


Translocation of the little whirlpool ramshorn snail: Scoping survey 2016




Highways England

9th October 2016

Prepared by 
Principal Ecologist
Abrehart Ecology

Checked by 
Ecologist
Abrehart Ecology

Approved by 
Associate Director
AECOM

Rev No	Comments	Checked by	Approved by	Date
1	Draft			09/11/2016
2	Revised draft			08/05/2017
3	Final draft			09/05/17

AECOM, 2 City Walk, Leeds, LS11 9AR, United Kingdom

Telephone: +44(0)113 391 6800 Website: <http://www.aecom.com>

Abrehart Ecology Limited, Pound Farm, Low Road, Great Glemham, Suffolk, IP17 2DQ

Telephone: +44(0)1728 663282 Website: <http://www.abrehartecology.com>

Job No **47075202**

Reference

November 2016

This document has been prepared by AECOM Limited for the sole use of our client (the "Client") and in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM Limited and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM Limited, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM Limited.

Contents

1	Introduction.....	2
1.1	Background	2
1.2	Project Outline	2
1.3	Scoping Survey	3
2	Methods.....	4
2.1	Study Area.....	4
2.2	Site Walkover	5
2.3	Appraisal Criteria and Classification	5
2.4	Limitations	7
3	Results	8
3.1	██████████ (Area 1)	8
3.2	██████████ (Area 2)	9
3.3	██████████ (Area 3)	10
3.4	██████████ (Area 4)	11
3.5	██████████ (Area 5).....	12
3.6	██████████ (Area 6)	13
3.7	██████████ (Area 7).....	14
3.8	██████████ (Area 8).....	15
3.9	██████████ (Area 9).....	16
3.10	██████████ (Area 10)	17
4	Discussion	18
4.1	General.....	18
4.2	Recommendations for Detailed Surveys.....	19
4.2.1	Site Selection	19
4.2.2	Fieldwork Protocol.....	19
5	Summary and Conclusions.....	21
6	Acknowledgements	22
7	References.....	23

1 Introduction

1.1 Background

Little whirlpool ramshorn snail *Anisus vorticulus* is a small aquatic gastropod with a dorsoventrally flattened spiral shell approximately 5mm in diameter. It is a UK Biodiversity Action Plan Priority Species and the only British non-marine snail which is a European Protected Species. Since 2004, the little whirlpool ramshorn snail has been listed in the EU Habitats and Species Directive as a species of community interest, requiring special areas for conservation (Annex II) and strict protection (Annex IV), and is further listed as Red Data Book: Vulnerable.

Populations of the little whirlpool ramshorn snail have been declining the UK since the 1960s, and in their conservation assessment for the species the Joint Nature Conservation Committee describe the future prospects for the little whirlpool ramshorn snail as 'poor'; a species likely to struggle unless conditions change (JNCC, 2007). Although the precise cause of population decline is not clear, it is thought that drainage, over frequent dredging, and eutrophication are all likely to be contributing factors (JNCC, 2007; Van Damme, 2012).

Within the UK, little whirlpool ramshorn snail can currently be found at sites in Norfolk, Suffolk, and Sussex, although the majority of published literature on the species has focussed on the Sussex population. There is little consensus regarding the small-scale habitat preferences and ecology of little whirlpool ramshorn snail, and relatively little is known about even its basic biology (reviewed by Terrier et al. 2006). Given its precarious conservation status, the need for more research and more detailed understanding of the species is clear.

1.2 Project Outline

The work detailed here is a continuation from a previous pilot conservation translocation study conducted in 2016 (see AECOM 2015b, and AECOM/Abrehart Ecology 2016a, 2016b, 2016c for further details), and therefore forms the basis for a second phase of translocations for little whirlpool Ramshorn snail within the Broads.

The translocation approach carried out to date has involved moving 800 little whirlpool ramshorn snails from 'donor ditches' (which already contain healthy populations of the species) to 'receptor ditches' (where the species is absent, but the habitat is suitable to potentially support a population). Prior to translocation, ditches were assessed to ensure that they met the broad requirements of either a donor or a receptor ditch – this assessment entailed an initial non-intrusive scoping survey to identify broad, potentially suitable habitats, followed by a detailed survey of the vegetation and mollusc communities and abiotic variables (such as water quality and land management practices). This process provided data for a detailed multivariate analysis (see AECOM/Abrehart Ecology 2016c for details) which was used to select donor and receptor ditches for the pilot translocation.

Monitoring is ongoing at the pilot translocation sites, and will continue for at least three years. While long-term data from the pilot study sites will be required for a full assessment of the success of the translocation, initial results (six months post-translocation) have been promising, indicating good survival of adults and reproduction at the receptor sites (AECOM/Abrehart Ecology 2016a).

This report presents the findings of a scoping survey which aimed to find areas potentially suitable for a second, more extensive translocation of little whirlpool ramshorn snail.

1.3 Scoping Survey

The scoping survey described in this report is the first stage of a second round of conservation translocations for little whirlpool ramshorn snail (for details of the first see AECOM 2015b and AECOM/Abrehart Ecology 2015c, 2016a, 2016b, 2016c). The purpose of this scoping survey was to determine which sites and ditches were likely to be most suitable as receptor/donor sites, and where subsequent detailed survey efforts should be focused.

The aims of this scoping study are therefore as follows:

- to investigate whether there are adequate potential receptor and donor sites within the study area for further, more detailed survey;
- to select which are the most appropriate sites for further detailed survey; and
- to eliminate ditches with little potential to support little whirlpool ramshorn snail.

The scoping study comprises non-intrusive site walkover of the ditches, using expert knowledge of the species habitat, derived from the literature review described in the Feasibility Report (AECOM, 2015a).

2 Methods

2.1 Study Area

Whilst the little whirlpool ramshorn snail's range extends across a number of areas in England, the scoping survey reported here concentrates on ten survey areas across East Anglia - [REDACTED], [REDACTED], [REDACTED].

- [REDACTED] (Area 1, central grid ref: [REDACTED]) is managed as [REDACTED], and is located [REDACTED], immediately [REDACTED]. The site falls [REDACTED] and is noted for its floristically diverse fen habitats, which are managed using low-intensity grazing.
- [REDACTED] (Area 2, central grid ref: [REDACTED]) is immediately [REDACTED].
- [REDACTED] (Area 3, central grid ref: [REDACTED]) [REDACTED] beyond it. [REDACTED].
- [REDACTED] (Area 4, central grid ref: [REDACTED]) is to [REDACTED], [REDACTED] (Area 5, central grid ref: [REDACTED]) [REDACTED].
- [REDACTED] (Area 6, central grid ref: [REDACTED]) comprises [REDACTED], which is [REDACTED]. The area, including ditches, is managed with an emphasis on conservation and biodiversity. [REDACTED].
- [REDACTED] (Area 7, central grid ref: [REDACTED]) is an area of [REDACTED]. The site is owned and managed [REDACTED].
- [REDACTED] (Area 8, central grid ref: [REDACTED]) [REDACTED]. The site is [REDACTED].
- [REDACTED] (Area 9, central grid ref: [REDACTED]) is an area of grazing marsh [REDACTED]. [REDACTED].
- [REDACTED] (Area 10, central grid ref: [REDACTED]) [REDACTED].

Each of the areas were selected for scoping based upon firstly, likely suitable habitat for little whirlpool Ramshorn snail (characterized by slow-flowing ditches within areas of grazing marsh and/or fen), and secondly by historical records of the species at some of the sites. Area 3 was selected for scoping based upon previous results of survey work carried out by Abrehart Ecology (2012), which found the marshes at [REDACTED] to hold a rich aquatic flora and suitable habitat for little whirlpool ramshorn snail, including the presence of shining ramshorn snail *Segmentina nitida*, an indicator species of habitat suitability for the target species (AECOM/Abrehart Ecology 2016b).

A summary of the approximate size and ditch length within the seven different areas are summarised in Table 1. The ten areas contain an estimated 43.8km of ditch in total.

