A303 Amesbury to Berwick Down

TR010025

6.3 Environmental Statement Appendices

Appendix 8.8 Desmoulin's whorl snail survey report

Volume 6

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

September 2018

Technical Note

A303 Amesbury to Berwick Down

Subject:	River Avon and River Till Desmoulin's Whorl Snail Surveys		
Date:	05 June 2017	**Date amended:**	HE551506-AA-SGN-SWI-SU-YE-00000118 August 2017
Reference:	HE551506-AA-SGN-SWI-SU-YE-000001 P02		
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1 Summary

- This project was planned to survey selected areas on the rivers Till and Avon for the presence of Desmoulin's Whorl Snail *Vertigo moulinsiana,* an EUHSD Annex IIa species and a qualifying feature of the River Avon SAC.
- The surveys focus on river margins and associated floodplains of the River Till for about 2 km upstream of Winterbourne Stoke and on the River Avon for about 1.5 km upstream and 6 km downstream from Amesbury.
- No populations of *V. moulinsiana* were found on the River Till because of an almost complete lack of suitable habitat there. These results confirm those from a similar survey undertaken in 2001.
- On the River Avon, upstream of the A303 despite the presence of some potentially suitable habitat, *V. moulinsiana* was not recorded. This appears to indicate a loss of the snail, which was recorded there in 2001.
- The Avon between the A303 and Church Street bridge (south of Amesbury Park) there is very little suitable habitat and the absence of *V. moulinsiana* mirrors survey results undertaken in this area in 2001.
- In the Avon survey area between Amesbury and West Amesbury there is again little suitable habitat and no *V. moulinsiana* were recorded.
- In the survey area covering both banks of the Avon between West Amesbury and Normanton 5 populations of *V. moulinsiana* were located, three of which had been recorded in 2010 and/or 2014. The snail had also been recorded in this general area in 1996 but not with specific site locations.
- Numbers of *V. moulinsiana* were very much lower than recorded in 2010 and 2014; it is not known whether this marks a longer term decline of these populations or a temporary and natural population oscillation possibly related to habitat changes and / or relatively short term environmental events such as drought of river flooding.
- Two of the *V. moulinsiana* populations maybe ones not previously recorded (certainly as specific sites).
- One of the new populations (S1 in the report) is of particular interest in being a river margin fen. Work undertaken between 2010 – 2014 has demonstrated the wholesale loss of V. *moulinsiana* from this habitat in the Avon catchment (and a loss of the snail from at least 86% of all Avon catchment sites since the early 2000s). This newly discovered population is one of only two currently known

river-margin sites in the Avon system and so merits further study and monitoring.

2 Background

2.1.1 *Vertigo moulinsiana* (Dupuy, 1849) is a small snail mostly found in old or semi-natural open (unshaded) calcareous fen and wetlands, usually adjacent or close to rivers, streams, lakes and ponds. In the UK it is chiefly distributed in a broad band of country from central-southern England to East Anglia (Kerney 1999). Outlying populations also exist in north and mid Wales, the north-west Midlands and north Cornwall.

2.1.2 The conservation importance of the species has meant its inclusion in various schedules and red data lists. Thus, it is categorised as Rare (category 3) in the UK Red Data Books (Bratton 1991). Whilst more recently the snail has been classed as vulnerable on the recent IUCN based UK red list status review (Seddon et al 2014). The species is listed in Annex IIa of the European Community Habitats and Species Directive (92/43/EEC) and is also an English Section 41 'Species of Principle Importance' (replacing the UK BAP priority species in 2006). Following the inclusion of *V. moulinsiana* as a Priority Species in 1995, many surveys have been undertaken (summary details of some of earlier ones appear in Drake, 1999).

2.1.3 *V. moulinsiana* is a qualifying feature (S1016) of the River Avon SAC[1]. Populations of the snail have been recorded from close to the head of the river near Pewsey, in Wiltshire downstream to Sopley, just north of Christchurch in Hampshire (e.g. Killeen 1997a; Willing 1998, Killeen & Willing 2002). The snail has also been recorded on most of the tributary rivers including the Bourne, Nadder, Wylye, Nine Mile River and Nutbush Stream (Killeen 1997a, 1997b, Killeen 2001, Killeen & Willing 2002).

2.1.4 In 2010 a series of surveys were undertaken to revisit most previously recorded *V. moulinsiana* sites on the rivers Avon, Bourne, Wylye, Nadder, Till and Nutbush Stream (Willing 2011), whilst in 2011 a selection of sites mostly those where losses had been recorded in 2010 were revisited (Willing 2012).

2.1.5 In the 2010 surveys a total 98 sites were revisited, but the snail was only recorded at 17, marking an 83% decline in site occupancy in about 10 years. The most recent survey of selected sites (Willing 2015) records losses at a further three sites now suggested an approximately 86% decline of snail populations in the Avon catchment (if no recovery or recolonization of former losses has occurred) over the last 14 years. This latest work suggests that this loss may be an under-estimate as it demonstrates the further loss of *V. moulinsiana* from another two-three sites

[1] EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora 'Citation for Special Area of Conservation (SAC)' states for the River Avon on 1.4.2005, "There is an extensive population of Desmoulin's whorl snail *Vertigo moulinsiana* along the margins and associated wetlands of the Rivers Avon, Bourne and Wylye".

3 Methods

3.1.1 Surveys were completed over 6 days on 17th, 18th & 19th, October, 9th & 10th November and 1st December 2016. Survey days were selected to ensure the dry conditions needed to undertake *Vertigo moulinsiana* sampling.

3.1.2 This project required the assessment of relatively extensive lengths of river bank and adjacent flood plain for the presence of *V. moulinsiana* (*Vm*). A proportion of these areas had already been surveyed during earlier work (Killeen 1997a, 1997b, 2001, 2002, Killeen & Willing 2002, Willing 2011, 2012, 2015) and included some *Vm* populations. MJW's extensive previous experience was used to target those areas of habitat with the potential to support *Vm* populations. These included areas with no or minimal shading which *Vm* avoids; populations can be suppressed by even slight shade (e.g. Willing 2016). Additionally, ground moisture conditions were used; *Vm* ideally require sites where ground moisture (GM) levels* are between 3 – 4 for most of the year (*for details see below). Any potentially suitable habitat was surveyed using the well-established technique of beating herbaceous fen vegetation onto a gridded white plastic tray. This survey methodology broadly followed the 'level 1' survey techniques detailed in Killeen & Moorkens (2003). In suitable (or marginally suitable areas) this tray beating was undertaken in a systematic way with this sampling technique being applied approximately every 5 – 10 m. When *Vm* were located population and habitat details were recorded using the 8-point procedure described below:

