Appendix 7.8

2024 WATER VOLE SURVEY

Water Vole Survey Report

Broadwater Lake, Denham, Hillingdon

Taylor Lawton B.Sc. & Hazel Reading B.Sc.

January 2025

Derek Gow Consultancy Ltd

Upcott Grange, Broadwoodwidger, Lifton, Devon, PL16 0JS

01409 211578

derekgow@derekgowconsultancy.com

Table of Contents

Acronyms used in this report;

DZ = Development Zone

N, S, E, W = North, South, East, West

D,A,C,F,O,R = Dominant, Abundant, Common, Frequent, Occasional, Rare

1. Introduction

Derek Gow Consultancy Ltd (DGC) were contracted by Harper Environmental to survey Broadwater Lake, an old gravel pit that has since flooded into a lake in Denham, Hillingdon for water voles (*Arvicola amphibius*) (see map 1 in Appendix A). The purpose of this survey was to ascertain the presence of water voles on this waterbody. On this survey no field signs were recorded within the survey area. Nevertheless, a habitat suitability map (Map 5.1 and Appendix A map 2) has been determined and recommendations discussed as to how to improve the habitat for this species with the inclination towards potential future reintroductions.

Samantha (Hazel) Reading (B.Sc.) and Taylor Lawton (B.Sc.) of DGC visited the site from the 3rd to the 4th of December 2024 to complete a full field sign survey and habitat assessment of Broadwater Nature Reserve. Time also permitted a survey of a small section of the River Colne. The DGC survey team all specialise in the survey, conservation and mitigation of water voles with Hazel and Taylor both having over two years specialism in water voles.

This report presents the findings of the survey conducted in December 2024, along with habitat assessments and recommendations for improvements. Photographs are shown in Appendix B.

2. Ecology

Found along slow-moving watercourses with well vegetated steep or sloping banks, water voles excavate extensive burrow systems into the friable earth banks. These burrow systems house numerous chambers for sleeping and food storage, with interconnecting tunnels and multiple entrances above and below the water level in order to escape predators (Gow, Andrews and Smith, 2011; Dean *et al.*, 2016). Water voles are strict herbivores consuming a variety of flora species, such as grasses and waterside vegetation during spring and summer and roots, bark, rhizomes and bulbs during winter, approximately 227 different species (Moorhouse, Gelling and Macdonald, 2015; Abi Khalil *et al.*, 2021).

Water voles live in loose colonies, with approximately 10 breeding individuals (Gow, Andrews and Smith, 2011; MacPherson and Bright, 2011). Female water voles are fiercely defensive over their territory during breeding season, while males will overlap female territory (Tom Matchet, 2020). Territory length will vary depending on the habitat quality and the population density. However, female territories are considered to be 30 -150m while males are approximately 60 -300m (LEUZE, 1980; MacPherson and Bright, 2011). Territories are marked through latrine sites that are often found

outside the burrow entrances on prominent features. These are scent marked by the females using lateral scent glands on their flanks (Strachan, 2004).

Water voles have a relatively small lifespan of approximately 1.5 years for a female and 2 years for a male (Tom Matchet, 2020). However, due to their high mortality from predation, water voles usually live approximately one year in the wild. During winter, a loss of roughly 70/80% of a population can be expected due to over-winter stresses along with predation (Potapov *et al.*, 2004). Water voles do not hibernate but will spend more time within their burrow system living off their food caches during winter months.

Once widespread across Britain, water voles have seen a significant decline in population and range due to habitat loss and degradations, changes in land management and the introduction of the American Mink (*Mustela vison*) (Bonesi *et al*., 2007; Baker *et al.*, 2018). Water voles are particularly susceptible to mink predation as their usual method of evading predators, diving underwater into their burrows, is ineffective as the mink will follow them (Rushton *et al.*, 2001).