Table 1 Summary of survey areas

Site Name	Area Number	Location (National Reference)	Grid	Historic records of little whirlpool ramshorn snail	Approximate Total area of site (Ha)	Total length of ditches (m)
██████████	1	██████████		██████████ ██████████ ██████████ (in nearby habitats)	13.5	██████████
██████████	2	██████████		No	37.2	██████████
██████████	3	██████████		██████████ ██████████ ██████████ (in nearby habitats)	15.1	██████████
██████████	4	██████████		No	42.2	██████████
██████████	5	██████████		No	23.3	██████████
██████████	6	██████████		Yes	21.6	██████████
██████████	7	██████████		Yes	52.2	██████████
██████████	8	██████████		Yes	15.7	██████████
██████████	9	██████████		No	8.7	██████████
██████████	10	██████████		No	6.1	██████████

2.2 Site Walkover

The site walkovers were carried out during October 2016 on days with suitable weather conditions (good visibility with little or no rain). The survey team comprised:

- ██████████ (Abrehart Ecology) – Principal Ecologist and Mollusc Specialist
- ██████████ (Abrehart Ecology) – Ecologist
- ██████████ (Abrehart Ecology) – Ecologist

All the ditches within each area (apart from those in Area 3) were walked and appraised. The ditches in Area 3 were scoped from a vantage point due to access constraints, and were evaluated based upon this and previous assessment of the site (as reported in Abrehart Ecology, 2012).

2.3 Appraisal Criteria and Classification

The initial scoping study only considered parameters that could be determined by a non-intrusive walkover of the ditches within each area. The approach adopted for the scoping survey followed the method detailed in the scoping survey for the initial pilot study (AECOM 2015b). Each of the ditches within Areas 1 – 10 were appraised using criteria based on the habitat requirements of the species (as set out in the Feasibility Study report; AECOM

2015a) and other practical constraints. Factors and/or features considered favourable for little whirlpool Ramshorn snail included:

- Relatively late successional ditches (but not very late ditches that are likely to be too overgrown);
- Presence of diverse emergent and/or submerged vegetation;
- Natural high nutrient status, but not highly eutrophic - ditches that appear to be highly eutrophic (e.g. significant algal growth or choked with species indicative of eutrophication, such as common duckweed *Lemna minor*) are not likely to support little whirlpool ramshorn snail;
- No evidence of pesticide usage in adjacent terrestrial habitat (i.e. not ditches adjacent to land used for arable farming);
- Presence of shallow marginal habitats – including poached/trampled areas;
- Sympathetic management of ditches and limited mechanical digging - i.e. not ditches that appear to be area regularly or intensely determine habitat suitability classes between 1 and 5, as dredged;
- Appropriate breed and density of cattle; and
- Absence of obvious signs of pollution.

These criteria were used to assign a habitat suitability score to each ditch, using a six-tiered scoring system (described in Table 2). Sites containing a high proportion of high-scoring ditches were subsequently considered for further, detailed surveys.

Table 2 Description of habitat suitability classes

Habitat Suitability Class (HSC)	Description	Example
5 – Very good potential	Ditch of very good potential for little whirlpool ramshorn snail	Ditch with diverse emergent and submerged vegetation, presence of extensive shallow marginal habitat, relatively late successional, with no sign of recent management and appropriate surrounding land use
4 – Good habitat	Ditch generally of good potential for little whirlpool ramshorn snail	Ditch with relatively diverse emergent and submerged vegetation, presence of limited shallow marginal habitat, with no sign of recent management and appropriate surrounding land use
3 – Good/moderate potential	Ditch generally of good potential for little whirlpool ramshorn snail, but with some potential limitations	Intermediate between HSC type 4 and HSC type 2
2 – Moderate potential	Ditch generally of moderate potential for little whirlpool ramshorn snail, but clear potential limitations	Ditch with some floating leaved and emergent plants steep sided, but with some shallow marginal habitat due to cattle poaching. Some evidence of eutrophication and recent management/dredging.
1 – Low potential	Ditch of poor potential for little whirlpool ramshorn snail	Ditch with few floating leaved plants, steep sided, presence of extensive algae, Enteromorpha etc. surrounding land use arable
0 – Negligible potential	Ditch of very little or no potential for little whirlpool ramshorn snail	Heavily shaded ditch or excessively eutrophic ditch.

2.4 Limitations

The survey findings are based on conditions recorded at the time of the survey. The results presented in this report therefore describe a snapshot of the conditions of the ditches and surrounding land use.

There were no issues with access in Areas 1-2 or 4-8 where all the ditches could be surveyed sufficiently for the purposes of this investigation. However, there was no access to Area 3, meaning that the ditches could only be appraised from vantage points and compared to previous data collected at the site (Abrehart Ecology, 2012). Data obtained from this area are therefore should therefore be interpreted with more caution.

3 Results

A summary of findings of the scoping study are presented in Sections 3.1 – 3.10, and are presented on a site by site basis. For each Area, maps are presented depicting the categorization of ditches using a “traffic light” scale, with green representing the ditches deemed to be of highest potential (Category 5 – very good potential) and Red representing those of negligible potential (Category 0), where little whirlpool ramshorn snail is likely absent.

3.1 [REDACTED] (Area 1)

All the ditches in Area 1 were fully accessible during the site walkover. As shown in Figure 1, of the approximately [REDACTED] of ditch within this land parcel, the majority (approximately [REDACTED]) was deemed to be of ‘good’ habitat suitability (Category 4 – Table 2) for little whirlpool ramshorn snail and thus likely to either already support the species and therefore represent a potential donor site, or provide suitable receptor sites. One approximately [REDACTED] section on the eastern boundary was deemed to be of ‘moderate/good’ (Category 3) potential, but ditches along both the eastern and western boundaries of the overall area (approximately [REDACTED] of ditch in total) were mostly deemed to be of ‘moderate’ habitat suitability (Category 2).

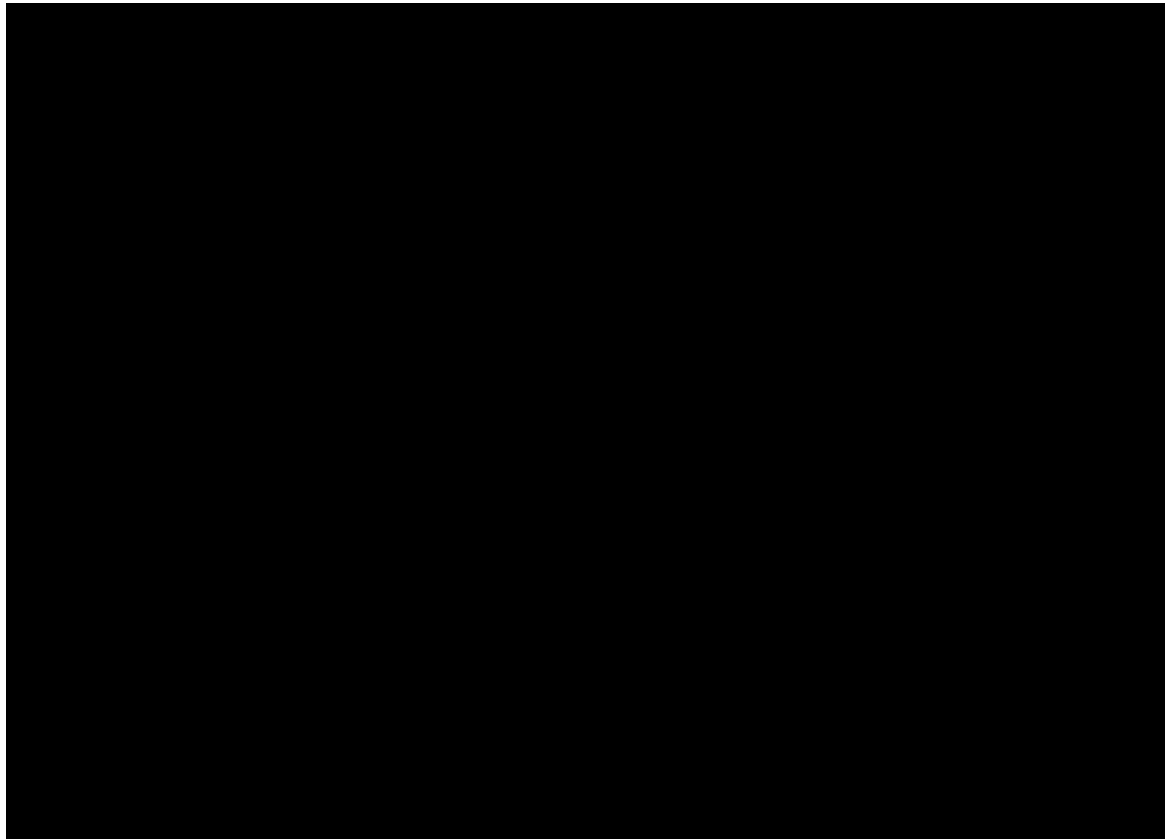


Figure 1: Location and designated habitat potential of ditches in Area 1 [REDACTED]

3.2 [REDACTED] (Area 2)

All of the ditches in Area 2 were fully accessible during the site walkover. As shown in Figure 2, of the approximately [REDACTED] of ditch within this parcel, [REDACTED] were deemed to be of 'good' habitat suitability (Category 4), and approximately [REDACTED] were deemed to be of good/moderate habitat suitability (Category 3). Approximately [REDACTED] of ditch were deemed to be of moderate potential (Category 2), while a further approximately [REDACTED] of ditch were deemed to be of 'poor' habitat suitability (Category 1).

