

**Bentinck Tip and Void, Nottinghamshire**

**Water Vole Survey Report**



**October 2007**  
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## 1.0 INTRODUCTION

This report summarises the findings of a water vole survey undertaken at Bentinck Tip and Void by SLR Consulting Ltd (SLR) in May 2007. It has been prepared by SLR on behalf of Waste Recycling Limited to inform the Environmental Impact Assessment (EIA) and mitigation proposals in respect of the proposals to reclaim the Tip and Void.

### 1.1 Legislative Background

Water voles (*Arvicola terrestris*) are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) in respect of Section 9(4) only. This makes it an offence to intentionally or recklessly damage, destroy or impede access to a place of shelter or protection for water vole.

Water voles are a UK Priority Species within the UK Biodiversity Action Plan (BAP) and are also included in the Nottinghamshire Local Biodiversity Action Plan (LBAP)<sup>1</sup>.

### 1.2 Survey Aims

The aims of the water vole survey were to:

- determine the presence of water voles within the site in 2007;
- assess the status of the population within the site between 1999 and 2007;
- assess the significance of the population at Bentinck ; and
- identify suitable recommendations and mitigation measures to minimise any impacts on the water vole population in line with guidance produced by English Nature<sup>2</sup> and the Wildlife Conservation Research Unit<sup>3</sup>.

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<sup>1</sup> Accessed at <http://www.nottsbag.org.uk/projects.htm#bag> on 17/10/07

<sup>2</sup> English Nature (2001) *Water Vole Guidance for Planner and Developers*

<sup>3</sup> Strachan, R. & Moorhouse, T. (2006) *Water vole Conservation Handbook (Second Edition)*

### 1.3 Summary of Previous Surveys and Records

Several previous surveys for water vole have been undertaken at the site between 1999 and 2006. These are summarised below in Table 1. In addition to these surveys, ecological records were also obtained from the Nottinghamshire Biological and Geological Records Centre (NBGRC, 2004).

**Table 1 Previous Surveys for Water Vole**

<b>Title</b>	<b>Date</b>	<b>Author</b>
Annual Ecological Report: Amphibian and Water Vole Surveys	April 1999	Wessex Ecological Consultancy for Terry Adams
Assessment of Nature Conservation Value, Bentinck Void	August 2001	Humphries Rowell Associates (HRA) on behalf of Nottinghamshire County Council
Ecological Surveys, Bentinck Void	May 2001	Applied Environmental Research Centre
Ecological Surveys, Bentinck Void	August 2002	Richard Kilshaw Ecological Services
Ecological Surveys, Bentinck Void	May 2003	Richard Kilshaw Ecological Services
Protected Species Survey, Bentinck Void	May 2004	Applied Environmental Research Centre
Protected Species Survey, Bentinck Void	May 2005	Applied Environmental Research Centre
Protected Species Survey, The Pit Area	May 2005	Applied Environmental Research Centre
Protected Species Survey, Bentinck Void	June 2006	Applied Environmental Research Centre
Protected Species Survey, The Pit Area	June 2006	Applied Environmental Research Centre

Evidence of water vole was observed within the site during all of the above surveys. Drawings 2 to 8 summarise the results of these. Full details of the findings of each survey can be found in Appendix 13 of the Environmental Statement (October 2006)<sup>4</sup>.

<sup>4</sup> SLR Consulting Ltd (October 2006) *Bentinck Tip and Void Appendices to Environmental Statement Volume 2 (Ecology)*

## 2.0 METHODOLOGY

On 2<sup>nd</sup>, 3<sup>rd</sup> and 8<sup>th</sup> May 2007, an ecologist from SLR Consulting undertook a survey for water vole at Bentinck Tip and Void. This survey was conducted in line with guidance produced by English Nature<sup>5</sup> and the Wildlife Conservation Research Unit<sup>6</sup>. Ad hoc observations of water vole or its field signs made during other surveys undertaken at the site in 2007 are also recorded here.