3. Legislation

In England and Wales water voles are listed on Schedule 5 of the Wildlife and Countryside Act 1981, receiving full protection since 2008. This makes it an offence to:

- Intentionally kill, take or injure a water vole.
- Possess or control any live or dead water vole or any water vole derivatives.
- Intentionally or recklessly damage or destroy a water voles place of shelter or protection.
- Intentionally or recklessly disturb a water vole whilst it is occupying a structure or place which it uses for shelter or protection.
- Intentionally or recklessly obstruct access to a water vole's place of shelter or protection.
- Sell, offer for sale, possess or transport for the purpose of sale any live or dead water vole, or any part or derivative, or advertising any of these for buying or selling.

The trapping or displacement of water voles needs to be carried out under a conservation licence issued by the relevant SNCO. This requires the applicant to demonstrate a conservation benefit for the species (Dean *et al,* 2016).

As the water vole is listed on Section 41 of the NERC Act 2006, a duty is placed on all public bodies to have regarded the conservation of biodiversity in England, while carrying out their normal functions.

Meaning the water vole must be treated as a material consideration within the planning process.

4. Survey Methodology

Two ecologists from Derek Gow Consultancy, Hazel Reading and Taylor Lawton, visited the site from the 3rd to 4th December 2024 to complete a water vole field signs survey.

The weather at the time of the survey was dull and cloudy, a small smattering of rain passed over quickly but this did not impact the survey results in any manner. The average temperature over both days came to 7°C.

Both of the surveyors were in a kayak surveying the bank from within the watercourse, both wearing life jackets, searching for field signs. Both surveyors are experienced and trained kayakers, registered with the British Canoeing Association. Areas inaccessible with a kayak were surveyed from the bank (I.e. “Lagoon & Inlet”) The surveyors stayed within eyesight of each other for H&S and rescue purposes. Field signs, for water voles, which could be identified on the survey include latrines, feeding stations, footprints and burrows which would be recorded using Mergin software (Lutra Consulting Limited, 2024) to map any significant information.

On arrival, the surveyors both accessed the main lake from a safe launch point. The first day the E bank islands and sailing club were surveyed, the second day surveyors focused on the lagoon, inlet, woodland, W bank and River Colne. Suitable habitat was identified and the vegetation and prominent ledges were searched thoroughly. Any signs found and habitat assessment points were recorded digitally using Mergin software.

The water vole survey was completed according to good practice guidance (Strachan, R. and Moorhouse, T. 2011, Dean, M. *et al,* 2016) and CIEEM competencies for undertaking water vole surveys (CIEEM, 2013).

4.1 Survey Constraints

Due to the size of the survey area and rocky substrate, the watercourses had limited access on foot, in addition to the low visibility of burrows from the top of the bank. This was overcome using a kayak to survey the watercourse.

There were time restraints on the survey which meant that not all of the lake could be surveyed thoroughly. As such the DZ area to be impacted, sailing club banks, and the habitat with the best suitability and potential for improvement were prioritised.

The timing of the survey was outside of the usual survey season for the species and therefore absence

cannot be assumed based on these results. Nevertheless, the banks could be seen more clearly through the barer branches while checking for burrows. The areas with optimal vegetation would also have shown evidence of feeding and feeding stations if these were present. The weather had stayed warm late into the year and many plants had not fully died back and remained a viable food source into December. There were many signs of other animals such as water fowl and rats feeding on the emergent vegetation, therefore it is concluded that these constraints did not significantly impact the results.

5. Results

Maps are presented in Appendix A. Photographs of the site are presented in Appendix B.

5.1 The Development Zone

The Development Zone (DZ) (also known as the peninsula) is located in the south east of the survey area and contains a very large concreted layer (old foundations approximately 9800 m^2) which extended up to the lake itself, thus no substrate was available for burrowing along this bank (SW edge of 'Woodland'). South of this concreted area of the DZ the lake partitioned itself into a small 'Inlet'; this has very shallow banks and an extremely crowded canopy layer with very little undergrowth and no edible riparian species.

The DZ also encompasses the north west bank of the 'Lagoon'. This section of the bank, like the whole of the site, is covered by more woody species creating a dark canopy which does not allow many herbaceous species to grow beneath. This is also reflected around the rest of the banks of the lagoon.