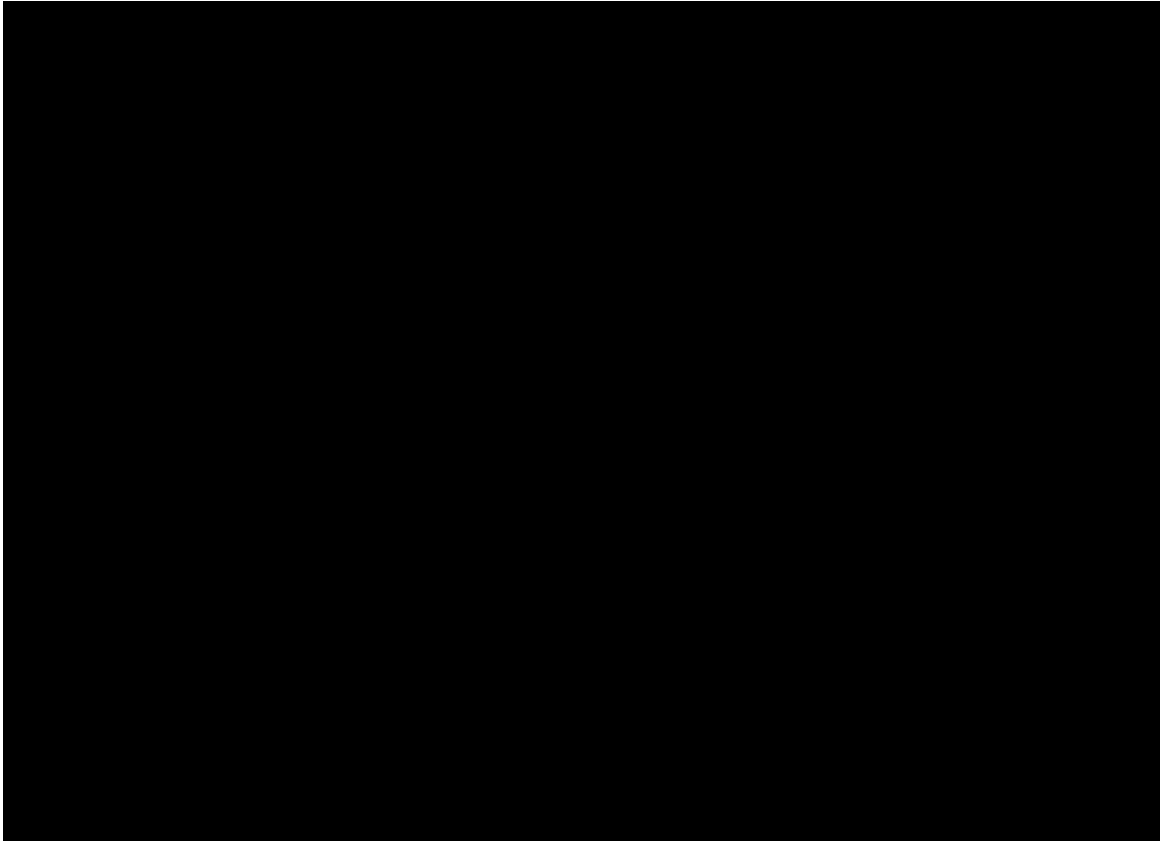


Figure 2: Location and designated habitat potential of ditches in Area 2 [REDACTED]

3.3 [REDACTED] (Area 3)

The ditches in Area 3 were observed from accessible vantage points, as full access to the adjacent land plots had not been secured at the time of the scoping surveys.

Based on the limited observations made from the vantage points, previous habitat assessment by Abrehart Ecology (2012) and records of shining ramshorn snail at the site, the majority of ditches (approximately [REDACTED]) were considered to be of 'good' (Category 4) potential habitat suitability for little whirlpool ramshorn snail. [REDACTED] (approximately [REDACTED] in length), which formed the northern boundary of this parcel, was deemed to be of 'moderate/good' habitat suitability (Category 3), being [REDACTED] which feeds [REDACTED] [REDACTED] and therefore likely to be regularly dredged, with deeper, more open water and less aquatic vegetation than is considered optimal for little whirlpool ramshorn snail.

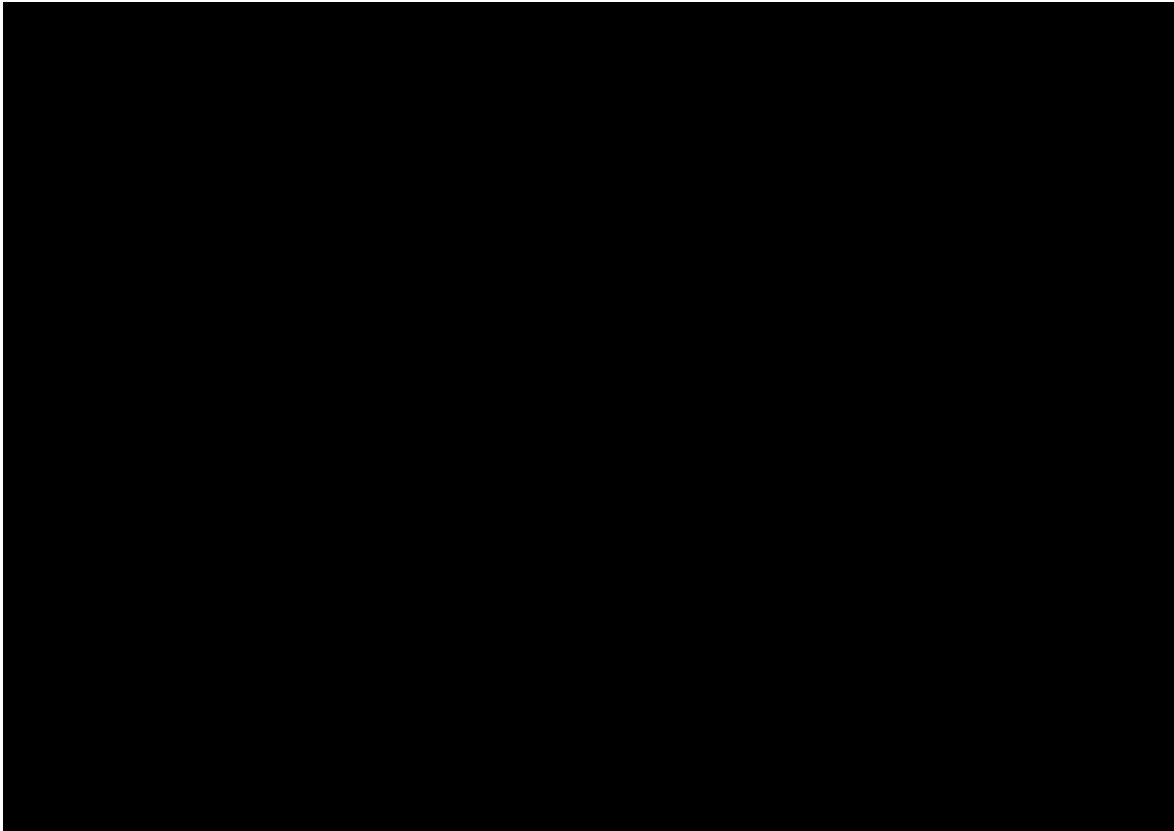


Figure 3: Location and designated habitat potential of ditches in Area 3 [REDACTED]

3.4 [REDACTED] - North (Area 4)

All the ditches in Area 4 were fully accessible during the site walkover. As shown in Figure 5, of the approximately [REDACTED] of ditch within this parcel, approximately [REDACTED] were deemed to be of 'good' habitat suitability (Category 4). Approximately [REDACTED] of ditch deemed to be of 'moderate/good' habitat suitability (Category 3) were located throughout this parcel, and approximately [REDACTED] of ditch were deemed to be of 'moderate' (Category 2) potential. Approximately [REDACTED] of ditch were deemed to be of low potential (Category 1), while a further [REDACTED] of ditch were deemed to have negligible potential (Category 0).