Water voles are most active between March and October and field surveys to confirm presence or absence can only be reliably carried out between mid-April and September. The survey method comprised a detailed search of the bank-side areas of all watercourses and waterbodies, including up to 2m of adjacent land. The animals themselves are rarely seen so the survey concentrated on searching for signs of water vole occupation, such as:

- burrows present along the bank, both above and below water level. These are 4-8cm in diameter and generally slightly wider than they are high;
- tracks/passageways through dense vegetation on the bank-side;
- cylindrical droppings around 1cm in length. They are generally odourless and sometimes green in colour;
- latrines filled with droppings, normally found in prominent places;
- feeding signs, including chopped lengths of grasses and similar plants left in piles and grazed 'lawn' areas around burrow entrances; and
- footprints, particularly in soft mud.

Confusion with brown rat (*Rattus norvegicus*) can occur so it is important not to rely on a single feature, such as burrows or footprints, as these are similar for both species. Latrines are the most reliable field sign to confirm presence of water vole, as they are distinctive and differ from the droppings of brown rat.

Field signs for brown rat, otter and mink were also recorded where observed.

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<sup>5</sup> English Nature (2001) *Water Vole Guidance for Planner and Developers*

<sup>6</sup> Strachan, R. & Moorhouse, T. (2006) *Water vole Conservation Handbook (Second Edition)*

### **3.0 SURVEY RESULTS**

#### **3.1 2007 Survey Results**

The watercourses and waterbodies at the site were surveyed in sections, which were numbered, as shown in Drawing 1. Short descriptions of each section and a summary of recorded field signs are shown in Table 1. Drawing 1 shows the results of the survey.

**Table 1 Water Vole Survey Results**

Section Number	Description of section	Field Signs Observed	Water Vole Presence
1	<p><b>Cuttail Brook</b> A section of Cuttail Brook within the site and to the north of Annesley Woodhouse Quarry SSSI, which runs into the south-east corner of the flooded void.</p> <p>The brook has steep banks (45-60°), densely vegetated with bramble, herbaceous vegetation and trees. The channel varies between 50cm and 2m wide, and the brook reaches a maximum depth of 30cm.</p> <p>Slight meandering of the stream has left exposed silt and shingle point bars. Flow is generally slow but occasional riffle and pool sequences encourage faster flow in places.</p> <p>The northern stretch is inaccessible due to fine sediment and dense bank-side vegetation.</p>	<p>Approximately 15 burrows were identified throughout the section, including an underwater bolthole. Several of these did not appear to be in use. One grazed lawn was also observed.</p> <p>However, over four aggregations of rat droppings were found along the banks. No water vole droppings or latrines were recorded.</p> <p>Water vole young are susceptible to predation by brown rat, thus colonisation of areas by rat may preclude the presence of water vole<sup>7</sup>.</p>	<p>No confirmed evidence to suggest the current presence of water vole. Historical presence possible.</p>
2	<p><b>Lower Ditch (Eastern Slope)</b> The ditch running adjacent to the flooded void on the eastern slope.</p> <p>The channel has shallow to steep, well-vegetated banks with willow and deciduous saplings in and alongside the bed.</p> <p>Water level was very low at the time of survey, with parts of the bed dry.</p>	<p>No signs of water vole were observed.</p> <p>Low water level makes this section unsuitable for water vole.</p> <p>On 5<sup>th</sup> June, the water level had risen significantly to approximately 30cm, and four latrines and a single dropping were found along the banks during a great crested newt survey.</p>	<p><b>Water vole present.</b></p>
3	<p><b>Upper Ditch (Eastern Slope)</b> The ditch running parallel to section 2 above.</p>	<p>Dry.</p>	<p>No evidence to suggest the presence of water vole.</p>
4	<p><b>Stream to NE of Flooded Void</b> A small, 5 metre-long stream flowing out of the north-east corner of the flooded void.</p> <p>The channel is narrow, less than 1m wide, and fast-flowing. The banks are well-vegetated by grass species and are vertically-sloping in places.</p>	<p>Runs and feeding remains were observed in the eastern part of the section.</p> <p>Two large latrine sites were recorded. Rat droppings were also present at one of these</p>	<p><b>Water vole present.</b></p>