5.2 Broadwater Lake

Broadwater Lake is a large sailing lake and nature reserve in Denham, Hillingdon. On the west side it is bordered by the River Colne, the eastern side has The Grand Union Canal running alongside it. The survey area contains approximately 6.9 km of bank with the lake's 14 islands' banks comprising 1.9 km of this. Only a small section of the River Colne (40 m) could be surveyed due to time restrictions.

Due to the lake's past usage as a gravel pit, there were not many areas which had good friable earthen substrate. Most of the lake's banks consisted of a stony and gravelly substrate but with potential to burrow behind with effort. There were a couple of patches mostly by the sailing club in which the bank was covered by a stabilising stone gabion wall. Additionally, nearly all of the islands on the lake had banks completely submerged by water. Harper Environmental states that the water fluctuates by 1 m over the year.

The constant presence of woody trees and shrubs created overshadowing around the majority of the

banks, resulting in very little herbaceous species on which water voles could forage. The seasonal changes in floral species have been taken into account within the habitat assessment in section 5.4. It can be surmised here; that where there were intense concentrations of trees and shrubs, although maybe letting sunlight through during the survey, the light allowed to penetrate during spring and summer would be greatly diminished when these were in full bloom. Where there were breaks in the trees and shrubs, it was assumed that herbaceous species present (alive as well as dead) would reinvigorate and there would be more opportunities for more species to colonise the area due to the increase in light availability.

There were a mixture of steep banks, such as on Island #2, and shallow banks. Although the small patches of reed bed (*Phragmites australis*) on the west bank had shallow banks under 45° there would still be opportunity for the water voles to create above water nest balls or burrow further back into the bank underneath the protective layer of bramble (*Rubus fruticosus*) that edged these beds.

There are some areas around the lake recorded as poor but suitable habitat on the Suitability map Appendix A. For example where Island #8 has its closest point with the main bank, there are some notable spots of good vegetative cover. As discussed further in Section 6 if improved upon, these areas could become rather amenable to water voles as well as a broader range of species.

5.3 The River Colne

The River Colne's habitat far exceeded expectations due to the lack of presence of water vole on the west bank of the lake. There were long and dense patches of suitable vegetation in the section surveyed. Despite the tree lined bank creating patches of overshadowed undergrowth, the riparian vegetation (as described below in section 5.4.) spread out 2 – 3 m into the channel and created much foraging and resting habitat for water voles. There was feeding on this vegetation from water fowl, there were no signs of water vole recorded on the River Colne however.

5.4 Vegetation on site

It was mostly woody species present within the whole of the survey area including: white, common and goat willow (*Salix alba, S. viminalis & S. caprea*), along with alder (*Alnus glutinosa*) and bramble (*Rubus fruticosus).* The occasional hawthorn (*Crataegus monogyna*), ash (*Fraxinus excelsior*), dog rose (*Rose canina*) and elder (*Sambucus nigra*) occur. Ivy (*Hedera helix*) and the dominant buddleja (*Buddleja davidii*) occupy most of the percentage of cover. Breaks in this dense canopy and ivy cladded ground allow for herbaceous species such as Pendulous sedge (*Carex pendula*), Water mint (*Mentha aquatica*), Nettles (*Urtica diocea*).

Below are the species specific to certain areas;

The West bank sheltered around five beds of Common reed (*Phragmites australis*) averaging around 15 m long. These beds along with those found adjacent to the sailing club in the north east, provide good potential habitat for water voles especially with the bramble covered bank allowing for protection. The trees and shrubs lining the circumference of the lake and between these beds are comprised mostly of buddleja and willows.

On the River Colne; at OSNR: TQ 04068 89528, was a plant that resembled Marsh pennywort (*Hydrocotyle vulgaris)* but we could not get close enough to fully identify it. If the development or further works were to impact the River Colne, then a further visit should be undertaken by an ecologist experienced in Invasive Non Native Species (INNS). This will determine if the species is in fact marsh pennywort and not floating pennywort (*Hydrocotyle ranunculoides*). A large mat of reed canary grass (*Phalaris arundinacea*) lends diversity to this surveyed section along with water mint various sedge species (*Cyperaceae*) and nettles.