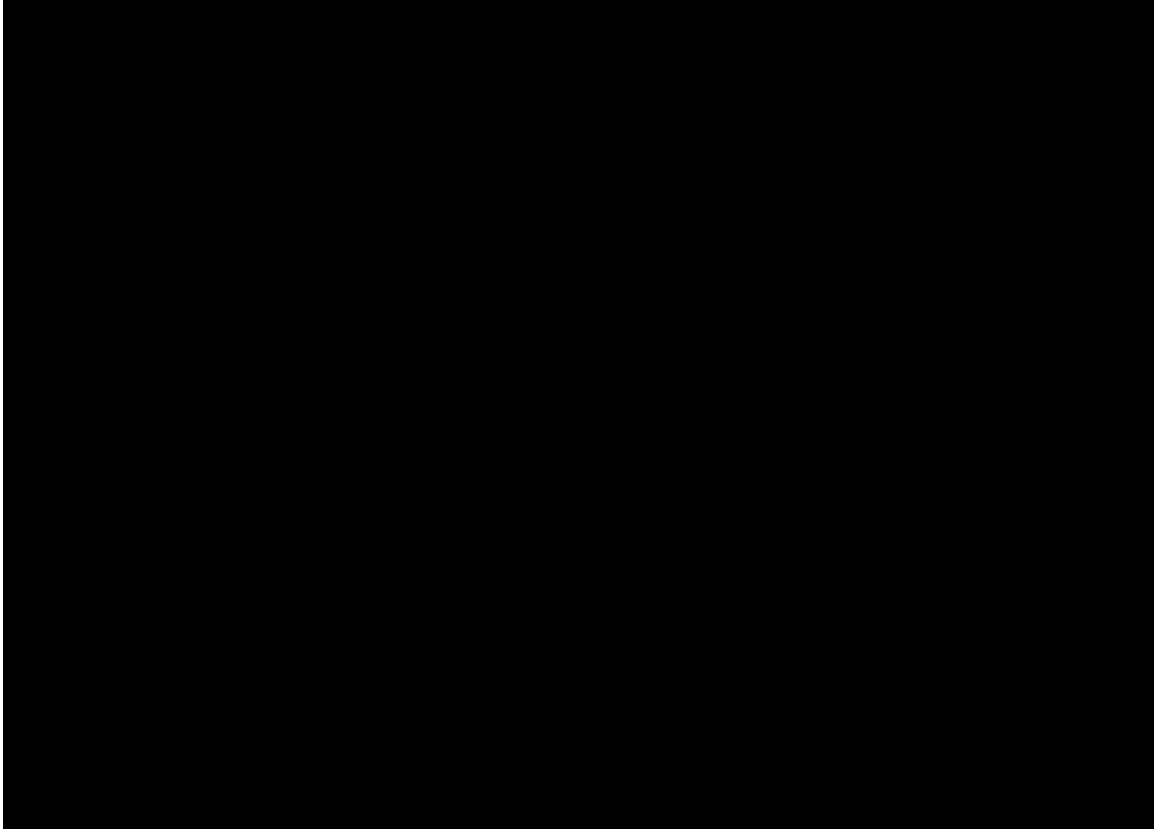


Figure 4: Location and designated habitat potential of ditches in Area 4 [REDACTED]

3.5 [REDACTED] - South (Area 5)

All the ditches in Area 5 were fully accessible during the site walkover. As shown in Figure 6, of the approximately [REDACTED] of ditch within this parcel, approximately [REDACTED] were deemed to be of 'good' habitat suitability (Category 4). Approximately [REDACTED] of ditch deemed to be of 'moderate/good' habitat suitability (Category 3) were located throughout this parcel, while approximately [REDACTED] were deemed to have negligible potential (Category 0).

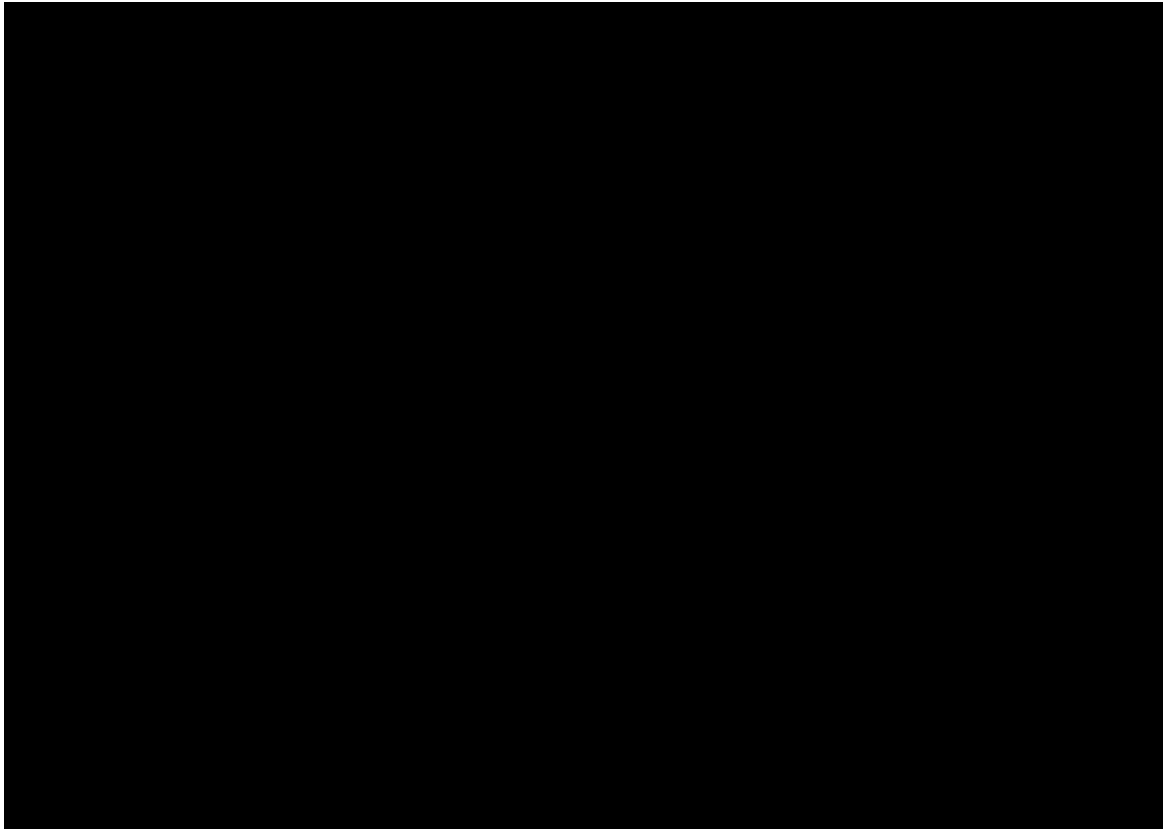


Figure 5: Location and designated habitat potential of ditches in Area 4 [REDACTED]

3.6 [REDACTED] (Area 6)

All the ditches in Area 6 were fully accessible during the site walkover. As shown in Figure 7, of the approximately [REDACTED] of ditch surveyed, approximately [REDACTED] were deemed to be of 'good' (Category 4) habitat suitability for little whirlpool ramshorn snail. Approximately [REDACTED] were deemed to be of 'moderate/good' (Category 3) habitat suitability and a further [REDACTED] of ditch were considered of 'moderate' (Category 2) quality. One small section of ditch, approximately [REDACTED] was considered to be of negligible potential (Category 0) for little whirlpool ramshorn snail.