<sup>7</sup> Barreto, G.R., Macdonald, D.W. & Strachan, R. 1998 'The Tightrope Hypothesis: An explanation for plummeting water vole numbers in the Thames catchment.' In: *United Kingdom Floodplains*. R.G. Bailey, P.V. Jose & B.R. Sherwood. (Eds.) Westbury, Yorks.

		sites.	
5	<b>Lagoon 5</b> A small lagoon dominated by bulrush with 30-50° slopes. The movement of water is sluggish.	Three latrines, one very fresh, were observed on a pipe. One burrow was also recorded.	<b>Water vole present.</b>
6	<b>Lagoon 4</b> A lagoon of approximately 25 x 8m with shallow, well-vegetated banks.	Runs and feeding remains were observed on the northern and western banks.	<b>Water vole presence possible but unconfirmed.</b>
7	<b>Lagoon 3</b> A lagoon measuring 20 x 25m with shallow to steep, well-vegetated banks.	Runs along the banks were observed to the north, south and east.	No evidence to suggest the presence of water vole.
8	<b>Lagoon 2</b> A lagoon measuring 20 x 25m with shallow to steep, well-vegetated banks.	No signs of water vole were observed.	No evidence to suggest the presence of water vole.
9	<b>Ditch beyond Lagoon 2</b> A very narrow channel of up to 20cm wide with steep banks.	Dry.  Eight old burrows with two grazed lawns.	No confirmed evidence to suggest the current presence of water vole. Historical presence possible.
10	<b>Ditch to West of Cuttail Brook</b> A 30m stretch of steep-banked ditch with well-vegetated banks and bed.	Dry.	No evidence to suggest the presence of water vole.
11	<b>Ditch adjacent to Farm</b> A ditch running parallel to the earth bund surrounding the farm to the south of the site.	Dry.	No evidence to suggest the presence of water vole.
12	<b>Ditch on Western Slope</b> A continuation of Section 10. The channel has steep, well-vegetated sides. In places, metal mesh is exposed in the bed where it is poorly vegetated.	Dry.	No evidence to suggest the presence of water vole.
13	<b>Ditch to North of Flooded Void</b> A steep-sided, unvegetated channel.	Dry.	No evidence to suggest the presence of water vole.
14	<b>Ditch to SW of Tip</b> A steep-sided, unvegetated channel.	Dry.	No evidence to suggest the presence of water vole.
15	<b>Lagoon 12</b> A lagoon half vegetated by bulrush and half comprising unvegetated quarry spoil.  There is sparse bank-side vegetation and a maximum depth of water of 5cm.	No signs of water vole were observed.  Low water level and sparse vegetation make this section unsuitable for water vole.	No evidence to suggest the presence of water vole.

16	<p><b>Lagoon 13</b> A lagoon measuring 15 x 10m, which is sparsely vegetated and up to 20cm deep.</p>	<p>No signs of water vole were observed.</p> <p>Poorly vegetated banks make this section unsuitable for water vole.</p>	<p>No evidence to suggest the presence of water vole.</p>
17	<p><b>Lagoon 14</b> A lagoon measuring 12 x 8m with steep, well-vegetated earth banks and extensive bulrush cover.</p> <p>Maximum water depth is 50cm.</p>	<p>Two latrines, one large and one with a small number of droppings, were observed on the eastern bank. At least twelve burrows were recorded in the vicinity.</p>	<p><b>Water vole present.</b></p>
18	<p><b>Lagoon 15</b> A lagoon measuring 7 x 5m with steep, well-vegetated earth banks.</p> <p>This lagoon is inaccessible due to its steep banks.</p>	<p>Approximately ten burrows were observed on the northern and eastern banks of the lagoon.</p> <p>Runs entering the water were also recorded here.</p>	<p><b>Water vole presence possible but unconfirmed.</b></p>
19	<p><b>Section of Stream</b> A steep-sided brook choked with vegetation such as bramble and willowherb.</p> <p>The channel is approximately 20cm wide, with water level less than 15cm.</p>	<p>No signs of water vole were observed.</p> <p>Densely vegetated banks make this section unsuitable for water vole.</p>	<p>No evidence to suggest the presence of water vole.</p>
20	<p><b>Lagoon 16</b> A half-dry lagoon with steep, well-vegetated banks of spoil.</p>	<p>Two burrows were observed on vertical slopes to the west of the lagoon.</p> <p>Feeding remains and runs were also recorded.</p>	<p><b>Water vole presence possible but unconfirmed.</b></p>
21	<p><b>Section of Stream</b> A length of brook downstream of section 19. The vertical banks are densely vegetated with bramble, nettle and willowherb, and the channel is frequently choked. Abundant tree cover along the bank-side affords a high degree of shading to the stream.</p> <p>The stream is a maximum of 50cm wide and 20cm deep. Flow is sluggish.</p>	<p>No signs of water vole were observed.</p>	<p>No evidence to suggest the presence of water vole.</p>
22	<p><b>Small Lagoon</b> A narrow lagoon, 15m x 1.5m, adjacent to lagoon 16.</p> <p>The water is slow-flowing and clear, with a maximum depth of 5cm.</p>	<p>No signs of water vole were observed.</p> <p>Low water level makes this section largely unsuitable for water vole.</p>	<p>No evidence to suggest the presence of water vole.</p>
23	<p><b>Small Lagoon</b> A very small lagoon with steep, well-vegetated banks and a clear, slow flow. Water level reaches a maximum of 20cm depth.</p>	<p>No signs of water vole were observed.</p>	<p>No evidence to suggest the presence of water vole.</p>