1. Tray beating was undertaken in dry weather conditions. The use of a gridded white beating tray measuring approximately 25cm X 33cm was used to assess approximate *V. moulinsiana* numbers per unit area. (6 trays being approximately equivalent to 0.5 m^2). At most of these sampling locations, several trays samples were taken (for each, beating beneath a fresh and undisturbed plot of vegetation, all within approximately 2m of a single sampling point). Material on the trays was combined and either counted in the field (if numbers of snails were low and easily seen amongst other vegetation detritus) or retained for later laboratory examination and snail counting (involving the inspection of samples microscopically using a x7 – x45 binocular microscope to count adult and juvenile *V. moulinsiana)*. Survey stations were mostly randomly located in larger fen blocks, but preferentially sampled habitat judged to be most likely to support *V. moulinsiana*.
2. Approximate area of occupancy was assessed with the use of a tray beating;
3. Degree of ground moisture (GM) (using a version of the '5 Point Wetness scale' of Killeen & Moorkens 2003) was recorded at all *Vm* survey sites;

   1. Ground dry: Possibly with cracks, and no evidence of surface moisture.

   2. Ground damp: Moisture observed on the surface but water does not rise under light pressure.

   3. Ground wet: No surface veneer, but water rises under light (foot) pressure.

   4. Ground wet: Surface veneer of water less than 1-2cm deep

5. Ground very wet: Water depth greater than 2cm which may cover the sward and tussocks.

4. Dominant vegetation presence was recorded, noting particularly '+' and '-' *V. moulinsiana* 'suitability indicators' (e.g. *Carex* sp, *Glyceria maxima* as '+' indicators and *Epilobium* sp and *Urtica dioica* as '-');
5. Degree of site shading by overhead or over-hanging trees and bushes was noted (as shading can negatively affect the suitability of sites for *V. moulinsiana)*;
6. Other potentially important site environmental and management details were recorded e.g. (i) grazing and/or ground poaching, (ii) recent cutting, (iii) human trampling.
7. Where located *V. moulinsiana* numbers were counted per 6-tray samples and then converted into approximate numbers m^{-2} with numbers of adult and juvenile snails recorded.
8. GPS 12 fig references and digital images were recorded for each site and sub-site (and of any site features of importance to help relocate sub-sites for future monitoring);

4 Results

4.1 Summary descriptions of river corridor surveys

4.1.1 For convenience, the results of field surveys are given in six blocks, each dealing with a relatively self-contained survey area. These are:

a. The River Till (upstream of Winterbourne Stoke)
b. The River Avon (upstream of A303 right & left banks)
c. The River Avon (south of A303 & lying east of A345)
d. The River Avon (sites in & close to Amesbury Park)
e. The River Avon (left river bank between West Amesbury – south Amesbury)
f. The River Avon (both right & left banks West Amesbury to Normanton)

4.1A The River Till (upstream of Winterbourne Stoke)

Fig. 1: Survey areas on the River Till

a. A – B: survey area 1,
b. B – C: survey area 2,
c. C – D: survey area 3.
d. 1: river channel dry upstream of this point
e. 2: Ungrazed fen
f. 3: Glyceria / Carex fen - potentially *V. moulinsiana* habitat

4.1.2 The River Till corridor was surveyed to the north of the A303. For convenience, the survey block has been divided into three areas (Fig 1). Area surveyed: 17.10.2016; Ownership: Mr Turner (Manor Farm)

1. Area 1: Close-cropped cattle and horse grazed pasture extends from the A303 margins (SU 07920 41571) up a farm road at SU 08031 41909. There is almost no river side fen (Fig. 9). At the time of survey there was some standing water in pools in the lower sections, but the stream was dry close to a broken

concrete bridge at SU 07920 41571. A few small areas of *Carex paniculata* lying immediately north-east of Manor Farm were surveyed for *Vm*.

Vm surveys were negative due to insufficient suitable habitat (lack of fen and dry ground conditions).

2. Area 2: Improved, close-cropped cattle grazed field lying between SU 08009 41938 (south) & SU 07942 42297 (north). The R. Till channel was dry (GM 2) and partially cattle poached when surveyed (Fig.10). No marginal fen was seen and so no suitable *Vm* habitat is present.
3. Area 3: The boundary fence (SU 07987 42370) marks a sharp transition from the heavily grazed Area 2 to one (estimated at least 1.5 hectares) of rank of ungrazed meadow with patches of fen including *Phalaris arundinacea*, *Carex riparia*, *Carex* sp, *Juncus* sp (Fig. 11). Ground conditions over most of the area were GM 2; mostly too dry for *Vm*. The western R. Till channel (the river divides into two branches just before this point) has been excavated toward the south, but contained no water. On the eastern margins the other river channel contained some standing water and was bordered on both banks by *Glyceria maxima, Phalaris arundinacea* and *Carex riparia* fen (Fig. 12). Some of this was shaded by *Salix* sp and other trees, but several open areas were potentially suitable for *Vm*; all surveys in this area were negative for the snail. The northern boundary fence (at SU 07886 42530) marks the end of the survey permission area, but beyond (to north-west) lies close-grazed pasture (unsuitable for *Vm*).

4.1Bi The River Avon (upstream of A303 - left bank & floodplain)

4.1.3 Left bank (east of river): Area surveyed 18.10.2016; Ownership: Mr Rowland. The site is described in 4 blocks.

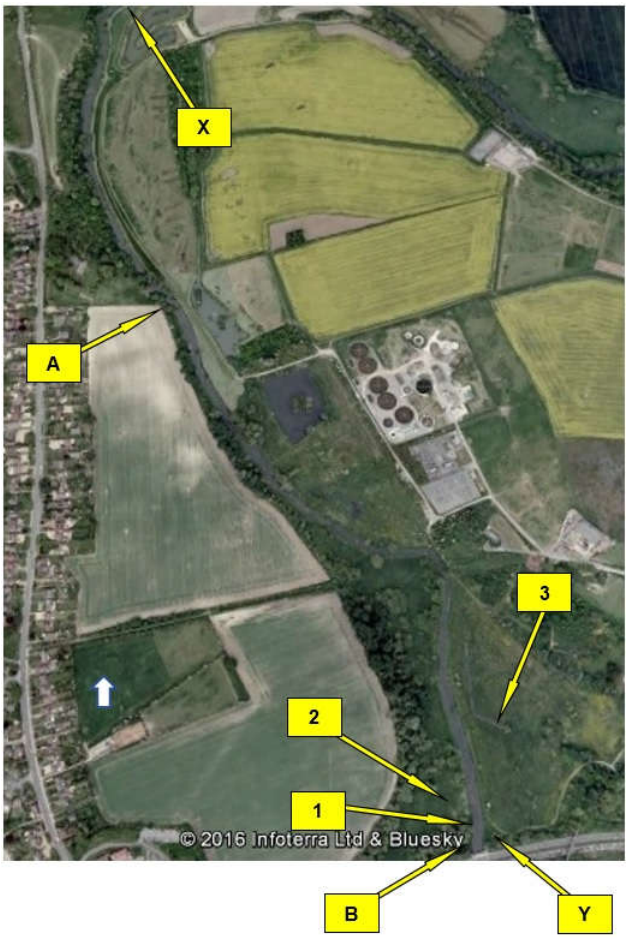

Fig. 2: Survey areas left bank of Avon north of A303 (both banks shown)

X – Y: survey limits
3: Fen filled ditch (potential *V. moulinsiana* habitat)