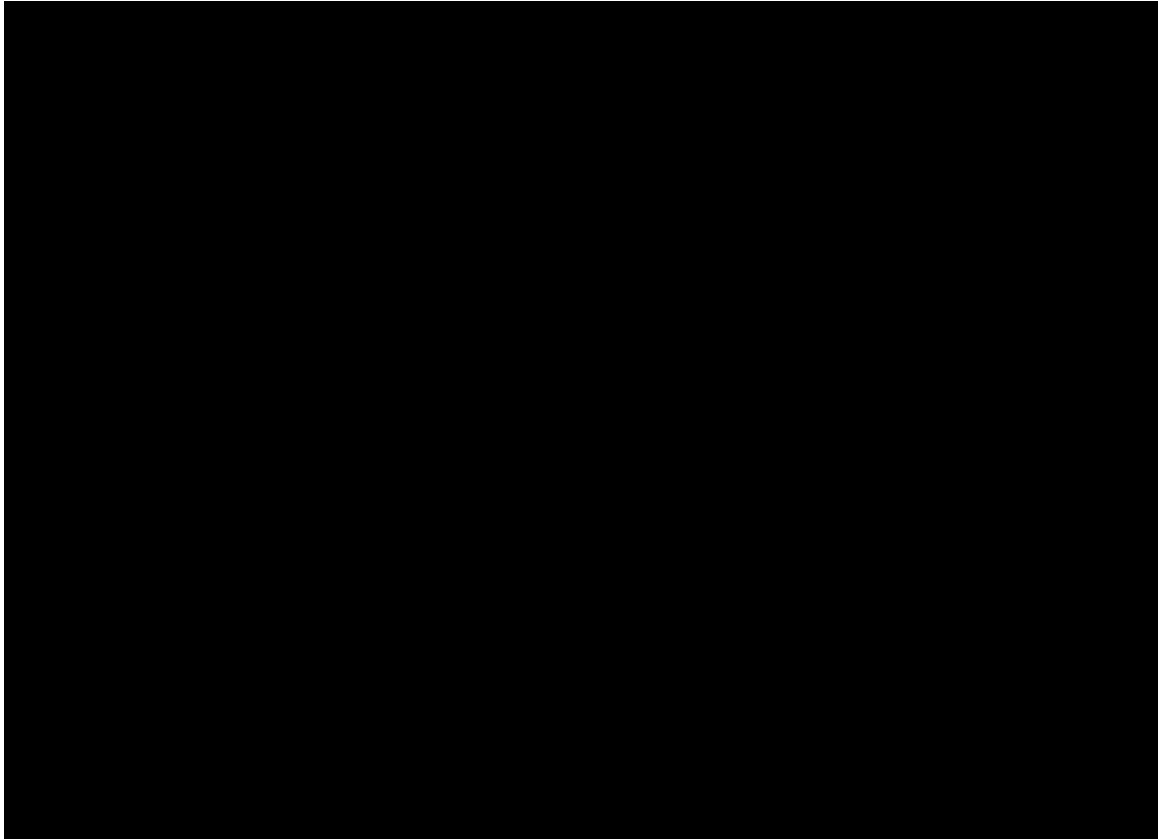


Figure 6: Location and designated habitat potential of ditches in Area 6 [REDACTED]

3.7 [REDACTED] (Area 7)

All the ditches in Area 7 were fully accessible during the site walkover. As shown in Figure 8, of the approximately [REDACTED] of ditch surveyed, approximately [REDACTED] were deemed to be of 'good' (Category 4) habitat suitability, approximately [REDACTED] were deemed to be of 'moderate/good' (Category 3) habitat suitability, and approximately [REDACTED] were deemed to be of 'moderate' (Category 2) habitat suitability for little whirlpool ramshorn snail.

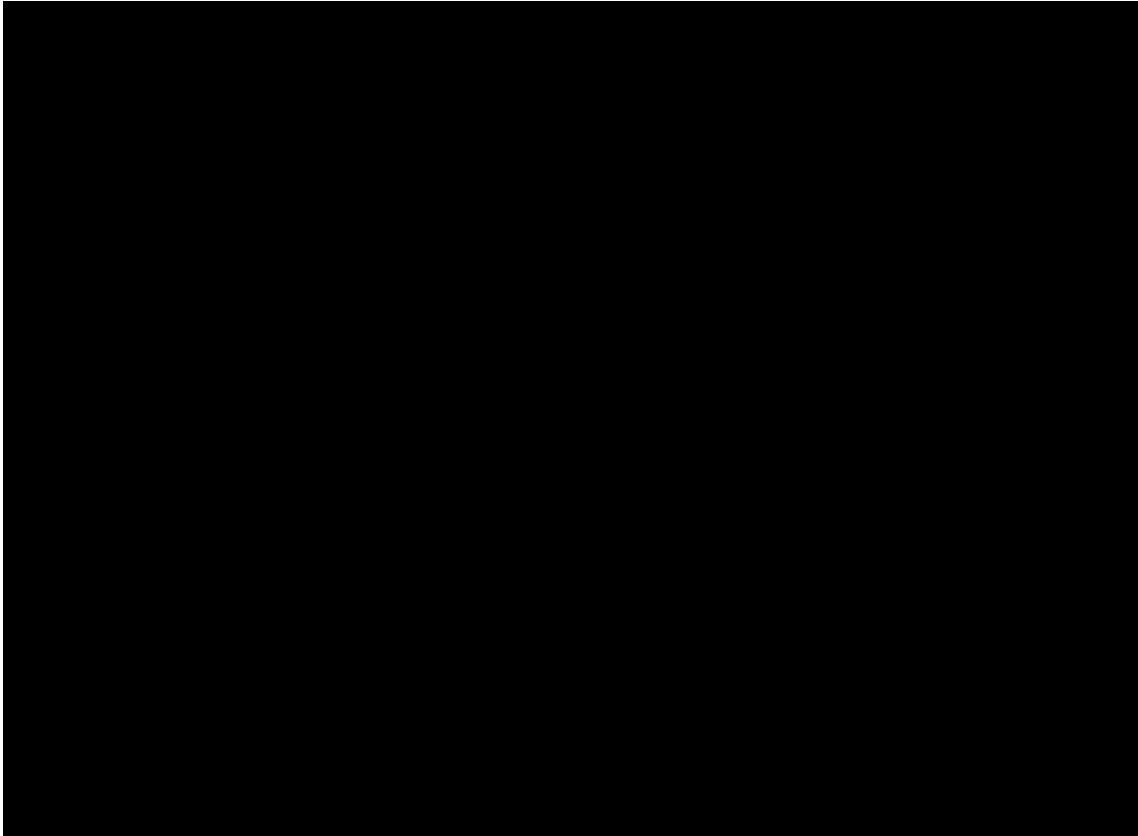


Figure 7: Location and designated habitat potential of ditches in Area 7 [REDACTED]

3.8 [REDACTED] (Area 8)

All the ditches in Area 8 were fully accessible during the site walkover. As shown in Figure 8, of the approximately [REDACTED] of ditch surveyed, all were deemed to be of 'moderate/good' (Category 3) habitat suitability for little whirlpool ramshorn snail.

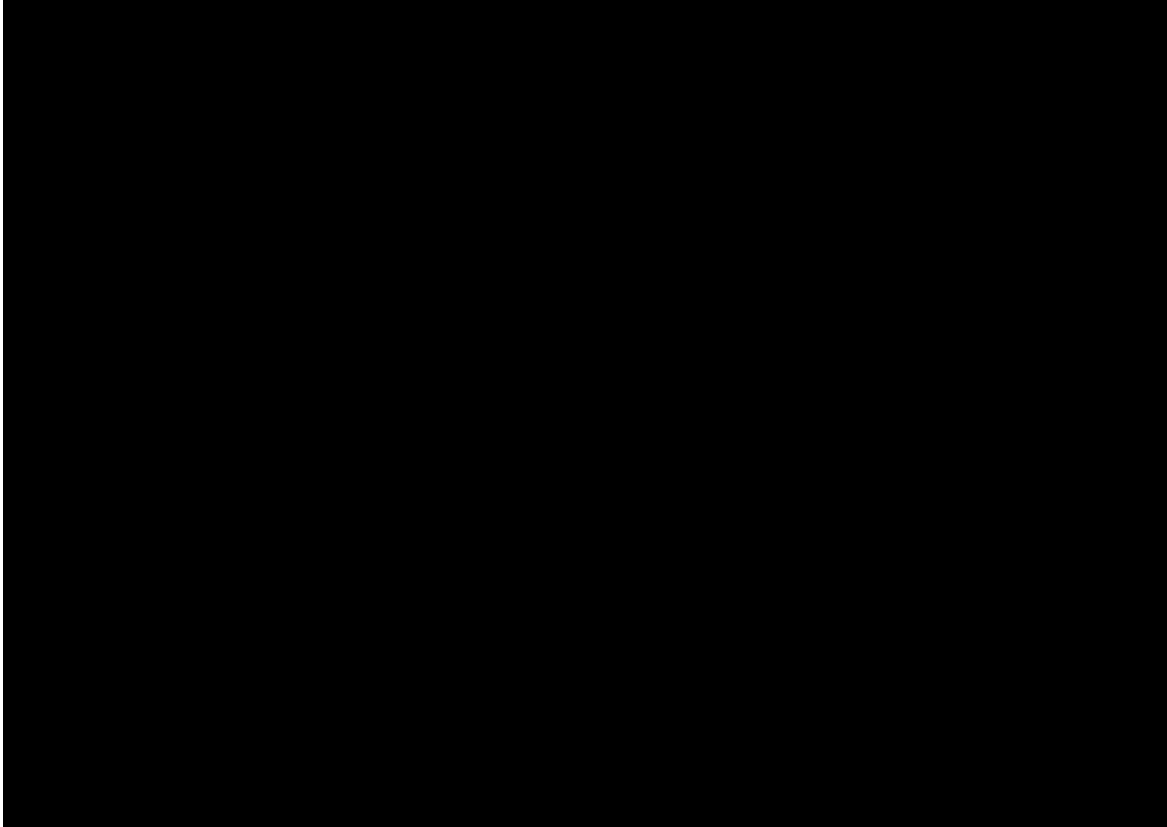


Figure 8: Location and designated habitat potential of ditches in Area 8 [REDACTED]

