodea nuttallii*)
- Parrot's-feather (*Myriophyllum aquaticum*)
- Water fern (*Azolla filiculoides*)
- Waterweeds (other *Elodea*) (*Elodea* spp.)

1.1.6 All surveyors should be made aware of the identification of the above species. Identification sheets are available at

https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?sectionid=47.

1.1.7 Should any invasive plant species be located, where necessary, a **photographic record** should be taken to confirm identification and details of the **location** (preferably as a global positioning system (GPS) location reference) **should be recorded.** Findings should be **reported to the ECoW** as soon as practicable.

1.1.8 **Avoid surveying waterbodies containing invasive plant species using a net**. Where this cannot be avoided take care to **remove plant material from the net and disinfect with Virkon ®** suitable for aquatic habitats and allow to dry at the end of each site visit.

Keep nets wrapped in plastic bags between site visits. **Where practicable, use different nets for those affected waterbodies**.

1.1.9 When surveying using bottle traps, **consider using different bottle traps for each waterbody or take care to remove all organic material and disinfect with Virkon ®** for aquatic habitats and allow to dry between waterbodies. **Whenever practicable avoid using bottle traps in waterbodies containing *Crassula***.

Invasive terrestrial plants

1.1.10 All surveyors should be made aware of the identification of any invasive species recorded on site during ecology surveys, as well as other potential invasive species. Identification sheets are available at https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?sectionid=47.

1.1.11 If any of the invasive species are located on site, a photographic record of the plant should be taken for later confirmation of identification and the location of the plant (preferably as a global positioning system (GPS) location reference) should be recorded. Findings should be forwarded to the ECoW as soon as practicable.

Signs of Plant Diseases

1.1.12 All surveyors should be made aware of signs that could indicate plants are infected by the following diseases:

- Ash dieback disease (*Chalara fraxinea*). Symptoms guide: http://www.forestry.gov.uk/pdf/Symptoms_guide_Chalara_dieback_of_ash_2012.pdf/$FILE/Symptoms_guide_Chalara_dieback_of_ash_2012.pdf
- *Phythopthora ramorum*. Symptoms guide: http://www.fera.defra.gov.uk/plants/publications/documents/factsheets/phytophthoraRamorumFactsheet.pdf.
- Alder disease (*Phytophthora alni).* Symptoms guide: http://www.forestry.gov.uk/website/forestresearch.nsf/ByUnique/INFD-737HZD.

1.1.13 Photographic evidence of any potential signs of plant disease should be taken along with a record of the plant species and location (preferably as a global positioning system (GPS) location reference). Findings should be forwarded to the ECoW as soon as practicable and an updated safe system of works will be produced by the ECoW. The ECoW should notify the Forestry Commission and/or AshTag project of the location of any new signs of disease.

1.1.14 Should signs of disease be recorded, the following actions should be taken.

- Where practicable, **alternative access routes** should be used so as to avoid disturbance of infected ground.
- **Vehicle access and parking should be off-site or away from infected areas**.
- **Avoid driving through wooded areas**.
- If plant samples are collected to aid identification, equipment should be **disinfected** using an appropriate disinfectant** **immediately after cuttings are taken** and each sample should be **stored in a separate well-sealed plastic container/bag**. **Disposable powder-free gloves should be disposed of between sites**.

- Prior to leaving the site, **extra vigilance should be practiced when cleaning vehicles (tyres and wheel arches), equipment, boots and clothing**.

*** Virkon ® broad spectrum disinfectant (1% solution or 10g/l)* or, for Phytophthora infections, Propeller™ disinfectant. All disinfectants should be used and disposed of in accordance with manufacturer and product label instructions and should not be disposed of in waterbodies. Take care to ensure all soil is removed prior to treatment and disinfectant has dried/evaporated before leaving or entering site. Take care so as to ensure no disinfectant enters a waterbody*
If Bovine Tuberculosis is known to be present in an area, a suitable effective disinfectant should be used such as Trigene © (Virkon is ineffective in this case).

Summary of Biosecurity Safe Systems of Work and Risk Assessment

Risk Assessment

Risk activity reference	Risk activity	Risk level	Measures to set in place	Risk level after measures	Measures set in place (Y/N)
NOTE: *All disinfectants should be used and disposed of in accordance with manufacturer and product label instructions and should not be disposed of in waterbodies. Take care so as to prevent run-off into waterbodies. Virkon ® is a suitable broad spectrum disinfectant (1% solution or 10g/l)* for general use and for use when likely to come into contact with water. Use Propeller™ disinfectant for in areas with known Phytophthora infections. Use disinfectant such as Trigene © If bovine tuberculoisis present. Take care to ensure all soil is removed and disinfectant has dried/evaporated before leaving or entering site. Take care so as to ensure no disinfectant run-off into a waterbody.*					
	General	Low	Ensure clothes, boots and equipment are clean before arriving on site/leaving site - remove organic material with a stiff brush/water and disinfect with an appropriate disinfectant.		
			Use disposable, powder-free gloves.		
			Hands should be wiped thoroughly with disinfectant alcohol wipes or 70% alcohol solution between each site visit		
			Field clothes can be disinfected by washing at 50-60^{o}C.		
1	Use of vehicles	Medium-high (invasives recorded, no disease reported to date)	Ensure tyres are clean before arriving on site/leaving site and when moving from one off-road site to another - remove organic material with a stiff brush/water and disinfect tyres and wheel arches.	Low	
			Whenever practicable follow hard-standing roads and tracks and use hard-standing parking areas.		
			When off-road/track driving or parking is required remove soils and organic material from tyres with hard bristle brush prior to leaving site.		
			Do not drive through wooded areas.		
			Avoid livestock areas where practicable.		
			Avoid driving across areas where invasive plant species are located or plant diseases are recorded.		