1. Block 1: This is an area of wetland situated to the east of the main river channel with a southern boundary on the A303. A small ditch (slow flowing water) runs through the block (surveyed SU 15941 42248 to SU 15872 42377). The stream is both infilled with emergent vegetation but also supports areas of marginal fen with stands of *Glyceria maxima*, *Carex riparia* (e.g. at SU 15931 423510) with GM levels of 3 – 5; all potentially suitable for *Vm* (Fig. 2 point 3; Fig.13). The floodplain either side of stream is moderately shaded by *Salix* spp and planted poplars. The presence of nettles amongst *Carex* spp suggests dry ground conditions, typically GM2. This area provides the largest area of potentially suitable *Vm* habitat on the left bank, but results were negative.
2. Block 2: This block runs from SU 15884 42227 to SU 15857 42573. The mostly unshaded river bank supports various mixes of *G. maxima, Sparganium erectum*, *Carex riparia*, figwort and nettles in drier areas. The relatively steep gradient of the river bank prevents the development of more than a very narrow band of marginal fen (Fig.14) with suitable GM conditions (3 - 4); there is a sharp transition from dry bank to standing water. *Vm* surveys negative.
3. Block 3: The block extends from SU 15857 42573 to SU 15538 42833. The river margins are mostly like Block 2, with steep banks, minimal fen

development but with much more shading from willow and alder. The adjacent flood plain to west of fishing path has un-grazed fen (*Phragmites*, *Carex* spp and *Urtica dioica* but also shading from a mix of tree including ash and planted poplars. In addition to shading the ground was too dry for *Vm* (GM 2). A side channel leading from the Avon to an artificial fish pond (SU 15592 42769) was steep sided with no marginal fen.

4. Block 4: Extending north to fishing hut at SU 15592 42769 (no survey beyond this point due to access restrictions relating to viral land contamination). As with block 1 the river margins along this stretch are too steep to allow the development of suitable marginal fen (Fig.15). Some shading both from trees on the river banks, but also lateral shading from woodland and steep land on the far (right) bank of the river. No *Vm* recorded. On a later visit to the right (western) bank on 1.12.2016 it was noticed that an area of carr and the river margin fen had been mechanically cleared here following the survey visit on 18.10.2016 (Fig.16).

4.1Bii The River Avon (upstream of A303 - right bank & floodplain)

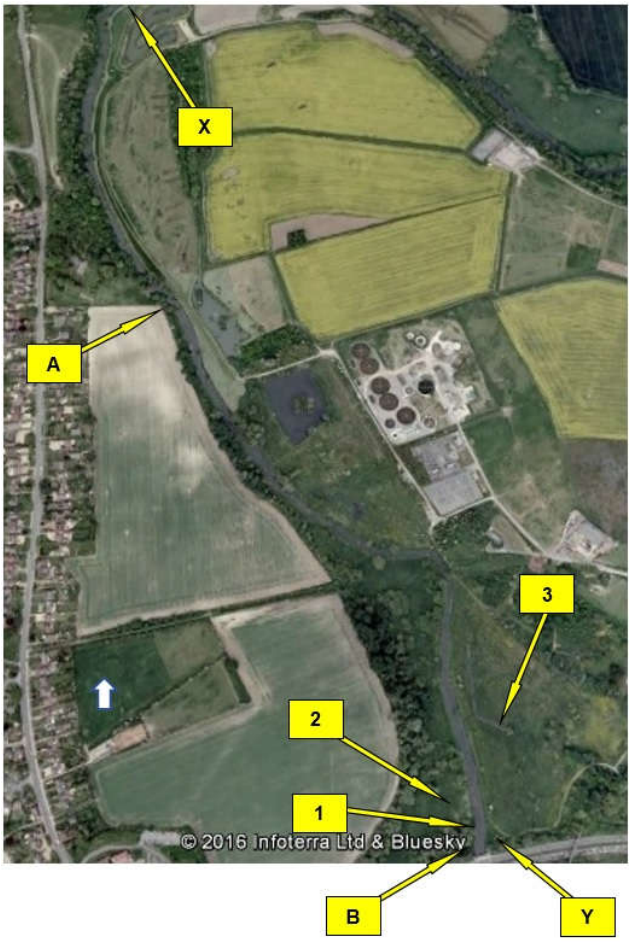

Fig. 3: Survey areas right bank of Avon north of A303 (both banks shown)

A – B: survey area zone
1: River margin fen - potential *V. moulinsiana* habitat
2: Flood plain fen - potential *V. moulinsiana* habitat

4.1.4 Right bank (west of river): Area surveyed 1.12.2016; Ownership: Hugh Morrison. This bank was surveyed north to the end of the land ownership at SU 15448 42989 (A on Fig. 3). Surveying southwards from this point much of the river bank has, as with the left bank, a steep gradient with insufficient marginal fen to support *Vm* populations. A few small areas of potentially suitable fen area present such as at SU 15614 42689 where an area of *Carex riparia*, *Glyceria maxima* and *Phalaris arundinacea.* A similar length of potentially suitable fen is the 2 – 3 m band of *Carex / Glyceria* dominated fen running along the river margins for about 50m from just north of the A303 boundary (at SU 15865 42211) (Fig 17). On the floodplain, immediately to the west of the southern part of this area there are blocks of *Carex / Glyceria* dominated fen, although much had recently been mechanically cut. Despite the cutting several drainage channels (e.g. at SU 15829 42256) retained uncut *Carex* spp and *Glyceria maxima*, potentially suitable for *Vm* due the ideal ground conditions (GM 3 – 4) and lack of shading (Fig 18). No *Vm* were recorded despite the presence of much suitable habitat.

4.1C The River Avon (channels situated south of A303 & east of A345)

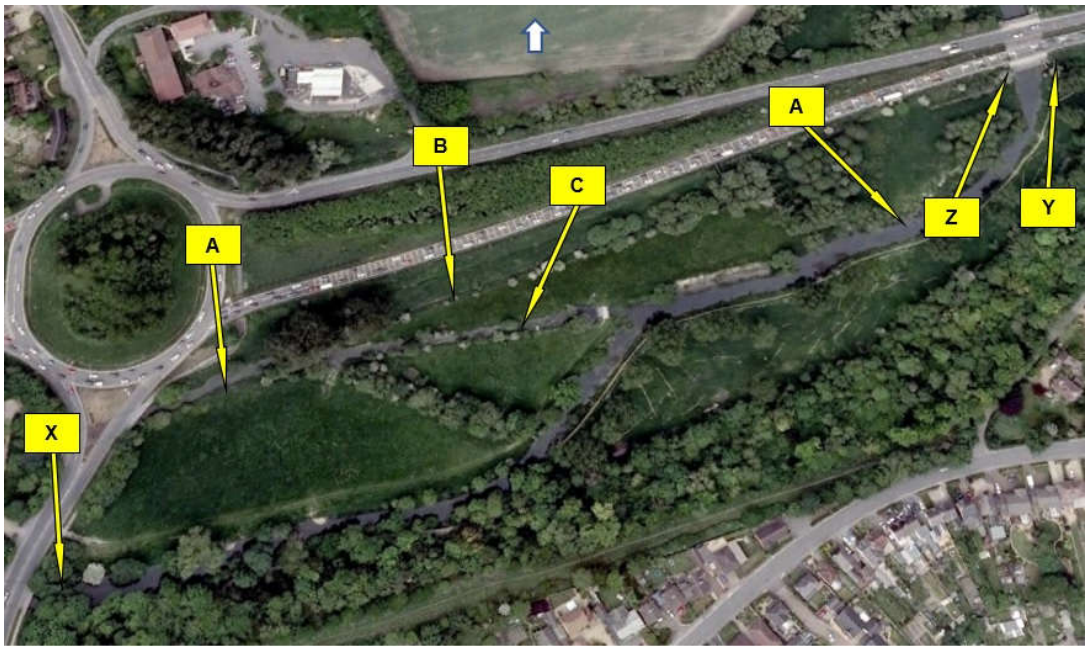

Fig. 4: Survey areas adjacent to the Avon immediately south of A303

X – Y: Avon left bank (Lords Walk)
X – Z: Avon right bank
A: River margin fens - potential *V. moulinsiana* habitat
B: Ditch at base of A303 embankment
C: Avon north channel