The Islands provided a good diversity of flora including: Yellow flag iris (*Iris pseudacorus*), fools-watercress (*Helioscadium nodiflorum*), willowherb sp. (*Epilobium sp.*), gypsywort (*Lycopus europaeus*) and a currant species which could not be identified at this time (*Ribes sp.)*. There were many islands completely submerged by water, during summer more of these species may show on other islands if not too densely shaded by bramble and the other trees and shrubs common to the islands.

The lagoon and surrounding woodland also held silver birch (*Betula pendula*) and hazel (*Corylus avellana*), daisies (*Bellis perennis*) and orange mullein (*Verbascum phlomoides*). Holly (*Ilex aquifolium*) was recorded here along with buddleja, ivy, grasses and sedges which are homogenous throughout the site.

Map 5.1 – Water vole habitat suitability - survey extent with feature ID labels and suitability lines

5.5. Summary

The Lagoon and Inlet did not, nor any other section of the lake within the DZ, contain signs of water voles. There are several areas of interest that can be improved upon to create a substantial increase in suitability of habitat, as discussed below (Section 6). The main hindrance to natural colonisation by choice edible plant species looks to be the dense overgrowth of buddleja and other scrubby species along the banks of the lake and islands. The reed beds and open unsubmerged islands would prove most beneficial to any reintroduction projects in the future. Especially if improved upon given the recommendation notes.

Fox scat, rat feeding and burrows were recorded around the SE section of the lake (see location in Appendix A) in currently poor habitat next to good vegetation adjacent to concrete banks in the woodland. The presence of rat burrowing and feeding in fallen trees around Island #8 (photo 10 in Appendix B) show proof as to the fitness of this surrounding poor but suitable habitat.

Many birds were recorded on the lake including grebe and cormorant, black headed gulls, mallards, moorhen, coots, Canadian goose and black cap.

The results of the habitat suitability assessment can be seen in map 5.1 above (and in map 2 shown in Appendix A). As can be seen the majority of the habitat around the lake is unsuitable for water voles currently. The islands 2 & 4 host the most favourable banks as does the small sections of reed beds around the sailing club and along the southwestern border.

6. Discussion

Although absence cannot be assumed based on the survey being completed outside of the optimal survey season, the lack of obvious burrows at this time of year and the lack of suitable habitat within the DZ means the lack of signs does signify absence of water voles. It is therefore possible that planned bank works can be undertaken, providing a precautionary method of works is in place and the area is checked by a suitably qualified and experienced ecologist in advance.

The reed beds along the western edge contained some viable habitat that may serve as a habitat corridor for water voles to bridge the rest of the lake banks from the river. The river has sufficiently suitable habitat in the area surveyed to entice water voles during the warmer seasons when population numbers increase. These corridors could be encouraged with thinning of trees and shrubs such that the reed bed sections can extend further along the bank and improve connectivity. Along with this increase in light, small ditches and bunds connecting the River Colne & banks of the lake when water levels are high would further encourage connectivity and the growth of herbaceous plant

species.

The islands #2, 2a & 4 also contained suitable habitat, especially come spring and summer as floral species already present in abundance and variety begin to flourish. The Reserve's islands all have the potential to become oases of excellent habitat for the water voles. This could be encouraged by any or all of the following; increasing diversity of herbaceous species present either via seeding or with plant plugs, this would also improve the bank surface for burrowing by establishing a margin of vegetation, the pruning of shrubs and trees around the edges of these islands would allow more light through to the herbaceous vegetation, leaving the established vegetation already present for potential nest-building. A release may be feasible on these islands following the improvement of herbaceous species.

The reed beds around the sailing club lake also hold suitable habitat currently which can be improved upon very easily. The limiting factor in this area is the low variety of edible species. Although the voles will be able to subsist on the common reeds, if the marginal vegetation such as the grasses, sedges, rushes and other soft leaved plants were allowed to grow long and form tussocks this would extend the viable range for the voles and improve the suitability score of this section. Additionally, as with the improvements on the islands mentioned above, seeding and plug planting of ground flora will benefit this section immensely. In line with this, minimal maintenance of the grass banks along the sailing club stretch -i.e. leaving a three metre buffer of untouched vegetation from toe of bank and edge of reeds as well as reduced timings and increased length of grass blade cutting on the higher bank – will prevent disturbance to all riparian species and improve this section's suitability.