24	<b>Lagoon 17</b> A lagoon with well-vegetated, grassy banks, which are generally steep. Flow is slow.	Several burrows and runs along the southern and eastern banks.	<b>Water vole presence possible but unconfirmed.</b>
25	<b>Lagoon 18</b> A lagoon measuring approximately 30 x 8m with near-vertical banks which have been undercut. The lagoon is greater than 1m deep.	Three burrows evident on the southern bank with footprints in mud around the entrances.	<b>Water vole presence possible but unconfirmed.</b>
26	<b>Lagoon 19</b> A rectangular lagoon with shallow and steep banks, which are poorly vegetated downslope.	No signs of water vole were observed.  Poorly vegetated banks make this section unsuitable for water vole.	No evidence to suggest the presence of water vole.
27	<b>Ditch alongside Lagoons 16-19</b> A narrow channel of less than 20cm wide with maximum water depth 10cm. Flow is sluggish. Upstream, the water has a distinct orange tint.	No signs of water vole were observed.	No evidence to suggest the presence of water vole.
28	<b>Flooded Void</b> The large lagoon at the bottom of the void.	No signs of water vole were observed.	No evidence to suggest the presence of water vole.
29	<b>Lagoon 6</b> A rectangular lagoon to the west of the flooded void.  The lagoon has steep and shallow banks and frequent cover of bulrush. The western bank is well-vegetated.	One run was found on the western bank.	No evidence to suggest the presence of water vole.
30	<b>Lagoon 7</b> A half-dry lagoon adjacent to lagoon 7. The southern bank is vegetated with dense scrub. The western bank is well-vegetated and grassy. Most banks are steep.	Two runs were found on the southern and eastern banks.	No evidence to suggest the presence of water vole.
31	<b>Lagoons 10A-G</b> The large lagoons at the top of the unvegetated tip.	No signs of water vole were observed.  Poorly vegetated banks make this section unsuitable for water vole.	No evidence to suggest the presence of water vole.

Four sections showed confirmed presence of water vole. Three of these are located adjacent to each other in the quarry void and the other is situated to the north of the tip. A further five sections, all within the vicinity of confirmed water vole sites, were identified as possibly supporting water vole.

Woodroffe *et al* (1990b)<sup>8</sup>, quoted in Wildlife Conservation Research Unit guidelines, suggest an approximate correlation of six latrines per breeding female. Using this correlation as a

<sup>8</sup> Woodroffe, G.L., Lawton, J.H. and Davidson, W.L. (1990b) ' Patterns in the production of latrines by water voles (*Arvicola terrestris*) and their use as indices of abundance in population surveys. *Journal of Zoology (London)*, 220, 439-445.

guideline, Section 2 probably comprises the breeding territory of at least one breeding female water vole. Similarly, sections 4 and 5 probably comprise the breeding territory of at least one further breeding female. This territory may extend to section 6 (lagoon 4). Section 17 is also likely to support at least one breeding female, and section 18 may be included in this territory. There may be a further water vole territory around sections 20, 24 and 25 (lagoons 16 to 18) on the tip side of the site. The site is therefore likely to support at least three breeding females.