4.1.5 Area surveyed 19.10.2016, 1.12.2016; Ownership: Hugh Morrison; Amesbury Council. The River Avon passes beneath the A303 and about 150m downstream splits into two channels, a smaller northern one with the main flow in the southern channel the southern border of which is the Lord's Walk. Between the northern river channel and the A303 runs a small ditch at the base of the road embankment.

1. The A303 embankment slopes down to a flat area of relatively dry (GM 2) fen with nettles, *Epilobium* sp and some *Carex* spp (Fig 19). The ditch channel (with slow flowing water), which is mostly unshaded at the western end (at SU 15525 41989) has some infill of potentially suitable *Carex riparia* (Fig. 4 point B). This ditch runs into an area of shaded alder carr that opens into dry (GM 2) nettle / *Carex* fen at SU 15809 42094. *Vm* surveys negative.
2. Most of the banks of the small northern Avon channel support no marginal fen except for a small potentially suitable area of *Glyceria maxima* at SU 15431 41965 (Fig 20). A small cross field channel connecting the northern and southern channels of the Avon is steep-sided and fully over-shaded with no marginal fen.
3. The northern banks of the Avon (from SU 15405 41885 to SU 15862 42147) are, apart from a small area of fen close to SU 15809 42068, too steep sided and/or shaded to support suitable *Vm* habitat.
4. The Avon margins lying on the southern (left) bank of the Lord's Walk (SU 15856 42146 west to SU 15424 41863) have a steep gradient not allowing the development of marginal fen (Fig 21); margins are also shaded along much of this stretch. A small area of *Carex* clumps are present on the banks towards the western end, but ground conditions were dry (GM 2). *Vm* surveys negative.

4.1D The River Avon (sites in or adjacent to Amesbury Park)

Fig. 5: Survey areas in Amesbury Park

X – Y: Avon left bank survey extent
A – B: Avon right bank survey extent
1: dry shaded ditch
2: upper limit to survey area 2
3: fen margins potentially suitable for *V. moulinsiana*

4.1.6 Area surveyed 19.10.2016; Ownerships: Sir Edward Antrobus, Mr Cornelius Reid, Mrs. M. Sebbon. The Avon flows beneath the A345 as two channels before re-joining immediately downstream of Bowles Hatches. The river then flows through Amesbury Park before passing beneath Church Street immediately to the west of Amesbury. Survey results firstly describe habitat on the right (western) bank (1 – 5 below) progressing upstream from the south (Church Street) followed by habitat on the left (eastern) side running downstream from the A345 (6 – 7 below).

1. To the west of the river a ditch at SU 14937 41360 is heavily over-shaded and dry. (*Vm* negative)
2. The Avon margins from SU 15076 41316 to SU 14790 41616 are largely un-shaded but mostly with short transition from dry bank to water (Fig 22) resulting in minimal marginal fen (*Vm* negative).
3. Between the stile (SU 14790 41616) and the Chinese House banks are mostly heavily shaded; there is again minimal marginal fen except a small area of *Carex riparia* fen just south of the house (*Vm* negative).
4. Between the Chinese House and the park bridge (SU 14774 41777 to SU 14939 41885) there is some potentially suitable, but recently mown marginal fen (*Carex ripara, Glyceria maxima*) (*Vm* negative). Side channels lying north of the Chinese House are heavily shaded by trees and support no fen so unsuitable for *Vm*.
5. Upstream of the bridge the river banks of the channel running north and south of Bowles Hatches (SU 15351 41945) are heavily tree shaded (Fig 23) with no marginal fen and so unsuitable for *Vm*.
6. The Avon margins from the A345 (SU 15326 41890) to the bridge (SU 14966 41882) are mostly heavily over-shaded and there is also little suitable marginal fen (*Vm* negative).
7. Downstream of the bridge there is only one potentially suitable area of marginal *Glyceria maxima* dominated fen at SU 14851 41786 (immediately opposite the Chinese House Fig. 24); *Vm* negative. The remaining banks (surveyed down to SU 15091 41441) have a relatively rapid transition from dry conditions to flowing water with no significant marginal fen (*Vm* negative).

4.1E The River Avon (selected areas lying between West Amesbury – south Amesbury)

Fig. 6: Survey areas West Amesbury to Amesbury

X – Y: Avon left bank survey extent
A: fen-filled channel
B: fen-filled ditch
(A + B potentially suitable for *V. moulinsiana*)

4.1.7 Area surveyed 10.11.2016; Ownerships: Hugh Morrison, Richard Cook & William Cook.

4.1.8 This section describes Avon margins and relevant flood plain features on the whole left bank running continuously from immediately upstream of Moor Hatches Bridge (SU 14152 41281) to Church Street bridge, Amesbury.

1. Most of the banks between the bridge and south Amesbury (SU 15791 40752) have a steep gradient with minimal marginal fen suitable and additionally much of this stretch is heavily shaded by trees, both reducing suitability for *Vm*. A few small areas supporting potentially suitable *Vm* habitat were located: (1) A side gulley leads down to the river at SU 14412 41284 infilled with *Carex riparia* and *Juncus* spp (Fig 25) seemed ideal for *Vm* with a lack of shading and suitable ground conditions (GM 3); (2) an area of un-shaded *Sparganium* dominated river-side fen is present at SU 14792 41153 and (3) an area of *Carex riparia* occur on the banks at SU 15791 40752 but with dry ground conditions (GM 2). All three points were negative for *Vm*.
2. The left bank between south Amesbury (SU 15720 40868) and the Church Street bridge (SU 15129 41304) is situated on the northern side of the river and split into two land ownerships (compartments) each with different managements. The western compartment has steep, un-shaded river banks with minimal marginal fen (Fig. 26) except at the upstream end (SU 15544 40943 upstream of an abandoned bridge) where an area of approx. 4m x 3m of

Carex riparia fen provides potential for *Vm* presence, but the snail was not recorded. A drainage channel with slow flowing water runs east- west through the centre of this ownership but the banks were mown and channel kept free of emergent vegetation providing no potential VM habitat. Land in the second ownership extends upstream to the Church Street bridge. The river margins again support little *Vm*-suitable fen except at SU 15332 41162 where a moderate area of *Glyceria maxima*; (*Vm* negative). The drainage channel running east-west across the flood plain (and continuous with that in the downstream ownership) has been left unmanaged so that numerous areas of *Carex riparia*, and *Glyceria maxima* fen (GM 3 – 5) have developed (Fig 27). Systematic survey along this ditch and a subsidiary side branch failed to locate *Vm* although habitat conditions seem ideal for the snail.