To improve the rest of the banks around the main lake, a largescale removal and maintenance management project of the scrubby species, particularly buddleja, and ivy ground cover will need to be undertaken. Once the banks have had a few years to recover, additional planting may be determined to encourage colonisation of species valuable to water voles.

The edges of the development zone that intersect with the lake's banks may have prime opportunity for improving water vole habitat. Especially if earth works were to provide more and deeper bank space to burrow into. The botanical biodiversity would benefit greatly from intensive buddleja management. If agreeable, seeding more emergent riparian species will also provide a secondary benefit to the lake's ecosystem as a whole by providing oxygenation, food and shelter for many species.

6.1. American Mink Control

With suitable habitat management, small areas around Broadwater Lake could be suitable for water

vole. If a water vole reintroduction project were to be applied to Broadwater Nature Reserve then it is advised that mink monitoring should commence as soon as practicable. Strachan, Moorhouse & Gelling (2011) recommend setting floats every kilometre of watercourse, especially where these join, suggestive of the deployment along the neighbouring stretches of the canal line bordering east and the River Colne bordering west also. The highest priority target areas should be the habitat that is most suitable for water voles. Use of the automated mink traps as discussed below is commendable.

It is a recommendation of the third edition of the Water Vole Conservation Handbook (2011) that any receptor site or sites must be verifiably free of mink. The presence of this introduced predator has been strongly linked to a national decline in water vole populations. Independent studies in areas of good, complex riparian habitat suggest that mink as a single predator may depress water vole populations by up to 65% (Reynolds. 2007) and when it is considered that one study of water vole overwinter decline in a mink free environment on the River Itchen in Hampshire concluded that water voles may in any case decline by 87% over winter it is easy to understand how this novel predation can be so devastating (Jordan & Chestnut, 1999). This decline is however natural and occurs in response to reduced food, cover and raised water levels. Water voles have a 'boom and bust' cycle meaning they breed heavily in the spring and summer, reducing in ranges and numerical distribution over winter.

The Game and Wildlife Conservation Trust (GWCT) developed a highly successful "monitoring raft" for mink in 2003 which allowed the identification of their presence from the footprints that they leave on its central tracking cartridge. The veracity of this technology has since become much more effective through the development of remote notification systems for mink raft captures provided by electronic 'Mink Police' or 'Remoti' units. This system which was first used to great effect in Scotland as part of Naturescots Scottish Invasive Species Initiative has been further upgraded by the Waterlife Recovery Trust (WRT) in its efforts to remove mink on a large scape scale from Norfolk and Suffolk. This highly successful process is now being expanded into Lincoln, Bedford, Hertford, Rutland, Northants, Essex and North London.

There is evidence from other water vole reintroduction projects that in locations where the habitat quality is both high, extensive and complex that a permanent works team can maintain a system of smart mink rafts that secure the existence of a reintroduced water vole population.

Both the 'Remoti' and the system developed by 'forteenacre' work well although their use is dependent on reasonable mobile phone coverage. Active traps are constantly maintained in a couple of strategic locations across the site. They are continuously set and monitored. The units and magnet are fixed to the traps with light gauge wire. Throughout DGC's experience with using these traps they

have never failed to alert following a trap event.

The advantage these automated traps hold over the GWCT monitoring system is that the best time window for catching the mink is during the initial investigation of the raft. In the case of GWCT's floats the mink will not only find nothing of significance to lure them back to visit on future occasions, there is also no way to tell if the animal is still even in the area and may be several kilometres away in the time taken to observe the prints and set the trap.

With the automated traps the mink is captured instantly.

The guidance for mink control given in the Water Vole Conservation Handbook (Strachan, Moohouse & Gelling, 2011) broadly remains correct. Recommending that the best time to trap is prior to the water vole breeding season in the early spring (Feb – Apr). With continuing monitoring throughout the year, again the remote notification system is recommended to efficiently monitor and capture in one. The most effective time window for mink trapping is between October and March, with particular emphasis on November to January, during which time the mink will be dispersing as the females come into breeding condition. If using the traditional non remote notifying system, then traps must be checked at least once (preferably twice) daily.