Risk activity reference	Risk activity	Risk level	Measures to set in place	Risk level after measures	Measures set in place (Y/N)
2	Terrestrial surveys	Medium (invasives recorded, no disease reported to date)	Take only the equipment required onto site.	Low	
			Avoid contact with invasive plants. Photograph for identification and report presence (GPS refs if possible) to ECoW as soon as practicable.*		
			Avoid noticeably diseased plants, note symptoms (photograph) and record locations (including GPS refs if possible). Report presence to ECoW as soon as practicable.*		
			If come into contact with diseased plant – dispose of disposable gloves in an appropriate way, disinfect boots and equipment.		
3	Aquatic surveys	Medium-high (invasives recorded, no disease reported to date)	Consider using different bottle traps per waterbody or between each waterbody, take care to remove all organic material and disinfect with Virkon ® for aquatic habitats and leave to dry completely before re-use.	Low	
			Reused equipment-wrap in plastic bags, store in plastic boxes.		
			If practicable, avoid using bottle traps in waterbodies with *Chytridiomycosis.* Consider using different bottle traps per waterbody or remove all organic material, disinfect and leave to dry between surveys. Where practicable, avoid bottle traps if *Crassula present*.		
			Avoid surveying waterbodies containing invasive plants with a net. If unavoidable thoroughly disinfect and leave to dry between waterbodies. Where practicable, use a different net for the pond containing invasive species.		
			Inform the ECoW as soon as practicable if invasive plants are located, provide photographic records if possible and details regarding the location (including GPS ref if possible)*.		
			Avoid contact with dead or dying amphibians or other fauna. Report any dead or dying amphibians to the ECoW as soon as practicable*.		
			If required, captured animals from one waterbody should not be kept in temporary storage together with individuals from another waterbody.		

* ECoW to update risk assessment and safe system of works on basis of findings.

Overall risk levels.

Factor	Number of sites/ponds	Risk level	Risk score	Score ("X")
Number of sites visited	1-10	Low	1	
	11-100	Medium	2	
	101+	High	3	
Area covered	0-10km^2	Low	1	
	11-100km^2	Medium	2	
	100km^2+	High	3	
Value of habitat feature surveyed	Local/district	Low	1	
	County	Medium	2	
	Regional-UK	High	3	
Score		**Low**	**3-4**	
		Medium	**5-7**	
		High	**8-9**	
Undertake measures described above and risk will be decreased to low.				

Completed by:

Verified on site by:

Annex 2: The Game and Wildlife Conservation Trust (GWCT) Mink Raft

V. 2.4
Revised December 2015

The GWCT Mink Raft

The Game & Wildlife Conservation Trust Mink Raft was developed both as a means of detecting mink, and as a favourable trap site. In pilot work in 2002, we found that it was a far more sensitive way to detect the presence of mink than speculative trapping, local knowledge or systematic searches for field signs.

The raft was conceived primarily as a research tool and we continue to use it to develop strategies for managing mink in a UK conservation context. But the raft is also a key feature of those improved strategies. The advantages of a raft-based control policy have been quickly recognised by conservation bodies throughout the UK, and it now forms the basis of many conservation projects, both local and large-scale.

In 2005, the GWCT Mink Raft won the first ever Wild Animal Welfare Award offered by the Universities Federation for Animal Welfare, in recognition that it led to a more focused form of control with greatly reduced animal welfare costs.

This leaflet explains how mink rafts are constructed and used, and the range of associated services offered by the Trust. There is much more to the use of mink rafts than can be covered in this brief leaflet. All the topics covered here (and more) are covered in depth at our mink raft training workshops, which can be arranged at a venue and date of your choice.

The GWCT Mink Raft is supported by a considerable body of research done by the Trust, which is ongoing. During this research, we have seen no reason to change the original design except in a couple of minor details. Inevitably though, a number of variant rafts have sprung up in other projects. To what extent our research findings also apply to such variants is unknown. You deviate from the well-researched design described here at your own risk.

What is the GWCT Mink Raft?

The GWCT Mink Raft is a simple, cheap, low-tech device that improves on previous mink control practices in almost every respect.

The raft has two modes of action: monitoring and trapping. In use, it spends most of its time in monitoring mode, and reverts to monitoring after each brief spell of trapping. In monitoring mode, the raft records the footprints of any visitors (from water shrews to otters), and can be left to accumulate such evidence over a period of one to two weeks. The idea is to set traps only on rafts that have recorded evidence of mink within the last check period. The mink will then usually be caught within a few days. After running the trap for a maximum of seven to 10 days, the raft is returned to monitoring mode, to establish whether there is still a mink to be caught. In this way, the mink control effort becomes self-assessing, and it is easy to see whether trapping is effectively controlling mink numbers.

Why use rafts?

1 Focus

Fundamentally, rafts give your mink control a clear focus and direction. Imagine you are setting mink traps without rafts. How many traps do you need? What is the best kind of site? For how long should you run each trap? If you catch nothing, should you stop trapping for a while, or should you move the trap?

These are difficult questions but with rafts, they are almost irrelevant. Thanks to the research that underpins the mink raft approach, you can start with a near-optimal raft density, use the minimum number of traps and will rarely be in doubt about what to do next.

2 Scaled-down trapping

Whereas conventional trapping requires one trap per site, the use of rafts requires a lower number of traps to be available for use and for a far shorter time. The use of traps is therefore vastly scaled down, and so are all the attendant costs: the need to check traps daily, the capital cost of traps, the ecological and animal welfare cost to non-target species.

3 Reduced manpower/effort

Traps must be inspected daily while set, so using traps speculatively (ie. running them in likely-looking spots) can be very time-consuming. Rafts can be inspected at a much longer time interval while they are simply collecting evidence of mink. Only where a raft collects evidence of recent

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mink visits is it necessary to set a trap and check it daily. So rafts save on manpower chiefly because they focus where and when to invest your trapping effort. Manpower is also saved by increased trap efficiency (see below).

Of course, the rafts themselves are an additional cost over and above the cost of traps. Against this, you don't need so many traps. For home construction, the rafts themselves cost approximately £31 each in materials (£51 if you cost in your time), at 2013 prices. A ready-made raft supplied in kit-form costs about £60 (Perdix Wildlife Supplies). For comparison, the cost of spring traps is about £10, and cage traps £23. A cost comparison of conventional trapping versus the raft system will depend on which type of trap is used, and at what density. Nevertheless, because manpower is the greatest expense in mink trapping, there is a net financial saving in most UK situations.

4 Increased trap efficiency

Because traps are set only on rafts shown to be in current use by mink, captures happen quickly (usually within a few days of trap placement), and thus traps are deployed for a shorter time. Field experience also suggests that rafts are typically much better trap sites than conventional land sets.

5 Reduced non-target captures

Because fewer traps are used, and because they are set for shorter periods, the risk of non-target captures is greatly reduced. Strictly terrestrial non-targets are avoided. Additionally, locations in frequent use by non-target species can be avoided after a short period of monitoring. Movement of a raft by as little as 50m can avoid a water vole colony without affecting the chance of mink captures.