3.9 [REDACTED] (Area 9)

All the ditches in Area 9 were fully accessible during the site walkover. As shown in Figure 9, of the approximately [REDACTED] of ditch surveyed, all were deemed to be of 'good' (Category 4) habitat suitability for little whirlpool ramshorn snail.

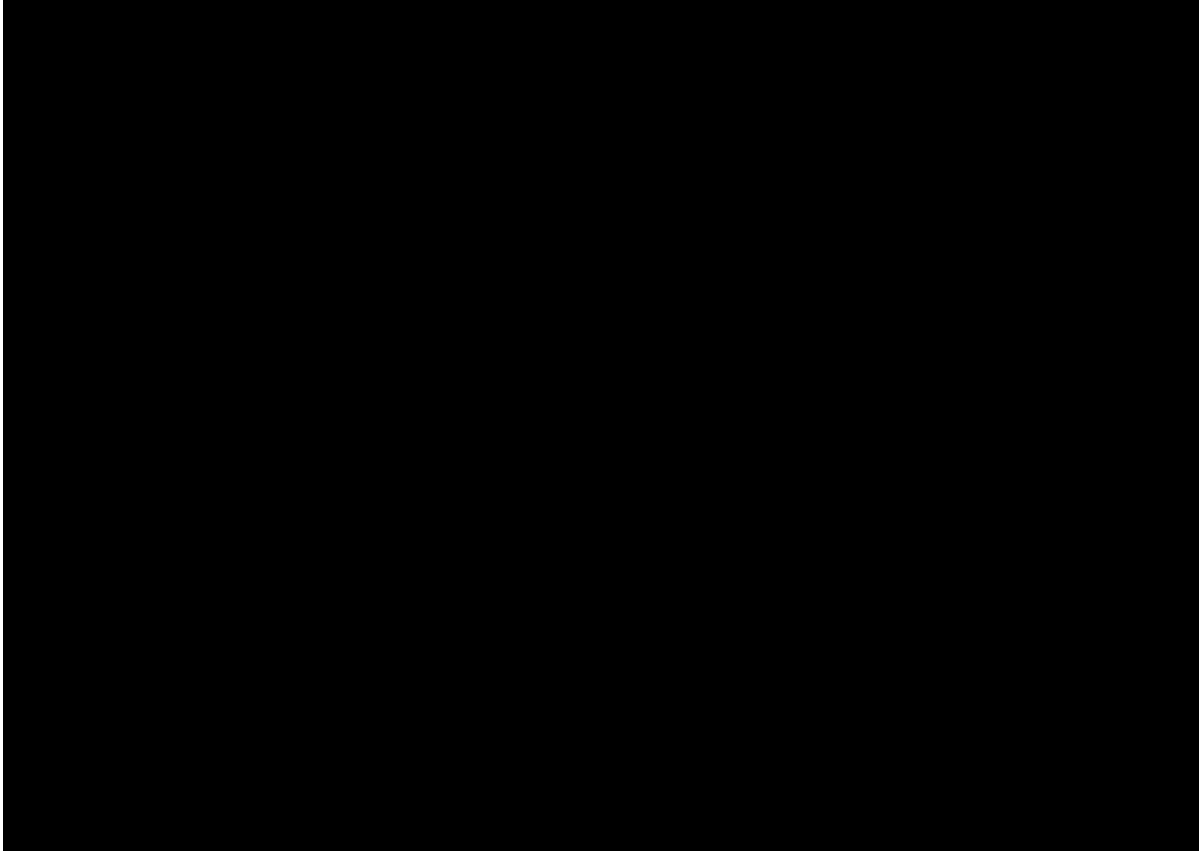


Figure 9: Location and designated habitat potential of ditches in Area 9 [REDACTED]

3.10 [REDACTED] (Area 10)

All the ditches in Area 10 were fully accessible during the site walkover. As shown in Figure 10, of the approximately [REDACTED] of ditch surveyed, approximately [REDACTED] were deemed to be of 'good' (Category 4) habitat suitability, approximately [REDACTED] were deemed to be of 'moderate/good' (Category 3) habitat suitability, and approximately [REDACTED] were deemed to be of 'moderate' (Category 2) habitat suitability for little whirlpool ramshorn snail.

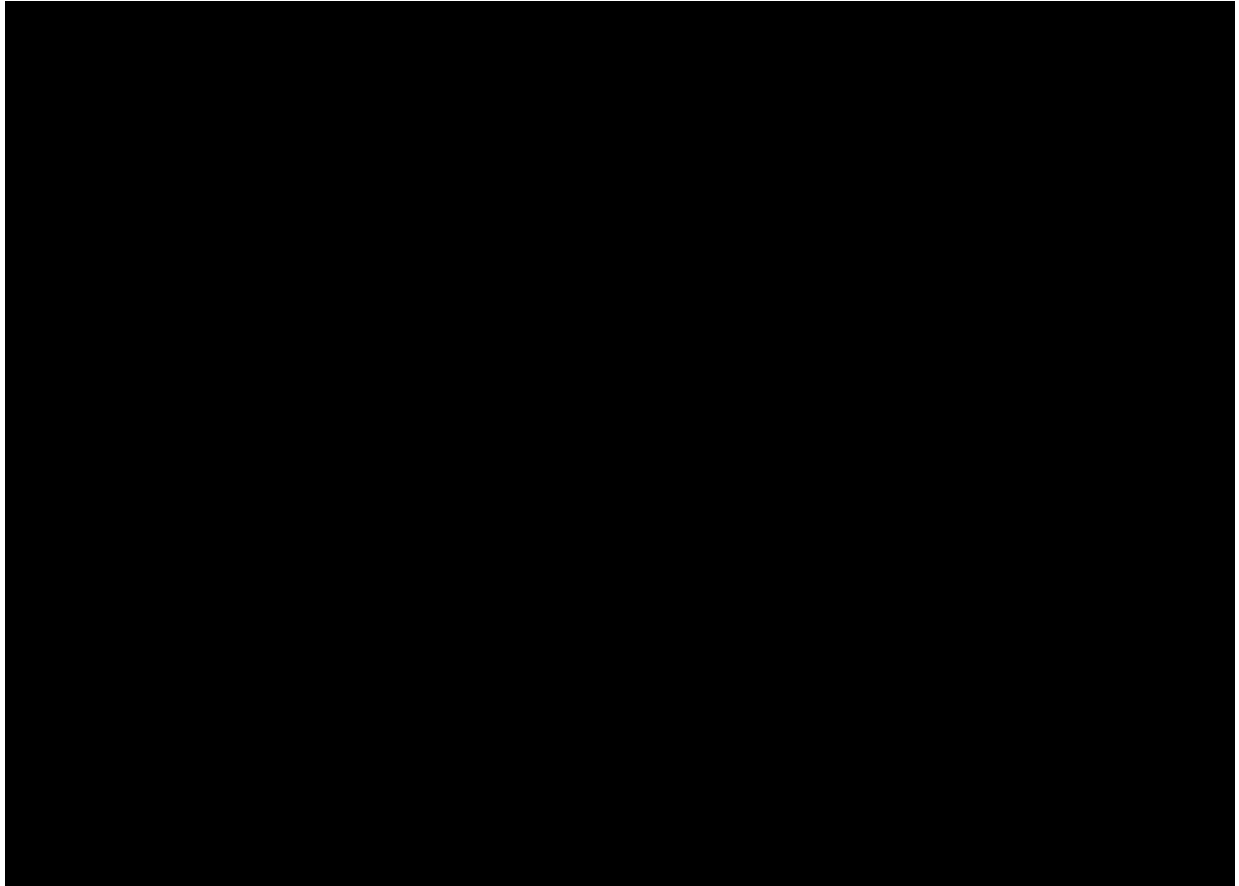


Figure 10: Location and designated habitat potential of ditches in Area 10 [REDACTED]

4 Discussion

4.1 General

The scoping survey indicated that within all areas there are several ditches worthy of additional detailed survey to ascertain whether they are potential receptor or donor ditches for translocation. Habitat suitability ranged from 'negligible' (Category 0) to 'good' (Category 4), but no ditches were considered of 'very good' (Category 5) suitability for little whirlpool ramshorn snail. Across all surveyed areas, a total of approximately 26.9km of ditch was considered to have 'good' (4) or 'moderate/good' (3) potential to support the target species.