A new method developed by the WRT that has become additionally effective is using scent lures within the traps drawn from the glandular secretions of previously killed mink.

Studies undertaken of the DNA of captured mink demonstrate that their maximum range is Circa 12km form their point of birth and that clusters of very closely related individuals are therefore commonly captured within the adjacent landscape. Though some individuals are capable of considerable movement across land most choose not to do so and very few individuals over the age of 3 years of age are currently being identified very closely related. These clusters may reflect the descendants from single distinct mink farms.

Any mink captured should be dispatched of and submitted for genetic analysis to the WRT. Once their origins are established a clearer understanding of population genetics and dynamics can be ascertained.

It should be noted that water voles will readily enter mink traps and so excluders (see *fig. 13* below) have been developed to deter their interference with the mink raft system. It is essential to fit these to prevent causing water voles stress or harm.

Figure 13 - Water vole excluder attached to a mink raft, photo credit Darren Tansley.

7. References

Bonesi, L., Rushton, S. P. and Macdonald, D. W. (2007) 'Trapping for mink control and water vole survival: Identifying key criteria using a spatially explicit individual based model', Biological Conservation. Elsevier, 136(4), pp. 636–650. doi: 10.1016/j.biocon.2007.01.008.

CIEEM (April, 2013) Competencies for Species Survey: Water Vole.

Dean, M. et al. (2016) 'The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series)', Sussex Wildlife Trust. Available at: www.watervoles.com (Accessed: 20 January 2021).

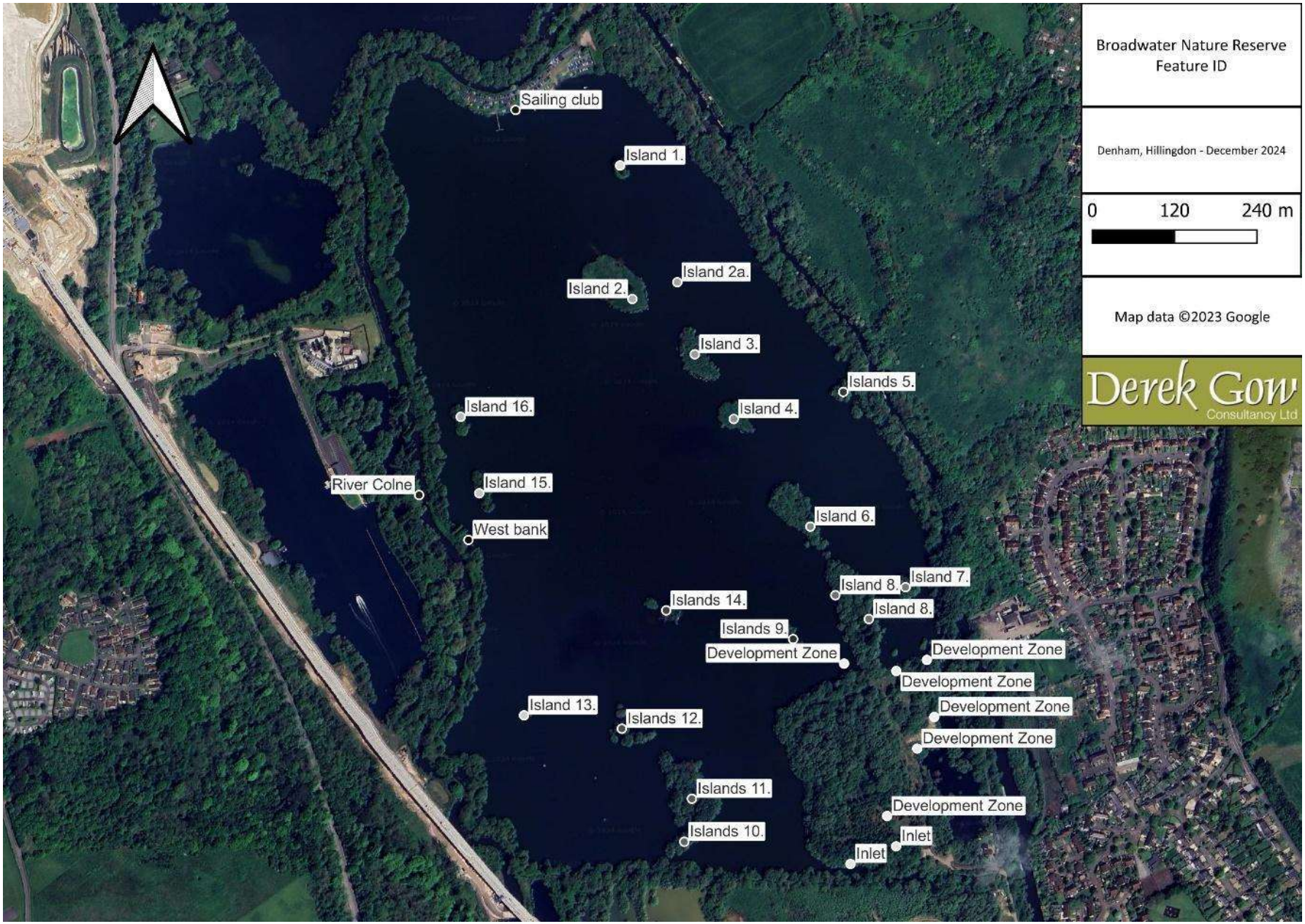
Gow, D., Andrews, R. and Smith, D. W. (2011) 'Water vole mitigation guidance - Important updates for evidence-based good practice.', (415), pp. 1–8. Available at: http://watervoles.com/index_htm_files/water vole mitigation guidance.pdf (Accessed: 16 February 2021).