### 3.2 1999-2007 Survey Results

Drawings 1 to 8 show the results of water vole surveys for the site from 1999 to 2007.

Previous results show significant variations over time in the presence of water vole across the site. Field signs of water vole have previously been found in sections 1, 3, 7, 8, 18, 20, 22, 23 and 30 in addition to the sections in which they were found in 2007.

### 3.3 Discussion

The survey results from 2007 suggest that colonies of water vole at the site are small. Only one other survey, that undertaken in the void in 1999<sup>9</sup>, estimated the size of the colony. This report estimated a colony of four breeding adults, which would also represent a small population. Generally speaking, small populations of animals are vulnerable to demographic and environmental fluctuations and therefore have a higher probability of extinction.

Results from 1999 to 2007 show large variation over time in the presence of water vole across the site. This suggests that movement of water voles across the site is common and that populations fluctuate on a yearly basis.

It is likely that water voles at the site exist as one or two colonies or metapopulations. This means that water vole will migrate between territories or colonies depending on factors such as food availability, predation risk and breeding opportunities. For example, a good breeding year may result in greater numbers of females dispersing to develop territories. This explains the spatial and temporal variations in water vole observations at the site between 1999 and 2007.

Water voles have been shown to disperse up to 5.2km (Telfer et al, 2003)<sup>10</sup> but it is considered unlikely that migration between the void and the lagoons to the north of the tip would regularly occur, due to the lack of connecting suitable habitats, e.g. vegetation cover and watercourses or waterbodies to provide protection en route. It is therefore likely that at least two colonies or metapopulations exist at the site.

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<sup>9</sup> Wessex (1999b) *Annual Ecological Report: Amphibian and Water Vole Surveys, Bentinck Void*. Appendix 13/3

<sup>10</sup> Telfer, S. et al. (2003) 'Parentage assignment detects frequent and large-scale dispersal in water voles'. *Molecular Ecology*, 12 (7), 1939-1949

## 4.0 EVALUATION OF WATER VOLE POPULATION AT BENTINCK

### 4.1 Population Significance in National and County Context

National Water Vole Status Surveys in 1989-1990 and 1996-1998 concluded that there had been an approximately 88% decline in water vole numbers in Britain between the two surveys<sup>11</sup>. A recent population estimate based on the number of latrines found suggested a total GB pre-breeding population of 1,200,000 animals<sup>12</sup>.

Local record centre data<sup>13</sup> shows the change in distribution of water voles in the East Midlands from historical known range to 2003. By 2000, water voles had disappeared from areas of known range in Lincolnshire, Northamptonshire and Leicestershire. Between 2000 and 2003, water voles disappeared from further areas within these three counties and, to a lesser extent, Derbyshire. In 2003, water voles were still present throughout the majority of Leicestershire and Derbyshire but were scarce in Northamptonshire and Lincolnshire.

Water voles have historically been recorded throughout Nottinghamshire. By 2000, there had been very little reduction in this range. By 2003, the majority of 10km-square areas within the county were still known to support water voles. Although the data is limited to presence-absence within 10km-square areas, Nottinghamshire remains a stronghold for water voles within the East Midlands regional area.

Correspondence with the mammal recorder for Nottinghamshire<sup>14</sup> has highlighted a decline in water vole populations similar to that reported in the rest of the UK, but that there are a few areas within the county with 'good' populations and that recently the decline appears to have slowed. Mink numbers within Nottinghamshire have also declined, which will have reduced the predatory risk to water vole populations. There is no data on water vole population sizes within the county.

However, draft criteria for the identification of mammal sites of significance in Nottinghamshire<sup>15</sup> state that any site supporting water voles should be designated a Site of Importance for Nature Conservation (SINC), which is a feature of county ecological value.