The total lengths of ditches with 'good' (Category 4) or 'moderate/good' (Category 3) potential varied considerably between sites, from [REDACTED], Area 1) to [REDACTED], Area 7). However, as total ditch length is a product of survey area size, areas have been considered for further, detailed survey based on the proportion of ditches with 'good' (Category 4) potential for little whirlpool ramshorn snail. Future detailed surveys should be focused on sites which contain a high proportion of ditches with good potential, rather than on sites with one or two suitable ditches surrounded by habitat with no or negligible potential. [REDACTED] (Area 1), [REDACTED] (Area 3), [REDACTED] (Area 6), [REDACTED] (Area 7), and [REDACTED] (Area 9) showed high proportions of ditches with 'good' potential habitat for little whirlpool ramshorn snail, and are therefore prime candidates for further, more detailed surveys. By adopting this approach, it should be possible to ensure that little whirlpool ramshorn snail can be moved to suitable habitat at receptor sites, and have chance to expand its range at those sites in the future – by avoiding isolation in small 'islands' of habitat, the persistence of translocated populations is more likely. With this in mind, it is worth noting that the 'good' (Category 4) and 'moderate/good' ditches at [REDACTED] were particularly well connected. Additionally, [REDACTED] is prone to annual flooding (Abrehart Ecology, 2012) which may aid the dispersal and recruitment of molluscs if the site is subsequently assessed as a receptor area through detailed surveys.

Across the ten survey areas, approximately [REDACTED] of ditch is considered to be of 'low' (Category 1) or 'negligible' (Category 0) potential to support little whirlpool ramshorn snail and would be suitable as neither receptor nor donor sites. Consequently, it is recommended that these ditches are 'scoped out' of the detailed surveys. Ditches were scored as having 'low' or 'negligible' potential for a number of reasons. Some were heavily shaded, for example by adjacent woodland very tall, dense reeds, and were therefore bereft of aquatic flora. Aquatic vegetation is an absolute requirement for colonisation by many mollusc and invertebrate taxa, and little whirlpool ramshorn snail in particular has been associated with dense and varied macrophyte communities (Willing 2006; Terrier et al. 2006). Other ditches with 'low' or 'negligible' potential were scoped out as they were highly eutrophic, indicated by with dense common duck weed, least duckweed *Lemna minuta*, and/or thick filamentous algae growing in them. These were often catch dykes intercepting runoff from the higher surrounding land and feeding into IDB drains. IDB drains, in addition to frequently being eutrophic, are also dredged more regularly than surrounding ditches. While the reasons for the decline of little whirlpool ramshorn snail are not fully understood (JNCC, 2015), eutrophication and dredging are likely to be important factors (English Nature 2000, Van Damme 2012) – ditches where these factors are known to be common (such as IDB drains) should not therefore be considered as appropriate for any conservation translocation of little whirlpool ramshorn snail.

The survey findings reported here present a 'snapshot' of current conditions, and ditches that are currently 'good' habitat suitability may deteriorate (for example become eutrophic and/or dredged) if there are changes in land use or drainage. Likewise, as full details of the management regimes are not known at all the survey areas, there may be threats to ditch quality from the management that have not been identified by this investigation. This would affect the long-term viability of receptor ditches. Both of these issues will could affect the long-term viability of receptor and donor sites, and need to be considered further during the next phases of this study.

4.2 Recommendations for Detailed Surveys

4.2.1 Site Selection

As detailed in the initial pilot translocation scoping report (AECOM 2015b) and detailed survey report (AECOM/Abrehart Ecology 2015c) the highest scoring ditches from this scoping survey should be given priority for detailed surveying, progressing to lower-scoring ditches as required until sufficient potential receptor and donor sites have been identified. No ditches were classified as having 'very good potential' (Category 5) during this scoping survey, so it is recommended that the [REDACTED] of ditch classified as 'good' (Category 4) or 'moderate/good' (Category 3) are surveyed first. Additional sampling should be carried out on ditches adjacent to potential receptor ditches (even if they are of lower habitat suitability) in order to ensure that the immediate network of ditches does not support populations of little whirlpool ramshorn snail. This is considered as being important, as existing nearby populations may subsequently colonise receptor ditches and give a 'false positive' result, i.e. indicate that the translocation trial was successful when in fact receptor ditches with newly established populations of little ramshorn snail are the result of colonisation from adjacent ditches.

Whether sufficient (or any) donor and receptor ditches are available will depend on the findings of the detailed survey. For example, if none of the ditches are found to have healthy populations of little whirlpool ramshorn snail, other donor ditches within the region will need to be found. Conversely, if all the ditches identified are found to contain little whirlpool ramshorn snail, then no potential receptor ditches will have been identified. Additionally, for the reasons described in section 4.1, identifying ditches with suitable management (notably dredging frequency and method) is key - if suitably managed ditches are not found within the current survey areas, alternative receptor sites will need to be considered.

4.2.2 Fieldwork Protocol

Methods for the detailed surveys will follow those described for the initial pilot translocation conducted in 2016 (see AECOM/Abrehart Ecology 2015c and AECOM/Abrehart Ecology 2016b). This will ensure consistency in data collection, allowing each survey to contribute to a growing knowledge base on the ecology and biology of little whirlpool ramshorn snail in East Anglia.

In summary, the fieldwork protocol will involve assessment of ditches classified as 'good' or 'moderate/good' habitat suitability for little whirlpool ramshorn snail. Surveys will be conducted by a pair of surveyors, including an experienced on-site mollusc surveyor ([REDACTED], national mollusc specialist) and a second team member responsible for recording ditch features, abiotic variables, and botanical diversity. The ditch characteristic and botanical diversity recording sheets are adapted from Buglife's manual for the survey and evaluation of grazing marsh ditch systems (Palmer et al., 2013).

At each sample location, ditch characteristics and a range of other environmental features will be recorded, including exposed and submerged bank profiles, channel width and depth, and levels of grazing, poaching and shelving. Abiotic parameters in the surface 10cm of water will be measured, including pH and conductivity (measured using a HI98129 pH/Conductivity Tester; Hanna Instruments), dissolved oxygen and temperature (measured using a PD0-520 Dissolved Oxygen metre; Lutron). Each sample point will be recorded as a 10-figure grid reference using a handheld GPS.

Mollusc community samples will be collected at each of three subsampling points spaced approximately 15m apart per sample location, giving three sets of data for each sample location. Samples will be collected using ten-second sweeps of a net with 0.5mm mesh, repeated three times in different sections of the ditch profile for each subsample i.e. floating vegetation (where present), the benthic layer, and the submerged side of the near bank. Samples will be removed from the sites and preserved in ethanol for later identification in the lab (appropriate licences will be obtained from Natural England for this purpose). All molluscs will be identified to species level, with the exception of pea mussels which will be identified to genus level only. The relative abundance of each species will be recorded using a DAFOR scale¹. The abundance of notable and rare mollusc species will be fully quantified, including little whirlpool ramshorn snail, shining ramshorn snail *Segmentina nitida*,

1, DAFOR. D = dominant: > 100 specimens recovered), A = abundant (31 -100 specimens recovered), F = frequent (10 - 30 specimens recovered), O=occasional (3 - 9 specimens recovered), R = rare (1 - 2 specimens recovered).

slender amber snail *Oxyloma sarsi*, Desmoulin's whorl snail *Vertigo moulinsiana*, and the pea mussel species *Pisidium pseudosphaerium*.