Rushton, S. P. et al. (2001) 'Modelling the effects of mink and habitat fragmentation on the water vole', Journal of Applied Ecology. Blackwell Publishing Ltd., 37(3), pp. 475–490. doi: 10.1046/j.1365-2664.2000.00504.x.

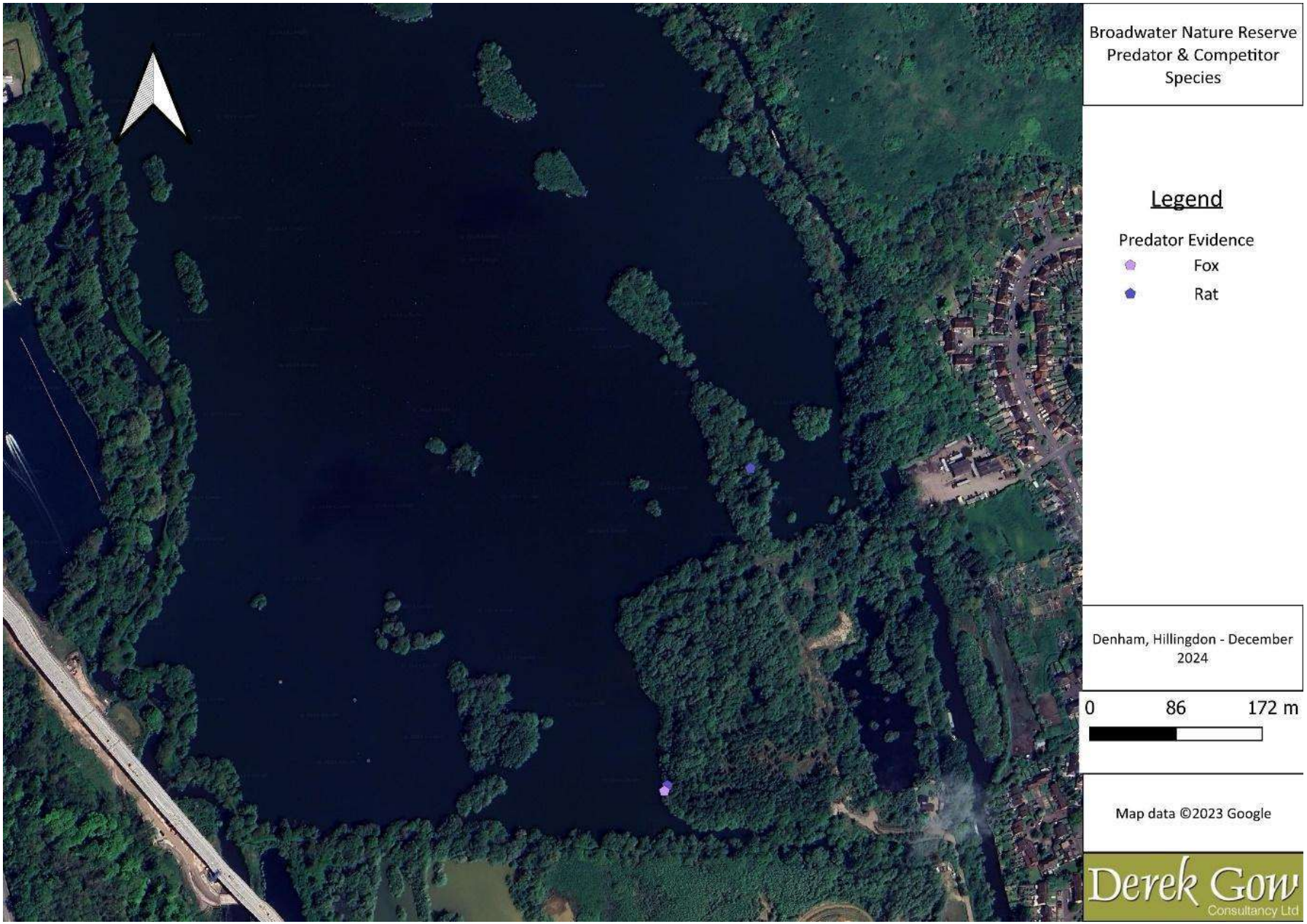
Strachan, R., Moorhouse, T. & Gelling, M. (2011). Water Vole Conservation Handbook (3rd edition). Wildlife Conservation Research Unit, University of Oxford.