4.1F The River Avon (both right & left banks West Amesbury to Normanton)

4.1.9 This survey section describes river margin and flood plain habitat on either bank of the Avon lying between West Amesbury and Normanton. For convenience, the survey descriptions are divided into two sections; running downstream on the right (western) bank and then upstream from the lower areas on the left (eastern) bank. Area surveyed 9.11.2016; Ownerships: (Right bank from top): Sir Edward Antrobus, Juliette Leech, Mr. E. Bailey; (Left bank from bottom): Mr. E. Bailey; Hugh Morrison

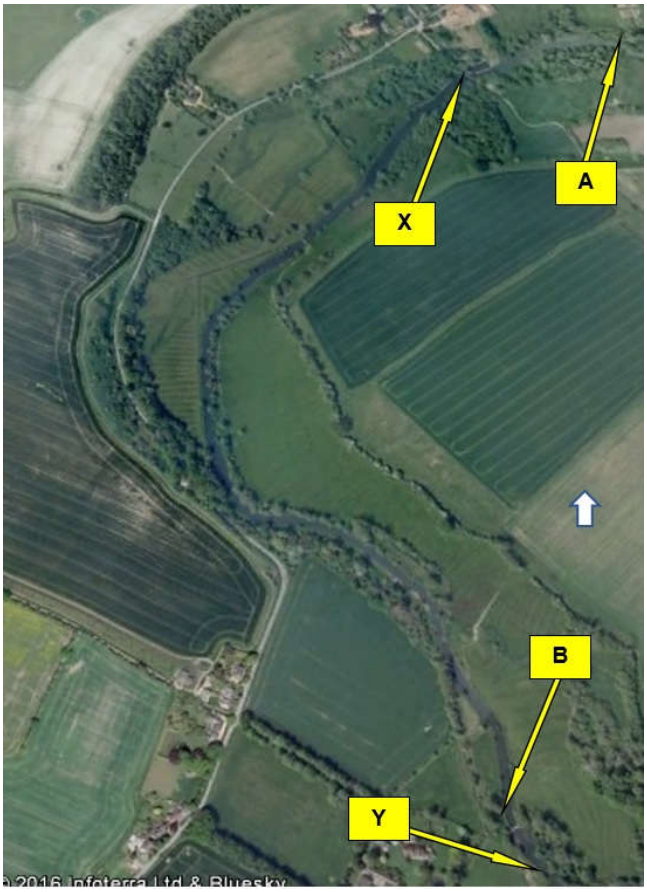

Fig. 7: Survey areas West Amesbury to Normanton

X – Y: Avon left bank survey extent
A – B: Avon right bank survey extent

1. **West Amesbury to Normanton (right bank)**

- **River margins**: Surveys were undertaken from an upstream point at approximately SU 14371 41365. Moving downstream from this upper location, an area of *Carex riparia* dominated fen (Figs 28/29) on the river margin near SU 14336 41389 supports a population *V. moulinsiana* (approx. 5 m^{-2} : S1 on Fig 8, for further details see 4.2 results). A similar (but not directly connected) *Glyceria maxima* fen is present a short distance further downstream at SU 14288 41370; this did not support the snail illustrating the limited extent of the live population. Running for about 60 – 70m upstream of Moor Hatches bridge (SU 14130 41294) is an ornamental (in garden of Moor Hatches) *Carex* spp, *Sparganium* fringed pool; (*Vm* negative). From this bridge to the lowest survey point on the right bank at Normanton (SU 14059 40126) there is minimal development of marginal fen due to the steep gradient from banks into the river (Fig 30). Systematic sampling of any small areas of marginal *Carex* spp and *Glyceria maxima* between these points produced no *Vm*.
- **Flood plain**: To the west of the main channel lie two areas of flood plain grazing marsh with occasional fen filled hollows and drains. The northern area (possibly 4 – 5 hectares) was formerly cattle grazed, but rank growth of fen vegetation across the site suggests recent reduction or cessation of grazing pressure since the 2014 surveys. Survey over the area reconfirmed the presence of low numbers of *Vm* two locations (S2 on Fig 8) where the snail had been recorded previously in 2010 and 2014 (Willing 2015). These were in an area of possibly abandoned drainage channel or flush at SU 14006 41216 where *Vm* was present at frequency of about 24 m^{-2} (Fig.31). The snail was also relocated in very low numbers (< 1 m^{-2}) at a second site, (S3 on Fig 8) a small fen-filled hollow at SU 13847 41098 (Fig.32). For further details on these populations see 4.2 results. The southern floodplain grazing marsh (an area of now abandoned water meadows) contains a *Carex/Glyceria/Phalaris* fen-filled ditch running from approximately SU 13853 40988 in a 'dog-leg' down to SU 13640 40770. *Vm* was recorded in low numbers (< 1 m^{-2}) at just one location (S4 on Fig 8) in this ditch (SU 13685 40815) about 35m further south from the 2014 record (at SU 13709 40907 (Fig.33). Further surveys across this area produced no further finds, but ground conditions are too dry (typically GM 2) over most of this area to support *Vm*.

2. **Normanton to West Amesbury (left bank)**

- **River margins**: To the south of the footbridge (SU 14172 39982) the river margins are shaded by poplars, hazel, ash and willow. The little marginal fen present was heavily horse-poached. North of the footbridge up to West Amesbury (SU 14080 40162 north to SU 13872 40981) the river margins are mostly fenced from the adjacent grazed fields. Occasional areas of *Carex riparia* and/or *Glyceria maxima* dominated fen are present on the river margins, particularly toward the south of the area (access often entailed fence crossing onto river margins). Although often potentially suitable for *Vm* (i.e. unshaded and with GM at 3 – 4), the snail was not recorded.

- **Flood plain**: To the east of the main channel lie two areas of flood plain grazing with a footbridge lying between the two at SU 13885 40531. The southern heavily cattle grazed and poached area, has numerous fen filled channels (Fig 34) many lying in a parallel series (abandoned water meadow channels). Many of these are infilled with various mixtures of *Carex riparia, Glyceria maxima, Phalaris arundinacea, Phragmites australis* (e.g. at SU 14081 40325; SU 13885 40531). With an absence of shading and suitable ground conditions (GM 3/4) this area seems suitable for *Vm,* but a selective survey of the area failed to produce *Vm*. The northern floodplain has an area of approximately 1.5 – 2 hectares of lightly cattle grazed fen (SU 13960 41032) (Fig 35). This area produced low numbers of *Vm* over much of the fen (S5 on Fig 8). For further details on this population see 4.2 results.

4.2 Vertigo *moulinsiana* population details

4.2.1 Live *V. moulinsiana* populations were found at 5 locations during these surveys (Fig. 8). Three of these populations are confirmations of previously recorded ones but two maybe newly discovered.