6 Feedback and motivation

There is nothing like a mink footprint to excite fieldworkers and if your mink control is working, the number of rafts with evidence of mink should be falling rapidly. The evidence that this is the case is hugely motivating to fieldworkers, managers and funders alike.

7 Detecting remaining or replacement animals after successful removal by trapping

All culling will have some impact on mink population size, but ecological consequences may perhaps be trivial if some mink are still present after trapping, or if removed animals are quickly replaced through reproduction or immigration. As yet, we don't know what level of mink abundance – if any – is low enough to allow persistence of different prey species. In the absence of such knowledge, the aim of most control efforts is currently to ensure complete absence of mink on a local or wider scale. The GWCT Mink Raft provides a method of monitoring presence or absence of mink at specific sites that is independent of the trap itself. In pre-existing trapping strategies, the continued presence of mink at removal sites (or elsewhere) could be monitored only by field signs, direct sightings or further trapping. All of these are less sensitive than the raft method.

The GWCT Mink Raft

Raft construction

The GWCT Mink Raft is now available commercially (see list of suppliers on page 10), so you may want to skip this section. However, it was intended for home construction and is easy to construct. You will need three power tools: a hand-held circular saw, jigsaw and drill (you could use manual tools if you are making only a few rafts and don't mind work). You will also need trestles (or similar supports), two G clamps or speed cramps, hammer, screwdriver, spanner and knife. A staple gun is handy but not essential. One person can make four to five rafts per day. A step-by-step photo guide to construction is available on our website **www.gwct.org.uk** or request the leaflet *GWCT Mink Raft building* from our Advisory Service on 01425 651013.

The GWCT Mink Raft has three elements (see Figure 1): a buoyant raft base, a removable tracking cartridge and a wooden tunnel.

The raft base

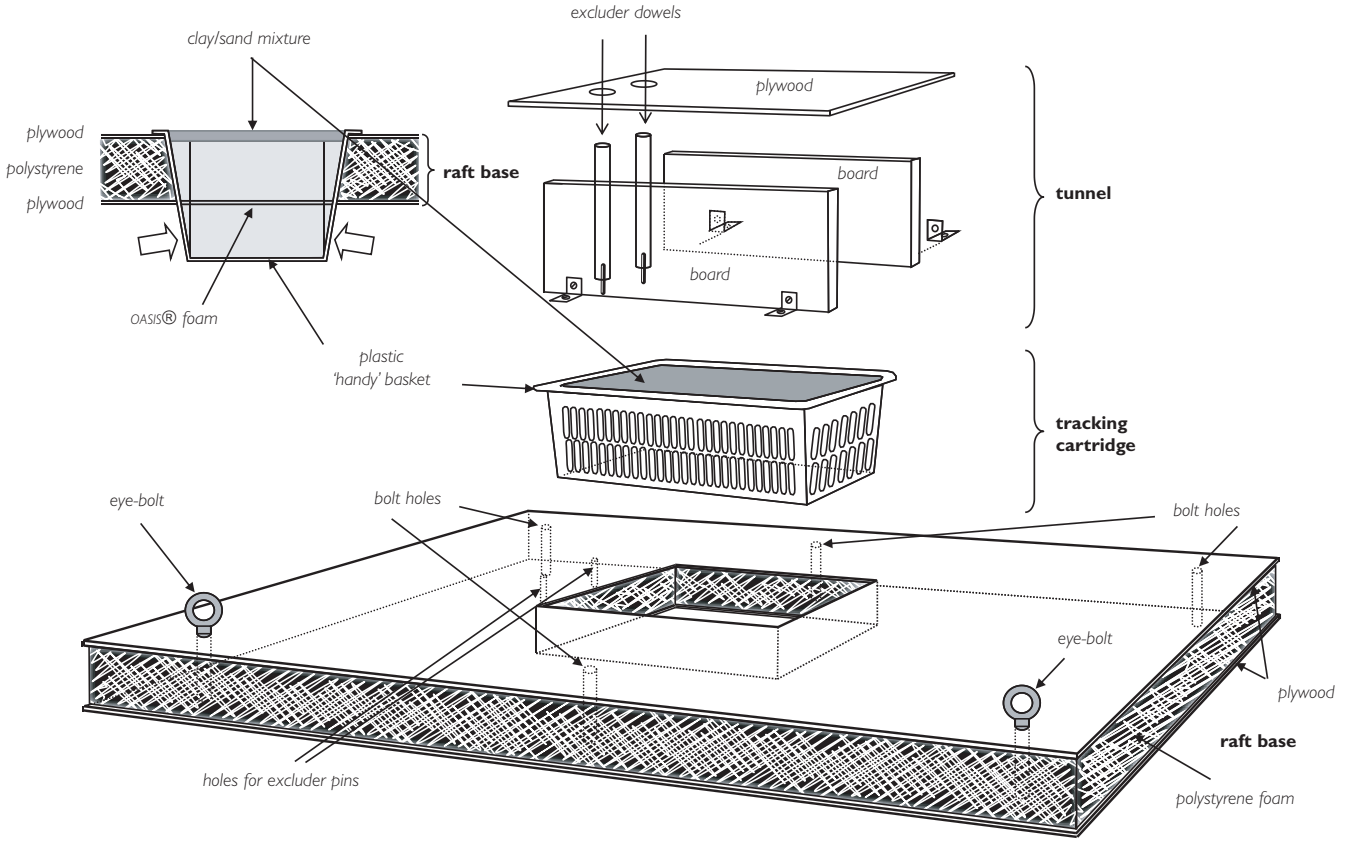
The raft base is a sandwich roughly 4ft x 2ft, with two 1220 x 610 x 6mm sheets of exterior plywood protecting a central 1200 x 600 x 50mm sheet of expanded polystyrene. These dimensions allow economical cutting of standard 2440 x 1220 x 6mm plywood sheets and 2400 x 1200 x 50mm polystyrene insulation sheets. A 237 x 152mm rectangular hole with rounded corners is cut in the centre of the plywood sheets using a jigsaw, to accommodate the tracking cartridge. It is best to clamp the two 4ft x 2ft pieces of plywood together with G clamps or speed cramps, to ensure the rectangular holes and bolt holes in the upper and lower sections of plywood are aligned. The sandwich is then fastened together using two 80mm M6 eyebolts (one either end of the raft on the same side) and four 80mm M6 roofing bolts with nuts. After this a sharp, thin-bladed knife is used to complete the aperture through the polystyrene foam. In the original design, wire mesh netting (500 x 250mm, 15mm mesh) was stapled over both ends of the raft to assist animals climbing out of the water onto the raft. This has proved not to be necessary.