Strachan, R. (2004) 'Conserving water voles: Britain's fastest declining mammal', Water and Environment Journal, 18(1), pp. 1–4. doi: 10.1111/j.1747-6593.2004.tb00483.x

Appendix A – Maps


Broadwater Nature Reserve
Feature ID
Denham, Hillingdon - December 2024
0
120
240 m
Map data ©2023 Google
Derek Gow
Consultancy Ltd
Sailing club
Island 1.
Island 2a.
Island 2.
Island 3.
Islands 5.
Island 16.
Island 4.
River Colne
Island 15.
Island 6.
West bank
Island 8.
Island 7.
Islands 14.
Island 8.
Islands 9.
Development Zone
Development Zone
Development Zone
Development Zone
Island 13.
Islands 12.
Development Zone
Islands 11.
Development Zone
Islands 10.
Inlet
Inlet


Broadwater Nature Reserve
Water Vole Habitat
Suitability
Legend
Suitability
Good
Suitable
Poor
Unsuitable
Denham, Hillingdon - December 2024
0
100
200 m
Map data ©2023 Google
Derek Gow
Consultancy Ltd


Broadwater Nature Reserve
Predator & Competitor
Species
Legend
Predator Evidence
Fox
Rat
Denham, Hillingdon - December
2024
0
86
172 m
Map data ©2023 Google
Derek Gow
Consultancy Ltd

Appendix B – Site photographs

Figure 1: Bank along eastern edge of DZ / lagoon area

Figure 2: Lagoon habitat to the east of DZ

Figure 3: Bank of the southwestern part of the DZ

Figure 4: Habitat along spit of land to the north of the DZ

Figure 5: Section of suitable habitat along the western bank of the lake

Figure 6: Islands #12 showing typical habitat on the islands in the lake

Figure 7: Large pond within DZ area which has potential to become good habitat

Figure 8: Island #2 with potential to have good habitat in breeding season

Figure 9: Sailing club marginal habitat

Figure 10: Rat burrow on island #8– shows the viability of bank substrate for burrowing in this

Figure 11: Overgrowth of buddleja and ivy present throughout the site.

Figure 12 - The River Colne - Brilliant vegetation for water voles.