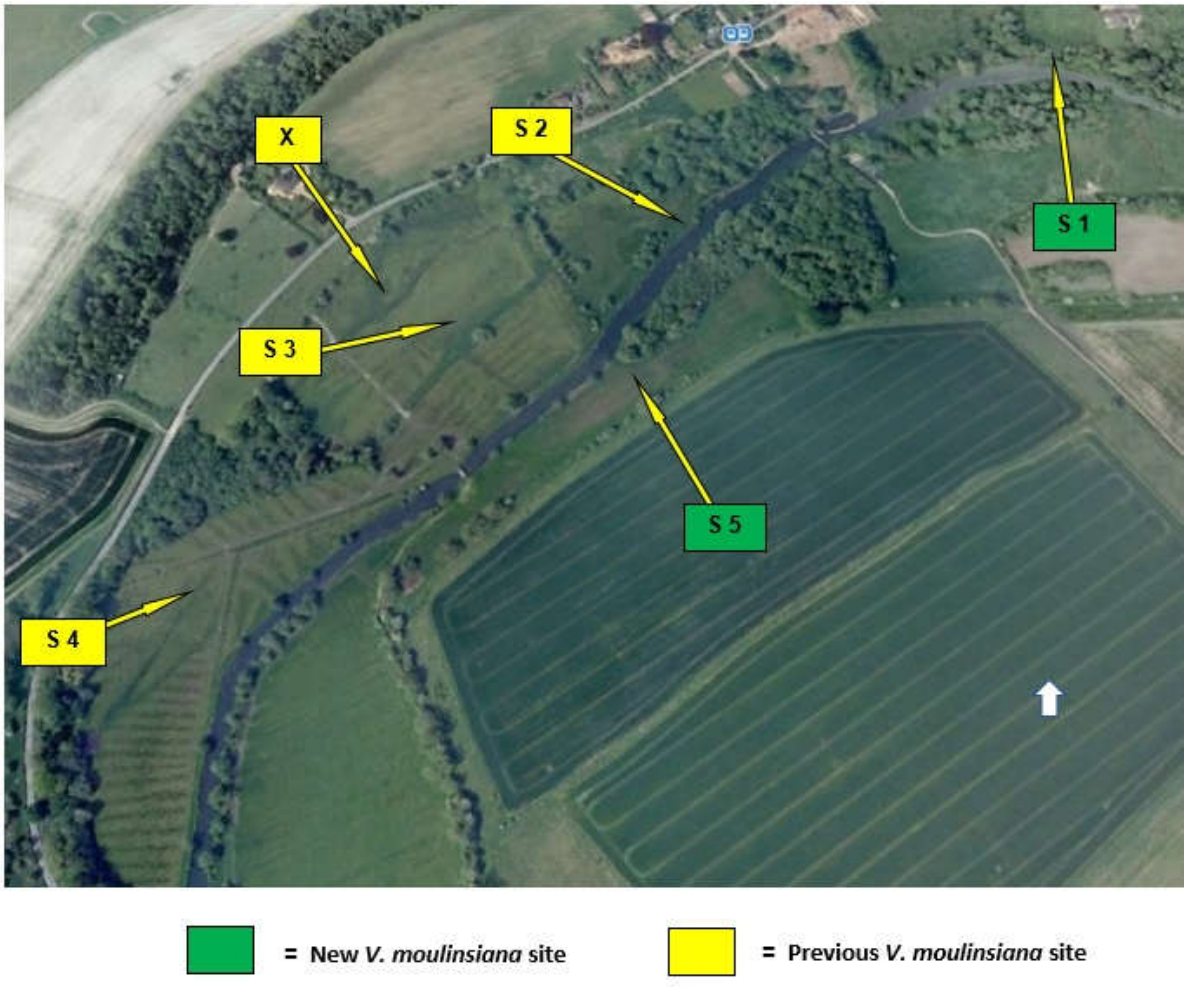

Fig. 8: *Vertigo moulinsiana* site locations (2016)

S1 – S4: right bank; S5: left bank

Table 1: Details of *Vertigo moulinsiana* sites

Vertigo moulinsiana site (nos in this report)	Grid. Ref	Ground moisture level (1- 5)	Shading	Dominant plants	Approx. V. moulinsiana (m^{-2}) (inc. counts from previous surveys)
S1	SU 14336 41389	4/5	Slight lateral shading from trees immediately upstream & downstream	*Carex riparia* (low levels of *Epilobium palustre* & *Urtica dioica* in drier fen near bank)	**Approx. 5 – 7** (1:4 - juvenile: adult ratio) Previous surveys: none; presumed new site
S2	SU 14006 49216	3/4	Nil	*Carex riparia, Glyceria maxima*	**Approx. 24** (1:1 - juvenile: adult ratio) Previous survey dates & *Vm* (m^{-2}): 2010: 748 2014: 42
S3	SU 13847 41098	3	Nil	*Carex riparia*	**Approx. <1** (juvenile: adult ratio – too few for meaningful estimate) Previous survey dates & *Vm* (m^{-2}): 2010: 108 2014: 30
S4	SU 13732 40845	3/4	Nil	*Carex riparia, Glyceria maxima, Phalaris aruninacea*	**Approx. <1** (4:1 juvenile: adult ratio – too few for meaningful estimate) Previous survey dates & *Vm* (m^{-2}): 2014: 16

Vertigo moulinsiana site (nos in this report)	Grid. Ref	Ground moisture level (1- 5)	Shading	Dominant plants	Approx. V. moulinsiana (m^{-2}) (inc. counts from previous surveys)
S5	SU 13960 41032	3	Nil	*Carex riparia, Carex sps*	**Approx. <1** (4:1 juvenile: adult ratio) Previous surveys: none; presumed new site

5 Discussion

Each survey section is discussed in report sequence.

5.1 River Till

5.1.1 Only one area of potentially suitable *Vm* habitat was located lying at the north of the survey area (Fig. 1; Fig. 12). The rest of the area supports no suitable *Vm* habitat. These results mirror those of Killeen (2001 p.4) who noted, "Upstream of the A303 road in Winterbourne Stoke village, there is no suitable *V. moulinsiana* habitat". Additionally, Killeen states (personal communication 2017):

5.1.2 "River Till (a) upstream of Winterbourne Stoke - For most of the section, the Till was dry during the survey - it only emerges c. 300m upstream of the bridge. The river course runs through improved/semi-improved grassland pasture - there was very little marginal vegetation such as sedges, and there were no suitable adjacent marshes or swamps".

5.1.3 It therefore seems that little has changed on this section of the River Till since 2001.

5.2 River Avon: Upstream of A303

5.2.1 Right bank (west). Killeen (2001 p.4) states (in relation to Avon north of A303 above Amesbury): "Populations of *Vertigo moulinsiana* were recorded within the survey area of the River Avon. Most of these were located along the right bank of the river upstream of the A303 road, either in marginal fringes or adjacent fens. Suitable marginal riparian habitat with *Carex, Glyceria* and *Sparganium* occurs along much of the right bank but is discontinuous, and only a few areas have stands of vegetation which support the snail". Additionally, in a personal communication (2017) he states: "Large triangle of marsh between right bank of river (left when looking u/s from bridge), and line of willows. Extensive area of wetland dominated by fen vegetation (*Carex riparia, Glyceria, Filipendula* etc). *V. moulinsiana* relatively common throughout, but mostly in the wetter depressions" (Fig. 7 & 18). In 2002 Killeen surveyed for an additional 1 km above these points (seemingly reaching the northern extent of these 2016 surveys;) and found few *V. moulinsiana*. He states (Killeen 2002; p4), "However, only 2 adult specimens were found at each location from a total of 16 samples. On the basis of these very low numbers, these cannot be regarded as populations, but more likely represent individuals that have been washed in from upstream locations".