Three recent records (since 1992) of water vole were provided by NBGRC in 2004 within 2km of the site, located between 400m and 2km to the north of the site. These records refer to a sighting of one water vole, a site of an indeterminate number of individuals and an observation of two latrines. There is no data on water vole population sizes within the vicinity of the site.

Surveys at Bentinck in 1999 and 2007 have estimated small populations of water voles within the site. In line with draft SINC criteria, the application site is likely to be considered of at least county value to water voles. However, given the small size of the population at Bentinck, the site is unlikely to be large enough to be of regional significance. The water vole population within the application site is therefore assessed as being of county value.

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<sup>11</sup> Jefferies, D. (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*. Vincent Wildlife Trust

<sup>12</sup> <http://www.ukbap.org.uk/UKPlans.aspx?ID=115>

<sup>13</sup> Leicestershire Environmental Resources Centre (April 2004) *Towards an Atlas of Biodiversity in the East Midlands*

<sup>14</sup> E-mail from John Ellis, County Mammal Recorder and Records and Information Officer for Nottinghamshire Wildlife Trust, 23<sup>rd</sup> July 2007

<sup>15</sup> Ellis, J (2007) *Sites of Importance for Nature Conservation: Criteria for the Identification of Mammal Sites in Nottinghamshire* [Draft]

## 4.2 Carrying Capacity of the Site

Survey in 2007 suggested a small population of at least three breeding females within the site.

Water voles prefer sites with well-vegetated banks, minimal shading by trees and slow-flowing water. Baker *et al* (2007)<sup>16</sup> suggest a water depth of 30cm as the critical depth at which water voles occupy ditches when other habitat conditions are suitable. Against these criteria, 2570m (20%) of the flowing and standing water bankside habitats within the site provide suitable habitat for water voles.

Depending on habitat quality, the length of a breeding female water vole territory varies between 30m and 150m<sup>17</sup>. If habitat quality within the site is optimal, up to 85 water vole territories could be supported, based upon full occupation of those ditches and lagoons with sufficient depth of water. However, if habitat quality is of low suitability for water voles, one would expect approximately 17 territories could be supported. On the basis of this information, it is considered that the majority of the flowing and standing water bank-side habitat is suboptimal. Bank-side habitats may be sub-optimal for a range of reasons, including:

- lagoons and ditches have banks of spoil and well-compacted made ground which are not easily penetrable for burrow excavation;
- there is minimal suitable connecting habitat between the lagoons to the north of the tip and between these lagoons, ditches and the void, preventing migration;
- proximity to urban areas may increase predation by domestic cats; and
- high density of other predators, including foxes, mink and rats.

Evidence of rats has been recorded within the site along Cuttail Brook and the stream to the north-east of the void. As young water voles are susceptible to predation by rats, the presence of rats may reduce the carrying capacity of the site for water voles. Evidence of mink within the site has not been observed.

Given the presence of rats and the suboptimal quality of habitat within the site, the population of water voles at Bentinck at carrying capacity would be likely to remain small and would not be significantly larger than the size of the population at the site at present.

## 4.3 Summary of Evaluation

At present, the population of water voles at Bentinck is evaluated as being small, comprising only several breeding territories. In line with draft SINC criteria for Nottinghamshire, the site is assessed as being of county value for water voles.

Habitats within the site are likely to be of suboptimal quality. Lagoons consist of spoil banks, which are not favoured by water voles for burrow excavation. Connecting habitat between lagoons is often unsuitable for water voles and would minimise successful dispersal to new territories. In addition, the presence of rats at the site, which are known to predate upon juvenile water voles, may reduce the carrying capacity of the site for water voles. It is therefore considered that the carrying capacity of the site for water voles would be small and not significantly larger than the current population of water voles at the site at present.

<sup>16</sup> Baker, M., Proud, A. and Ross, A. (2007) 'Are the Fens a national stronghold for Water Voles? Evidence from the Cambridgeshire fens'. *British Wildlife*, 18 (4), 259-266.

<sup>17</sup> Strachan, R. & Moorhouse, T. (2006) *Water vole Conservation Handbook (Second Edition)*

## 5.0 IMPACT ASSESSMENT

The proposed development has the potential to cause impacts during both construction and operation on the distribution of water voles and their habitats. These impacts comprise:

- habitat loss; and
- increase in pest species leading to inter-specific competition, or increased risk of predation.