The tracking cartridge and clay mixture

The tracking cartridge consists of a soft plastic basket (25cm 'Handy basket': Whitefurze, Coventry, UK) having a solid bottom, vented sides and an out-turned rim by which it can be suspended in the raft aperture. The tray is packed to 10mm below the rim with a highly absorbent foam (OASIS® floral foam: from florists, craft shops or Smithers-Oasis UK Ltd). Because the basket has tapered sides, the 230 x 110 x 78mm rectangular block of OASIS® must be cut and the pieces rearranged so that the outer wedges secure a central block in place (see Figure 2).

continued on page four

Figure 1. Construction of a GWCT Mink Raft



March 2007

A single block of OASIS® cut in this way fills the basket precisely and holds four pints of water. After the foam is saturated with water, a 10mm-thick layer of tracking substrate is smeared over the top surface with a broad spatula. The tracking substrate is a mixture of fine buff earthenware/stoneware clay (Process Control Systems, Bournemouth, UK) and kiln-dried block-paving sand (builders' merchants).

Tracking medium: 1kg clay (moist, as supplied) to 0.5kg dry sand.

The point of using kiln-dried sand is to be able to control how much water is in the mix. The ingredients are worked together by hand in a bucket, gradually incorporating enough water (approximately 100ml for the above quantities) to make a stiff but workable paste. By smoothing with a wetted spatula (eg. decorator's trowel), and finally with a rubber blade (grouting squeegee), the surface is left perfectly smooth and level with the rim of the tray. The OASIS® foam acts as a wick, drawing water from the river to maintain a permanently-moist tracking surface.

The tunnel

The tunnel has four intended functions: to provide a dark cavity which mink might find attractive to investigate; to protect the clay surface from rain and debris; to house a trap when required; and to provide a closed-off area whose entrances can be regulated using physical barriers to exclude non-target species larger than mink.

The tunnel dimensions must take account of the traps you intend to use (see traps, page five). For live catch (cage) traps, this is simply a matter of measuring the dimensions of the trap. For example, using a single-entry Rhemo live-capture mink trap (Rhemo Products Ltd, New Milton, UK), the tunnel measures 660 x 190 x 175mm internally, allowing 60mm at the entrance for an otter excluder (see below, this section; also page eight). The tunnel consists of two 660 x 175 x 25mm tanalised boards and a 660 x 250 x 10mm plywood roof screwed together.

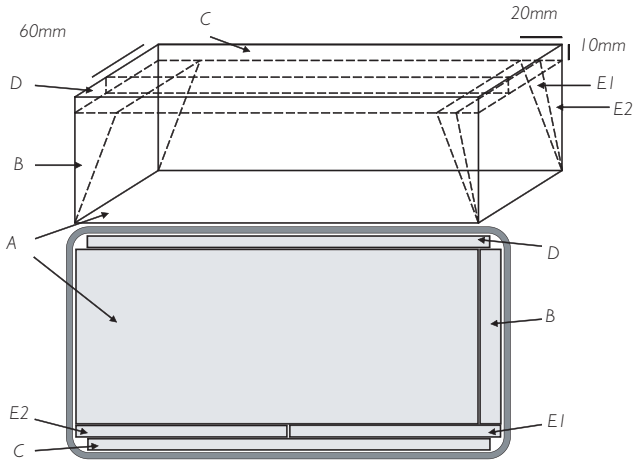
If you intend to use spring traps (see switching to trapping mode, page seven), you must dimension the tunnel to suit both set and sprung positions of the trap. It's important that there is no excessive clearance around the trap, otherwise a mis-catch can result, causing suffering to the captured animal. The tunnel is placed over the aperture in the raft and secured using small right-angle metal brackets (such as those used in kitchen cabinets) and screws. Some cage-traps for mink have otter guards built into the entrance. If you are not using such traps, one end of the tunnel should have an otter guard that is removable so that you can detect otter visits when in monitoring mode. Two dowels are inserted through holes pre-drilled in the tunnel roof so that the space between the dowels is 6cm wide. Headless nails tapped into the lower ends of the dowels (may require pilot holes) locate into holes in the top plywood sheet of the raft. The easiest way to make these match with the tunnel roof is to clamp the tunnel roof and raft top together and drill the smaller (nail-sized) holes through both. Then enlarge those in the tunnel roof to a size large enough to allow for swelling of the dowels when wet.

Anchoring the raft

The raft is tethered to riverside shrubs or trees, or to a post by a rope passing through the eyebolts in the raft corners. You must choose whether to fasten the rope to one ring on the raft or to two. Two provides more security, but one attachment allows the raft to find a position where it catches less current and may make it less vulnerable to swamping in spate conditions. We haven't found any satisfactory solution that allows the tethering point to rise and fall with the water level. If water levels are liable to rise considerably, fasten your rope high and allow enough slack – you will probably have to make adjustments in wet periods.

Figure 2. Fitting an Oasis block in a basket

(see **www.gwct.org.uk/minkraft** *for step-by-step photo instructions)*



Traps suitable for use with rafts

Mink control involves trapping and killing mink. Orders made under the *Destructive Imported Animals Act 1932* make it illegal to keep mink without a licence, and stipulate precautions that must be taken to prevent escape. This legislation, therefore, also prohibits you from keeping, transporting or releasing a mink once you have caught it. So besides rafts, you will need traps and equipment for humane dispatch.

Two kinds of trap are allowed by law: live-capture traps (cage traps) and spring traps (killing traps). On balance, we recommend the use of live-capture traps in most circumstances. Live-capture traps seem intuitively humane to most people, though actually their relative humaneness compared with good spring traps is not beyond argument. The humaneness of confinement in a wire cage for up to 24 hours is one issue, and the competence of the operator to dispatch the mink humanely when discovered is another (see section below). A more clear-cut advantage is that live capture traps usually allow any non-target captures to be released alive and unharmed. Because non-target captures are so drastically reduced through the use of GWCT Mink Rafts, this is a minor issue in ecological terms, but there are legal complications (unclear aspects of the *Wildlife & Countryside Act* that have not been resolved through case law), and most operators prefer not to take the risk. With live-capture traps, you will also need a weapon to dispatch the mink (see next section).