The bankside, emergent, floating, and submerged flora of the ditch will be recorded at each subsample point. The relative abundance of each floral species occurring within 5m of the subsample point will be quantified using a DAFOR scale² - this will include vegetation on both the nearside and opposite bank and up to 1 m from the water's edge.

² DAFOR. D = dominant (>75% cover), A = abundant (51-75% cover), F = frequent (26-50% cover), O = occasional (11-25% cover), R = rare (<10% cover)

5 Summary and Conclusions

The purpose of this scoping survey was:

- to investigate whether there are sites suitable for further, more detailed survey to identify potential receptor and donor sites for a second phase of translocation, following on from the pilot study conducted in 2016 (AECOM/Abrehart Ecology 2016b);
- to scope-in the most suitable potential ‘donor’ and ‘receptor’ ditches for further study (in terms of habitat, level of eutrophication and land use); and,
- to scope out ditches with little or negligible potential to support little whirlpool ramshorn snail.

The survey involved a walkover of 37.3 km of potential receptor and donor ditches within ten distinct land parcels (Areas 1 – 10). The habitat potential for little whirlpool ramshorn snail of ditches within each area was appraised against set criteria, based on species requirements and practical constraints determined during the pilot study conducted in 2016 (AECOM 2015b; AECOM/Abrehart Ecology 2016a, 2016b, 2016c). The findings of the survey were that:

- in Area 1 approximately [REDACTED] were deemed to be of ‘good’ (Category 4), [REDACTED] were deemed to be of ‘moderate/good’ (Category 3), and [REDACTED] were deemed to be of ‘moderate’ (Category 2) potential habitat suitability for little whirlpool ramshorn snail;
- in Area 2, approximately [REDACTED] were deemed to be of ‘good’ (Category 4), [REDACTED] were deemed to be of good/moderate habitat suitability (Category 3), [REDACTED] were deemed to be of ‘moderate’ (Category 2), and approximately [REDACTED] of ditch were deemed to be of ‘poor’ habitat suitability (Category 1);
- in Area 3 approximately [REDACTED] of ditch was considered to be of ‘good’ (Category 4) potential habitat suitability and approximately [REDACTED] was deemed to be of ‘moderate/good’ habitat suitability (Category 3). However, this area was not as closely surveyed as others, and results are based upon observations from vantage points and previous visits to the site by Abrehart Ecology (Abrehart Ecology, 2012);
- in Area 4 approximately [REDACTED] were deemed to be of ‘good’ (Category 4) habitat suitability, [REDACTED] were deemed to be of ‘moderate/good’ (Category 3) habitat suitability, [REDACTED] of ditch were deemed to be of ‘moderate’ (Category 2) potential and approximately [REDACTED] of ditch were deemed to be of low potential (Category 1). Approximately [REDACTED] of ditch were deemed to have negligible potential (Category 0);
- in Area 5 approximately [REDACTED] were deemed to be of ‘good’ habitat suitability (4). [REDACTED] of ditch deemed to be of ‘moderate/good’ habitat suitability (3) were located throughout this parcel and approximately [REDACTED] of ditch were deemed to have negligible potential (0);
- in Area 6 approximately [REDACTED] of ditch were considered to be of ‘good’ (Category 4) potential, [REDACTED] of ditch were considered to be of ‘moderate/good’ (Category 3) potential and [REDACTED] of ditch were considered to be of ‘moderate’ (Category 2) potential to provide suitable habitat for little whirlpool ramshorn snail; and,
- in Area 7 approximately [REDACTED] of ditch were considered to be of ‘good’ (Category 4) potential, [REDACTED] of ditch were considered to be of ‘moderate/good’ (Category 3) potential and [REDACTED] of ditch were considered to be of ‘moderate’ (Category 2) potential to provide suitable habitat for little whirlpool ramshorn snail.
- in Area 8 approximately [REDACTED] of ditch were deemed to be of ‘moderate/good’ (Category 3) habitat suitability for little whirlpool ramshorn snail.

- in Area 9 approximately [REDACTED] of ditch were deemed to be of 'good' (Category 4) habitat suitability for little whirlpool ramshorn snail.
- In Area 10 approximately [REDACTED] of ditch were deemed to be of 'good' (Category 4) habitat suitability, approximately [REDACTED] were deemed to be of 'moderate/good' (3) habitat suitability and [REDACTED] were deemed to be of 'moderate' (Category 2) habitat suitability for little whirlpool ramshorn snail.

Therefore, 32.8km of ditch of 'good' (Category 4) or 'moderate/good' (Category 3) potential to support little whirlpool ramshorn snails were identified within the scoping survey and are recommended to be carried into the next stage of detailed surveys, in line with the methodology applied during the 2015 scoping survey (AECOM 2015b) and confirmed as an appropriate approach during detailed surveys of the pilot study area in 2016 (AECOM/Abrehart Ecology 2016a, 2016b, 2016c). It is recommended that ditches of 'low' (Category 1) or 'negligible' (Category 0) potential are scoped out of the detailed surveys. Ditches were considered as being of 'low' or 'negligible' potential for several reasons, including:

- due to heavy shading from adjacent woodland, as heavily shaded ditches are bereft of aquatic flora, which is a requirement for colonisation by little whirlpool ramshorn snail (Willing 2006; Terrier et al. 2006) and many other mollusc and invertebrate taxa;
- because the ditches were highly eutrophic as a result of being located immediately next to arable fields or due to connectivity to large drains that are a source of nutrients; or,
- are intensely managed (i.e. heavily dredged), as these are not likely to support little whirlpool ramshorn snail.

Ultimately, whether sufficient (or any) donor and receptor ditches are available within the survey areas identified in this report will depend on the findings of the detailed survey.

6 Acknowledgements

Thank you to [REDACTED] granting access to the survey sites, and for their support and interest in the project.

7 References

This report to be cited as: AECOM/Abrehart Ecology, 2017. Translocation of the little whirlpool ramshorn snail – scoping survey 2016-2017. Report to Highways England.

Abrehart Ecology, 2012 Article 17 Assessment of *Anisus vorticulus* in Norfolk and Suffolk, Lot 4. An ecological survey including floral and fauna observations undertaken for Natural England by Abrehart Ecology.

Atkins, 2007. A47 Acle Straight Ditch Relocation. Feasibility Study.

AECOM, 2015a. Feasibility study on the translocation of the little whirlpool ramshorn snail. Report to Highways England.

AECOM, 2015b. Translocation of the little whirlpool ramshorn snail – Scoping survey. Report to Highways England.

AECOM/Abrehart Ecology, 2015c. Translocation of the little whirlpool Ramshorn snail – detailed surveys. Report to Highways England.

AECOM/Abrehart Ecology, 2016a. Translocation of the little whirlpool ramshorn snail – initial update 2016. Report to Highways England.

AECOM/Abrehart Ecology, 2016b. Translocation of the little whirlpool ramshorn snail – pilot translocation 2016. Report to Highways England.

AECOM/Abrehart Ecology, 2016c. Translocation of the little whirlpool ramshorn snail: multi-variate community analysis 2016. Report to Highways England.

Buglife, 2013. A manual for the survey and evaluation of the aquatic plant and invertebrate assemblages of grazing marsh ditch systems. Version 6.

Doarks, C. & Leach, S.J. 1990. A Classification of Grazing Marsh Dyke Vegetation in Broadland, NCC England Field Unit Report, unpublished.

English Nature, 2000. Norfolk Biodiversity Action Plan Little Whirlpool Ram's-horn Snail (*Anisus vorticulus*), Available at: <http://www.norfolkbiodiversity.org/actionplans/speciesactionplans/littlewhirlpoolsnail.aspx>. (updated 2012).

Joint Nature Conservation Committee, 2007. Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough. Available at: www.jncc.gov.uk/article17.

Terrier, A., Castella, E, Falkner G., & Kileen, I.J. 2006. Species account for *Anisus vorticulus* (Troschel, 1834) (Gastropoda: Planorbidae), a species listed in Annexes II and IV of the habitats directive. Journal of Conchology, 39(2), pp.193–205.

Van Damme, D. 2012. *Anisus vorticulus*. The IUCN Red List of Threatened Species 2012: e.T155966A738056. <http://dx.doi.org/10.2305/IUCN.UK.2012-1.RLTS.T155966A738056.en>. Downloaded on 09 October 2015.

Willing, M.J., 2006. Monitoring, survey and translocation of populations of the little whirlpool ram's-horn snail *Anisus vorticulus* at [REDACTED] June – November 2005, Report to RSPB and Environment Agency.