5.2.2 The 2016 surveys show the presence (4.1Bii above, Figs 17, 18) of fen on river margins and flood plain as Killeen described but *Vm* has been lost from these since the earlier surveys.

5.2.3 Left bank (east). Killeen (2001 p.4) states "The left bank of the Avon upstream of the A303 bridge is more heavily managed for angling activities. Marginal riparian vegetation was very generally sparse and *V. moulinsiana* was recorded only in very low numbers at few sites". Additionally, in a personal communication (2017) he states: "A section of the right bank c. 300m up from the bridge has a broad swampy fringe of sedge with moderate to low numbers of *V. moulinsiana.* The downstream c. 400m section of the left bank has little riparian vegetation, but wider fringes with

Phragmites and *Sparganium* occur further north - these only supported occasional specimens of *V. moulinsiana".*

5.2.4 As with the right bank *Vm* has disappeared, but habitat is broadly like that in 2002 (4.1Bi above).

5.3 River Avon: South of A303 (east of A345)

5.3.1 Killeen (personal communication 2017) summarises and amplifies work from 2001 (Killeen 2001) in stating: "Between Amesbury road *(meaning A345)* and A303, NE of town. River with 2 channels running through improved sheep-grazed pasture, or rank herb meadow. Right bank with dense fringe of *Sparganium* in places. Only 2 specimens of *V. moulinsiana* found - possibly washed out of upstream populations". So there were no established population of *V. moulinsiana* in 2001 and the situation had not changed in 2016.

5.4 River Avon: Amesbury Park

5.4.1 Killeen did not record *Vm* in Amesbury Park in 2001. In a personal communication (2017) he describes work from 2001 (Killeen 2001). He states, "Amesbury Abbey to main road just south of A303 roundabout. Mostly parkland, banks 'manicured' with very little riparian vegetation.

5.4.2 Occasional areas with sedge, *Glyceria* or *Sparganium* on either side of Chinese house but none with *V. moulinsiana*". ….and …. "South of Amesbury Abbey bridge rough grazed semi-improved pasture. Marginal, dense in places, stands of *Carex riparia* and *Sparganium erectum* along right bank but no *V. moulinsiana*. Riparian vegetation along left bank mostly herbs, and heavily poached". Habitat observations and *Vm* survey from 2016 are very like those from 2001 so little has changed in the last 15 years.

5.5 River Avon: West Amesbury to Amesbury

5.5.1 Killeen 1997a notes one *Vm* locality for this stretch of river at SU 157 408 but this is a site on the right bank and so not in the survey area for this study. It can be noted that Willing (2011) also surveyed this right bank area but did not record *Vm* which suggests that it may have been lost by this date.

5.5.2 In 2017 there little suitable habitat was located on the left bank (see 4.1E above); *Vm* was not recorded.

5.6 River Avon: West Amesbury to Normanton

5.6.1 Killeen (1997a) states, "SU 143413 to SU 142400. West Amesbury to Normanton. Fringes of sedge and *Glyceria* along riverbanks (cut in many places for anglers). Complex of ditches in grazed meadows and along woodland margins (unaffected by grazing) many with luxuriant patches of sedge swamp. *Vertigo moulinsiana* locally common, particularly in the un-grazed areas". The grid references given include a length of river extending from immediately above Moor Hatches to a point near Normanton, roughly equivalent to the southern limit of this 2016 work. It is not clear if Killeen surveyed both left and right banks of the river. It seems likely that the *Vm* population, S1 of this report (see 4.1F & Fig 8), is a newly discovered one

as it lies above the northern extent of the 1996 work. All the other *Vm* sites, S2 – S5 (see 4.1F & Fig 8) might have been located (or areas close by) by Killeen in 1996. S2 and S3 were first recorded as specific sites in 2010 (Willing 2011) with S4 in 2014 (Willing 2015); surveys in 2014 and 2016 show numbers of snails to have fallen at these sites (see Table 1 above) and disappeared from another area (marked 'X' on Fig. 8). Whether this is due to habitat deterioration, some chance environmental events (e.g. flooding or drought) or reflects natural population changes is unclear. Certainly, apart from less intensive grazing, the right bank flood plain areas do not seem to have changed significantly since 2010.

5.6.2 The *Vm* population at S1 is of particular interest in that it represents a river side fen. Systematic surveys of most *Vm* sites on the Avon and its tributaries (Willing 2011, 2012 & 2015) demonstrated the loss of the snail from virtually all river margin sites (a loss of *at least* 86% of all Avon catchment *Vm* sites in the 14 years up to 2014 - confirmation of the further losses of sites upstream of Amesbury in 2016 will increase this total). The few remaining *Vm* populations in the Avon catchment are all on flood plain hollows and fens set back from the main river margins. It is speculated that a series of low river flows in the early 2000s followed, in the last 5 – 6 years, by prolonged periods of winter flooding, have removed these river-margin populations. Apart from this newly discovered one at S1, the only other known remaining river margin population in the Avon catchment is that at Sopley, south of Ringwood (Willing 2015).

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Finally, I am especially grateful to Ian Killeen for sending copies of earlier survey reports and also sending additional summary notes providing details of *Vertigo moulinsiana* surveys locations and results from 2001 / 2002 for many of the areas covered by this project.

Appendix 8. Images of survey sites

Fig. 9: River Till (Area 1): displaying dry river channel & absence of marginal fen

Fig. 10: River Till (Area 2): displaying dry river channel & absence of marginal fen

Fig. 11: River Till (Area 3): un-grazed fen covering this area (dry river channel in this western branch)

Fig. 12: River Till (Area 3): area of *Glyceria / Carex* fen potentially suitable for *Vertigo moulinsiana* (adjacent to eastern branch of the river)

Fig. 13: River Avon (N of A303 - L bank) area of *Glyceria / Carex* fen in ditch suitable for *Vertigo moulinsiana* (point 3, Fig. 3)

Fig. 14: River Avon (N of A303 - L bank) showing steep river banks with no marginal fen

Fig. 15: River Avon (N of A303 - L bank) showing steep river banks with no marginal fen

Fig. 16: River Avon (N of A303 - L bank) showing clearance of river margins in Block 4 post-survey visit (as viewed 1.12.2016)

Fig. 17: River Avon (N of A303 - R bank) *Carex* dominated marginal fen suitable for *Vertigo moulinsiana*

Fig. 18: River Avon (N of A303 - R bank) *Glyceria / Carex* fen-filled channel on floodplain suitable for *Vertigo moulinsiana*

Fig. 19: River Avon (S of A303 / E of A345) ditch & area of 'fen-type' vegetation at base of A303 embankment (Fig 4: B)