There are two basic types of live-capture trap: single entry and double entry. The double entry type allows the mink to enter from either direction and presents no visible mesh barrier across the tunnel end when the trap is set. Although that may seem advantageous, double entry types have more mechanism to go wrong, tend to be skimpy in length between treadle plate and door, and would require a larger raft than we use. So on balance we prefer the single entry type. Field experience shows that mink have no trouble finding the entrance. Some traps have otter guards built in (see page eight).

Some operators choose to pack hay or similar material around live-capture traps to provide captive animals with both insulative bedding material and a diversionary activity. Two problems can arise. Firstly, vegetation dragged into the trap may hinder the use of trap combs which are crucial to the humane dispatch of mink with an air pistol (see section below). Secondly, an oversized tunnel is necessary. Once bedding material is drawn into the trap, the trap becomes a loose fit in the tunnel. Unless the trap is fastened to the raft, it is then possible for a captive mink to shuffle the trap out of the tunnel and off the raft, resulting in death by drowning and probably a lost trap.

Spring traps are cheaper and easier to transport than live-capture traps. They may be appropriate for an operator running only one or two rafts, for whom the expense and responsibility of owning a weapon and carrying out humane dispatch seems disproportionate. Spring traps may also have a role in catching 'trap-shy' mink. A list of trap models approved for mink can be found in the relevant Spring Traps Approval Order (see **www.gwct.org.uk/game/research/predation-control/tunnel-traps**). Note that approvals differ slightly between England, Wales, Scotland and Northern Ireland.

Although approvals are supposedly based on an assessment of humaneness, we suggest that most of the traps currently approved for mink in the UK are underpowered. Among those currently approved for mink, we recommend only the Kania 2000 and 2500, and the DOC250. These models reliably strike the head with enormous force, instantly destroying the brain.

Under wildlife legislation in all devolved administrations it is expected that the trap operator will take reasonable precautions to avoid capture or injury of protected species, including all birds, otter, and polecat. We prefer the Kania 2000 and DOC 250. These reliably strike the head with enormous force, instantly destroying the brain.

How to dispatch a live-caught mink

We recommend you use an air-weapon rather than a firearm. It is much easier to carry about discreetly, doesn't make you conspicuous and sinister, is quiet in use, safe for the operator, trap and bystander, and is perfectly adequate for the job provided you follow the procedure described below.

Currently, an air pistol generating up to 6 lbs muzzle energy may be held and used in the UK without a Firearms Certificate. You must be over 18 to purchase such a weapon. Air weapons may be sold only in person from a shop, not by mail order. To use an air weapon you must be over 14, but the weapon must be transported to the venue where it is used by someone over 18. Persons under 14 must be supervised by someone over 21. There is a trend towards tighter restrictions. The Air Weapons and Licensing (Scotland) Act 2015 means that a license will be required for purchase or possession of all air weapons in Scotland, with expected effect from April 2016. In all cases you must have authority from the landowner or shooting tenant for the land on which the weapon is used.

With air weapons, more power costs more money. We have researched the cheaper end of the market and can vouch for the ability of an air-pistol producing a muzzle energy of 3.1ft lbs or more to kill even the largest mink (1.7kg) humanely

Currently the Webley 'Typhoon' is probably the best buy for the purpose at about £75, but difficult to obtain. A good alternative is the Benjamin Trail NP at about £120. For such relatively low power weapons, it is also critical to use 'Prometheus' steel-tipped conical pellets (lead alloy pellets will not penetrate), and to follow the procedure described below. An air rifle (legal limit 12ft lbs) can also be used, but is considerably more awkward to manipulate, more conspicuous as you travel between traps and the extra power is unnecessary.

To use an air-weapon humanely the mink must be held still in the trap. This is easily done using two plywood 'combs' to form the equivalent of a livestock handling crush. The combs are made by cutting slots with a saw in 10mm plywood boards, so that the remaining 'tines' fit through the mesh of the cage trap from above, forming a divider within the trap.

continued on page six

Once exposed in a trap a mink may scream loudly and incessantly until it is dispatched. So prepare the air-pistol, pellets and trap combs before removing the wooden tunnel or pulling out the trap. Check that the pistol barrel is clear before loading it. If the mink has been caught on a raft, it is convenient to dispatch it on the raft in the water (the raft can be floated away from public view). Remove the wooden tunnel (or pull out the trap) and by inserting the combs alternately, gently push the mink to the end of the trap farthest from the door, until it is confined to a space only one or two meshes long. By easing or increasing pressure, you can allow the animal to squirm around or hold it in position.

Using the comb as a lever, push the mink up towards the roof of the trap, letting it squirm around until its head is immediately below the roof mesh, then clamp it in position by pressing on the comb. With the gun barrel perpendicular to the cranium, push the muzzle of the barrel down firmly and shoot the mink. Avoid the very strong centre line of the skull. Do not fire unless you have achieved the muzzle/cranium contact described. (If the muzzle is not perpendicular to the cranium, or if there is insufficient downward pressure, the pellet may glance off or fail to penetrate). Note that when using Prometheus pellets, the plastic skirt of the pellet typically lodges at the surface, while the steel pellet itself separates and penetrates deep into the brain.

One shot properly placed like this will cause instant and irreversible loss of consciousness, but be prepared for convulsions and kicks as the animal dies. To confirm that the animal is unconscious, lightly touch one of its eyes with a piece of vegetation. If there is no blink reflex the animal is unconscious. Although a single shot may be all it takes, we recommend that you fire a second shot into the junction between the neck and the back of the skull to destroy the brain stem. This can usually be achieved without emptying the animal out of the trap. Any regular breathing action also indicates that it is not dead. The carcass should be disposed of responsibly by incineration or burial.

To maintain the muzzle energy of an air weapon, the barrel must be kept clean and pellets should ideally be lightly lubricated with a specialist airgun oil (eg. Napier Power). Do not use shotgun oil or any other kind which will leave a residue when dry.

We do not recommend the use of firearms to dispatch cage-trapped mink. A .22 rim-fire pistol or rifle should never be used. If you are close enough to dependably hit the mink in the trap, you are at severe risk of being wounded by ricochet, and furthermore you will damage the trap. A shotgun can be used with a normal game or clay-shooting cartridge, though you must realise that its use at close quarters is risky. Place the trap in front of a safe background, retreat to a distance of about 10m (pace it out), and take careful aim. Do not allow any bystanders closer to the trap than this, and be aware that shot and fragments can richochet high above the trap. Please also remember that shot can ricochet off a water surface.