Habitat loss involves the direct destruction or physical take-up of vegetation, or other structures of conservation interest. In the absence of mitigation, the proposed development of the application site would require the loss of bank-side, standing and flowing water habitat, which supports or has the potential to support water voles. This loss of habitat would reduce the carrying capacity of the site for water voles and could lead to the direct loss of individuals within the current population due to a lack of suitable connected habitat in the vicinity. These effects are considered to be a significant negative impact upon a receptor of county value.

Brown rats are opportunistic scavengers which are often attracted to landfill sites or other anthropogenic sources of food. As mentioned above, young water voles are susceptible to predation by brown rat. An increase in brown rats within the site as a result of the potential development might preclude the presence of water voles. However, operations at the landfill site would involve the control of rodents and it is considered that this could reduce the numbers currently frequenting Cuttail Brook.

The proposed development would be unlikely to affect the number of domestic cats frequenting the site. Whilst some ponds created as part of the mitigation scheme outlined below will be closer to existing residential areas, a number will be further away. It is considered unlikely that operational activity at the site would further encourage or discourage cats from the site as a whole.

Mitigation and enhancement measures for water vole are discussed below. These measures are considered to significantly reduce the potential effects upon water voles.

## 6.0 MITIGATION

A mitigation and compensation strategy is proposed to minimise disturbance and provide adequate mitigation to water voles and their habitats during the proposed development in accordance with standard guidelines<sup>18</sup>. This strategy would be finalised through agreement with the Environment Agency, Nottinghamshire County Council and Natural England. The main elements of the mitigation proposals are:

- Where possible, avoid development disturbance to known water vole habitat through protection of key habitats, including the remnant section of the Cuttail Brook and lagoons on the colliery tip to the north of the site.
- Compensate for the loss of water vole habitat by the creation of new habitats in the first phase of development at least equal in area to that which will be lost.
- Instigate management of these newly-created habitats to provide adequate replacements in terms of foraging, territory, breeding and resting habitat. Bank materials would be of a soft substrate to enable water vole burrowing.
- Ensure that the timing of any disturbance to water vole habitat is the most appropriate time to minimise disruption to the animals.
- Where necessary, exclude water voles from habitats that cannot be avoided by development through habitat modification and trapping at an appropriate time of year.
- Where appropriate, reduce the possibility of water voles accessing development land; especially where there is a risk that they would be harmed by construction operations, through fencing or habitat modification.
- Ensure control of brown rat as part of the landfilling operation.
- Post-translocation monitoring of water vole population numbers and distribution for 25 years.
- Continue to manage aquatic and terrestrial habitats for 25 years.

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<sup>18</sup> Strachan, R. & Moorhouse, T. (2006) *Water vole Conservation Handbook (Second Edition)*

## **7.0 SUMMARY**

On behalf of Waste Recycling Limited, SLR Consulting Ltd undertook a water vole survey at Bentinck Tip and Void in May 2007. This survey was undertaken to inform the Environmental Impact Assessment (EIA) and provide more detailed mitigation measures in respect of the development proposals to reclaim the Tip and Void.

The survey comprised detailed searches of the bank-side areas of all waterbodies and watercourses within the site. As water voles are rarely seen, the survey concentrated on searching for signs of water vole occupation.

Several previous ecological surveys have been undertaken in relation to the Bentinck site between 1999 and 2006. These surveys all recorded evidence of water voles within the site.

The survey results from 2007 suggest a population at the site of at least three breeding females. This is comparable to 1999 survey estimates of four breeding adults. In line with draft SINC criteria, the application site is likely to be considered of at least county value to water voles. However, given the small size of the population at Bentinck, the site is unlikely to be large enough to be of regional significance. The water vole population within the application site is therefore assessed as being of county value.

Sub-optimal habitat and the presence of rats at the site suggest that the population of water voles at Bentinck at carrying capacity would remain small and would not be significantly larger than the size of the population at present.

A range of mitigation and compensation measures have been outlined to minimise the impacts of the proposed development upon water voles. In addition, recommendations to enhance the habitats of the final restoration scheme have also been made.