Deployment and maintenance

We find it easiest to carry the raft base, tunnel, clay/sand mix, tracking basket (with OASIS® foam in place), rope and tethering pole as separate items. At the chosen site, the foam is saturated with water (which takes a few minutes). The clay-sand mixture is then smeared on top and smoothed off. Finally the tunnel is screwed down onto the raft and the raft is tethered. You will need to carry a broad spatula and a flat-bladed squeegee (for the clay mix), screwdriver, screws, knife (for the rope) and lump hammer or mallet (for the pole). You should also have personal safety gear (eg. waders, life-jacket, mobile phone).

We favour locations where the raft can be pushed into the emergent vegetation at the water's edge, because we assume mink will hunt carefully through that habitat. However, where there is no vegetation (for instance on canalised and over-grazed sections of river) the rafts seem to work just as well. One advantage of vegetative cover is to hide rafts from passers-by who may vandalise the raft, trap or release a captive mink. We try to moor rafts where the only access is by wading or swimming. Children are often the worst culprits and some sites are simply unworkable during school holidays because of easy access. We always 'dress' the tunnel with local vegetation to camouflage it, and renew this at intervals to avoid it looking 'tired' and unconvincing, but be careful not to obscure the ends of the tunnel. The glaring white edge of the polystyrene foam quickly becomes covered with an algal film which tones it down. Incidentally, publicity explaining the rationale of your work, and a raft and explanatory material left at a visitors centre, are also important steps to reduce interference.

The tracking cartridge can be lifted out without removing the tunnel from the raft. It is important to keep the clay/sand mix in good working condition, otherwise you are wasting your time. At every check, remove debris and smooth over the surface with a wet rubber squeegee (best), spatula or wetted hand. At intervals (eg. every two to four checks) it will be necessary to resurface, flip over or replace the clay-sand layer, because the clay particles gradually wash away with repeated smoothing, leaving a depressed surface and a hard gritty mix. Strong drying winds or sub-zero temperatures can also require the clay to be resurfaced. We carry the clay/sand medium already mixed in plastic bags when checking rafts. It is a false economy to skimp on the above.

Check rafts at one or two week intervals, depending on circumstances. More frequent checks are obviously desirable where you have recently returned a raft from trapping to monitoring mode, in case further mink remain to be trapped. At certain times of year (eg. during autumn dispersal) a fast response may be important. In these circumstances, try a one-week check interval and run traps for a maximum of seven days.

Longevity of rafts is probably about three to four years, depending on plywood quality. We have had rafts in almost constant use for this long, after which most show signs of the plywood delaminating. These rafts also become less buoyant resulting in the tracking cartridge becoming easily flooded.

Identifying mink tracks

Tracks are captured in perfect detail on rafts and mink tracks are easily recognised (see below). A field guide on animal tracks will help you distinguish other species if you are in doubt, but we plan to publish a separate photographic guide for raft users shortly. The tracks most similar to mink are those of polecats, and at present we can offer no reliable rule to distinguish the two species from their tracks. Polecats do visit rafts, but not frequently.

Tracks of other species, for instance water voles and water shrews, may also be of interest. Note that water vole tracks are often impossible to distinguish from those of brown rats. Only where droppings are also present can you be completely sure which of the two species was involved. Water voles often use the rafts as latrines, leaving droppings on the raft base, tunnel and tracking cartridge.

Switching to trapping mode

When adding a trap to the raft the tracking cartridge is removed. The cartridge and clay can often be stored somewhere close at hand after wrapping it in a plastic bag to keep it wet. If you leave it in place, it will probably be fouled by the captured animal.

For live-capture traps it is usually simply a matter of sliding the trap into the tunnel. If the tunnel is closely dimensioned to suit your live-capture trap, you may need to remove or loosen it to slide the trap in. When tightened down, it will clamp the trap to the raft, which helps to prevent theft. Small brackets or short lengths of galvanised steel builders' band can also be used to secure the trap to the raft with screws.

To set a spring trap, the tunnel must be lifted off, and you will need to remove the tracking cartridge and fit a solid base for the trap in its place. With any spring trap, remember to slip off the safety catch before you leave!

Record keeping

Your ability to assess how your mink trapping impacts on mink numbers and how that translates into conservation benefits, will be enhanced if you keep detailed records of your rafts, especially of tracks found during monitoring mode. It's not the number of mink you remove that matters, but how much of the time the river is free of mink. This is the evidence that will motivate your funders to support the project, and convince the public that this is the right course of action.

Responsibilities

For operational and river maintenance purposes, the Environment Agency (EA) needs to know where mink rafts are being used. If you are planning to use mink rafts, please contact the EA's local offices. There is a small theoretical risk of a raft causing obstruction to a sluice or other drainage control structures, resulting in flooding and extra maintenance work. In practice, we are not aware of any instance where this has occurred, as the raft is a small structure compared with trees and other common flotsam. Nevertheless, the legal situation is that the raft operator could be open to prosecution by the drainage board if these circumstances arose. Similarly, environmental pollution by raft materials is not really an issue, as rafts which break loose in flood conditions are generally easy to retrieve in large pieces. However, morally as well as legally, the operator should assume full responsibility for the raft while it remains on the water. It is advisable to 'retire' rafts after three years, rather than risking them breaking up at the next spate.

You should also be conscious of the risk of carrying disease (eg. fungal fish diseases, crayfish plague) from one river to another on any wet equipment. This includes rafts and waders. The best form of disinfection is to thoroughly dry equipment for a minimum of 48 hours. Drying in sunlight is the most effective option. A raft will take a long time to dry unless it is completely dismantled. Iodine-based preparations (eg. Iodophor, from veterinary suppliers or online services) are also recommended for disinfecting equipment. Iodophor contains iodine and phosphoric acid, so read the safety data.

Raft FAQs

Please remember that this information sheet reflects work in progress. We don't have all the answers yet, and our advice on how to use rafts may well develop as time goes on. But here are our current answers to some frequently-asked questions.

- ***How many rafts should I use?***

We currently recommend one raft per kilometre of river. Our research shows that this allows each mink access to at least one raft, and usually two to three rafts. In open water, our best guess would be to follow the same spacing along the water's edge, including islands. For land intersected by many ditches and channels, we would suggest one raft per square km as a starting point (not including rafts on the main river channel), but more may be necessary depending on the density of ditches.

- ***How long should the raft stay in trapping mode?***

It's tempting to leave traps 'just a little longer', in the hope of catching the mink that left its footprints. However, experience tells us that a mink will usually be caught within a few days, if at all. If it isn't caught in that time frame, don't jump to the conclusion that you have a 'trap-shy' individual. It is much more likely that it has been caught elsewhere, died through some other means or that it was a 'transient' individual simply passing through. If you keep the trap set you will probably only increase the number of non-targets you catch. Return the rafts to monitoring mode after each capture, or after a maximum of 10 days without a capture.

- ***Is there a way to keep non-target species out of traps?***

In trapping mode we use a physical excluder modified after Short & Reynolds (2001), to ensure that otters cannot force their way into the trap. This has a central space of 60mm between two upright dowel bars, leaving smaller spaces to the sides (see raft description and diagram on page three).

In a field experiment using paired rafts, with and without excluders (autumn 2002), visits by mink to rafts were shown to be unaffected by this excluder. Otters do visit mink rafts, leaving spraints on the ends and on the tunnel roof to prove it. When excluders are not present (we remove them when the raft is in monitoring mode) some otters do enter the tunnel – which is a tight squeeze, to judge by the deep footprints! But after seven years of research, in all seasons, in places with otters present, we haven't had any otters pass through tunnels that were protected by this excluder.

Other designs of otter excluder are offered by trap manufacturers, for instance by restricting the trap entrance to a three-inch square aperture. We now use this kind of trap without the dowel excluders. These too have allowed efficient capture of mink including large males, of which the largest encountered was 1.7kg.

Polecats (a species with Schedule 6 protection under the *Wildlife & Countryside Act, 1981*) are similar in size to mink, so clearly they can enter tunnels even with excluders fitted, as do other non-target species such as moorhens and water voles.

It is illegal to return either mink or grey squirrels to the wild after capture, so these species must be dispatched.

- *What is the best trapping strategy?*

There is no statutory restriction on when to trap mink. Arguably the most important time to monitor and trap is in the spring. The idea is to prevent on-site production of young mink and to safeguard prey species, which are breeding themselves and are therefore vulnerable. In spring mated female mink will be choosing den sites in which to pup, and until their pups are weaned the family will be relatively sedentary. Female mink we have trapped in spring time were carrying up to 10 foetuses. A family of this size develops a huge need for food as the summer progresses and the implications for prey species are obvious. If trapping commences as early as mid-February or early March, you are also likely to catch adult males as they roam around searching for females to mate.

As summer progresses you start to run into a welfare dilemma. If you kill adult females that have dependent young, those young will die of starvation and cold (mink dens are difficult to locate). If you want to avoid this scenario, you must suspend trapping until the young are free-ranging, have already eaten a lot of prey and have to be trapped one at a time. There is no easy solution to this dilemma. It arises in most other vertebrate pest control issues, eg. mice, rat, rabbit, woodpigeon, fox etc. Clearly the ideal is to trap adult females before their young are born. Rafts help to achieve this quickly, but they will also show if any mink are present during the summer, bringing the dilemma to uncomfortable prominence. You need to decide whether you are prepared to compromise effectiveness in the interests of welfare. If you are using rafts on a fairly wide scale, a ruthless campaign in year one that quickly reduces the population to low levels is arguably more humane than a campaign that is drawn-out because it has a close season.

Having stressed spring-time control because it has the greatest impact on the mink population, we don't actually know when mink have their greatest impact on prey species like water vole, crayfish or amphibians. It may be that autumn or winter predation by mink is critical for some of these species and the advice above may need to be revised in due course.

However, because it is not a nationwide eradication campaign, the mink you remove will eventually be replaced through immigration. If you are addressing only a small section of river, and/or you are in a region with a high mink density, this may happen very quickly. The peak time for dispersal is August/September and this is the second key period of the year after spring. Only experience in your location will tell you how much immigration typically takes place, but using the raft system you can clear the river again quickly.

- *Can rafts be used on spate rivers?*

The GWCT Mink Raft was developed on southern England chalk-streams, but it has been used successfully on rain-fed rivers in (for example) Cumbria, Aberdeenshire and the Welsh borders. Of course you must be aware of the dangers of rafts being swept away by sudden spates or flood water, and it may be that in rainy seasons you simply cannot use them. But we have made the system work despite these practical difficulties. It is advisable to rope only to one corner of the raft, allowing it to find quieter water, but also to fix a second 'back-up' rope in case the first one fails.

Knowledge of how your river behaves in spate is vital. Experience will show you where the slack water areas are. Try to position the raft so that it is protected by a large tree or other feature, so when the river floods there will often be slack water directly behind (downstream of) the tree and the raft will float quite safely. This will also protect it from heavy debris (tree trunks etc) floating down stream. The rope should be anchored quite high up allowing maximum rise and fall – too low and the raft may be dragged under water and lost or damaged. When water levels recede it will be necessary to re-float any rafts that have become beached. Experimentation is the key.

- *What bait should I use?*

We use no bait or scent lure on our rafts. In general, we have no problem in catching a mink within a few days, once we have detected it using a raft (see below for exceptions). Both bait and scent lures introduce complications which we feel are unnecessary. Bait needs to be replaced regularly to ensure it is fresh, and it may increase the interest from non-target species. Scent lures may have different effects on different mink depending on their sex and age class. Please don't use bait and then ask us why you aren't catching.

- *Why am I not catching mink despite finding tracks on rafts?*

Don't jump to the conclusion that the mink is 'trap-shy'. There are several more likely reasons for this situation. Mink tracks found during during late winter-early spring and in autumn, may have been left by 'transient' animals moving through the catchment, either to find mates or to disperse. Setting traps in response to these will waste time if the animal responsible for leaving the track has already moved away from the vicinity. The only options here are to shorten the raft checking interval to give a faster response time and to set traps, not only on the raft where you have found tracks, but also on adjacent ones. Obviously in taking these steps you sacrifice some of the labour-saving benefits of mink rafts.

Alternatively, the mink you have detected may live predominantly in terrestrial habitats, making only rare visits to the river. This applies particularly to male mink, which are more inclined to live on terrestrial resources such as rabbits. The problem may be increased in the presence of otters, which are thought to displace mink aggressively from the main river channels. Catching such individuals becomes more of a lottery. It may be necessary to set some traps on land nearby, to catch mink known to be present. But think: if the aim is to protect the river channel, then a mink that visits the river only occasionally is not such a big problem. If it's a male, then it is largely irrelevant either to water vole conservation, or to mink population control. Also the tracks you recorded could be one of the occasional visits to a raft by a polecat.

If the tracks were large, it's possible that the animal entered your trap but failed to trigger it. A very large male mink standing in front of the treadle plate will have its nose up against the end mesh, and may not take that final step before turning round and leaving the trap. In these circumstances the use of a spring trap may be justifiable.

If you are using an otter excluder different from the one described here, it may have the effect of reducing mink captures. Intuitively one would expect any such effect to be on the larger (male) mink.

One thing that isn't a problem is the use of single entry traps as mink have no trouble finding the way in.

- *There are too many tracks and I can't identify any – what can I do?*

Where there is a lot of 'traffic', mink tracks may become overlaid by those of other species, which can make identification difficult. Ironically, water voles have proved to be the main culprit. Territory-holding voles scent-mark in raft tunnels, then drum their feet over the latrine, which can quickly obliterate any other tracks present on the clay mix. The problem can be overcome by more frequent raft checks. Moving the rafts a short distance (50-100m) along the river may avoid the middle of a water vole colony. Trapping can still proceed if mink tracks are identified, but it should be remembered that water voles will not be excluded from traps and will enter them, rendering them unavailable to mink. Arguably if this is an issue, then water vole populations are healthy suggesting that mink presence is minimal.

Suppliers

Note: Listing does not imply endorsement by the GWCT of products from any manufacturer or supplier.

Suppliers of ready made rafts

Perdix Wildlife Supplies
(rafts, traps and materials)
Avenue R
Stoneleigh Park (National Agricultural Centre)
Kenilworth
Warwickshire, CV8 2LG
02476 692257
sales@perdixwildlifesupplies.co.uk

Albion Manufacturing
(rafts and traps)
The Granary
Silfield Road
Wymondham
Norfolk
NR18 9AU, UK
Tel. 01953 605983
Fax. 01953 606764

Dean Eley
(rafts)
The Timber Seasoning Sheds
The Historic Dockyard
Chatham
Kent ME4 4TZ
01634 234 024
07885 484881 (mob)

Pottery Ceramic Services
(clay for track baskets)
Unit 2
Arch Farm Industrial Estate
Fordingbridge SP6 1NQ
Hampshire
01425 655540
www.thekilnengineer.com

Filcris Limited
(recycled plastic rafts)
The Old Fire Station
Broadway
Bourn
Cambridge CB23 2TA
01954 718327
sales@filcris.co.uk
www.filcris.co.uk

Country Pursuits
(air pistols)
1A Grove Road
Mill End
Rickmansworth
WD3 8EB
01923 772916
sales@country-pursuits.info
www.country-pursuits-rickmansworth.co.uk

Other literature

- Reynolds, JC, Richardson, SM, Rodgers, BJE, Rodgers, ORK (2013). Effective control of non-native American mink by strategic trapping in a river catchment in mainland Britain. *Journal of Wildlife Management* 77(3): 545-554.
- Porteus, T, Short, M, Richardson, S, Reynolds, J (2012). Empirical development of strategy for the control of invasive American mink by trapping. *European Journal of Wildlife Research* 58(2): 403-413.
- Reynolds, JC, Porteus, TA, Richardson, SM, Leigh, RJ & Short, MJ (2010). Detectability of American mink using rafts to solicit field signs in a population control context. *Journal of Wildlife Management* 74:1601–1606.
- Reynolds, JC (2009). American mink: the art of the possible and national aspirations for biodiversity. *International Urban Ecology Review* 4: 74-82.
- Reynolds JC, Short MJ & Leigh RJ (2004). Development of population control strategies for mink *(Mustela vison)*, using floating rafts as monitors and trap sites. *Biological Conservation* 120: 533-543.
- Short MJ & Reynolds JC (2001). Physical exclusion of non-target species in tunnel-trapping of mammalian pests. *Biological Conservation* 98: 139-147.
- Sheail J (2004). The mink menace: The politics of vertebrate pest control. *Rural History,* 15(2): 207–222
- Jeffries DJ (2003). *The water vole and mink survey of Britain 1996-1998 with a history of the long term changes in the status of both species and their causes.* The Vincent Wildlife Trust. 234pp.
- Macdonald DW & Strachan R (1999). *The mink and the water vole. Analyses for conservation.* Wildlife Conservation Research Unit, Oxford University. 161pp.

Training workshops

We offer one day workshops or refresher courses for conservation bodies engaging in mink control. The workshops can be tailored to your requirements from the topics listed below, and are suited to everyone including decision-makers and practitioners, professionals and volunteers. You choose the location and the emphasis you require.

Topics available include:

- The history of mink and mink control in Britain.
- Is mink control necessary? The evidence linking water voles to mink.
- The GWCT Mink Raft. A logical approach that leads to focused, incisive mink control.
- Mink traps – recognising good and bad traps.
- Mink trapping on land.
- Planning and budgeting for mink control.
- Ethics.
- Humane dispatch and related safety and legal issues.
- Health and safety, risk assessments.
- Water vole reintroductions.
- Hands-on practical outdoor session: How to deploy and maintain the mink raft. Handling the mink in the cage. Humane dispatch. Gun safety.

Our workshops offer you the very best instruction from the experts, based on a long history of involvement in predator management, richly supported by research data and fully up-to-date. To book please contact our advisory department on 01425 651013 or email **advisory@gwct.org.uk**

Please keep in touch

If you are planning to use the GWCT Mink Raft, please get in touch with us. Mink are a difficult issue for everyone and we are keen to see management methods developed that are both effective and appropriate. Until we have a clear evaluation of what it takes to achieve particular conservation goals, none of us can decide what is feasible and reasonable. Intensive research of the kind done by the Game & Wildlife Conservation Trust, WildCru (Oxford University) and Aberdeen University has a crucial role here to gain unequivocal answers to specific questions. But ultimately the real test of any approach is in actual use. By co-ordinating practical trials across the country, we can turn locally applied effort into a collective learning experience.

Contacts

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Registered charity no. 1112023

Jonathan Reynolds, July 2003, revised with Mike Short, Tom Porteus, Ben Rodgers, Austin Weldon and Mike Swan, 2009, 2013 and 2015.