Fig. 20: River Avon (S of A303 / E of A345) *Glyceria maxima* marginal fen, margins of northern Avon channel (Fig 4: Point A)

Fig. 21: River Avon (S of A303 / E of A345) left banks of the Avon looking downstream on the Lord's Walk showing steep river banks & minimal marginal fen

Fig. 22: River Avon (Amesbury Park) river margins in 'area 2' (lower R-bank) showing lack of wide fen margin

Fig. 23: River Avon (Amesbury Park) river margins in 'area 6' (upper L-bank) Displaying shading & lack of marginal fen

Fig. 24: River Avon (Amesbury Park) river margins opposite Chinese House with *Glyceria maxima* fen (mid L-bank)

Fig. 25: River Avon (Amesbury to West Amesbury L-bank) Fen-filled channel leading back from river (suitable for *Vertigo moulinsiana*)

Fig. 26: River Avon (Amesbury to West Amesbury L-bank) steep banks with minimal marginal fen

Fig. 27: River Avon (Amesbury to West Amesbury L-bank) *Carex riparia* / *Glyceria maxima* fen-filled channel suitable for *Vertigo moulinsiana* (point B on Fig. 6)

Fig. 28: River Avon (West Amesbury to Normanton R-bank) *Carex riparia* dominated *V. moulinsiana* site (Fig. 8, S1) - viewed from right bank

Fig. 29: River Avon (West Amesbury to Normanton R-bank) *Carex riparia* dominated *V. moulinsiana* site (Fig. 8, S1) - viewed from left bank

Fig. 30: River Avon (West Amesbury to Normanton R-bank) showing typical steep banks with minimal growth of marginal fen

Fig. 31: River Avon (West Amesbury to Normanton R-bank) *V. moulinsiana* fen on flood plain (Fig. 8, S2)

Fig. 32: River Avon (West Amesbury to Normanton R-bank*) V. moulinsiana* fen on flood plain (Fig. 8, S3)

Fig. 33: River Avon (West Amesbury to Normanton R-bank*) V. moulinsiana* fen-filled ditch on flood plain (Fig. 8, S4)

Fig. 34: River Avon (Normanton to West Amesbury L-bank*)* fen-filled ditch on flood plain (note heavy cattle-poaching)

Fig. 35: River Avon (Normanton to West Amesbury L-bank) fen-filled meadow with *V. moulinsiana* (Fig. 8, S5)

Addendum I: Surveys for Desmoulin's Whorl Snail *Vertigo moulinsiana* on the River Till (south of A303) between Winterbourne Stoke and

Berwick St James May 2017

Dr. M.J.Willing (June 2017)

1 SUMMARY (additional to main report)

- Survey of the river margins and associated potentially suitable floodplain sites were undertaken on the River Till from Winterbourne Stoke to Berwick St James on two days in May 2017.
- Very few areas of habitat potentially suitable for *Vertigo moulinsiana* were located.
- No *V. moulinsiana* were recorded.
- Historic records indicate the former presence of *V. moulinsiana* at Berwick St James about 16 years ago.

2 Background (additional to main report)

2.1.1 This survey is a continuation of surveys undertaken for Atkins on the rivers Avon and Till October – December 2016. During that work on the River Till north of Winterbourne Stoke no *V. moulinsiana* were recorded. In 1996 - 2001 I. Killeen undertook visits to the R. Till south of Winterbourne Stoke and although not finding the snail in the upper regions, did report live snail presence further downstream (considered further in Section 5 below). In 2010 MJW (as part of a wider *V. moulinsiana* survey of the river for Natural England) also surveyed the area for about 1 km upstream of Berwick St. James. Although potentially suitable habitat was reported no *V. moulinsiana* were recorded. In 2010 no *V. moulinsiana* were recorded anywhere else on the Till.

3 Methods (additional to main report)

3.1.1 All areas of potentially suitable *V. moulinsiana* habitat were tray-beaten to determine presence of the snail. Surveys were undertaken on 5th and 21st May 2017.

4 Results (additional to main report)

4.1.1 The survey area is divided into 3 blocks (each dealing with a relatively self-contained unit; Figs A - C).

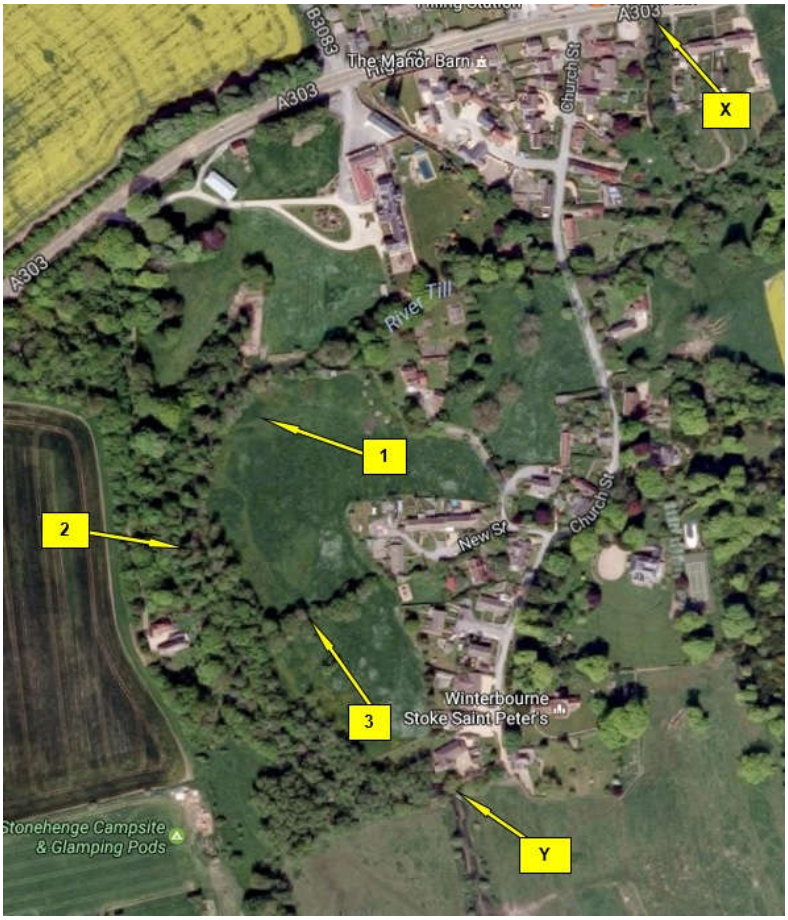

Fig A: Northern Survey Block (for figured points see text)

4.1 **Northern block**: This block runs from immediately south of the A303 (SU 07766 41093) to the river channel immediately south of Winterbourne Stoke Saint Peter's church (SU 07625 40600, Fig A: X – Y). Much of the sector has relatively steep gravel banks (rapid transition from dry banks to water) preventing formation of marginal fen and are also over-shaded by willow, alder and other trees (Fig 1). There is a small area of *Phalaris arundinacea* grading into *Glyceria maxima* in a short unshaded sector immediately upstream of Church Street road bridge (SU 07730 40931, Fig2) but most vegetation is emergent growing in flowing water. Downstream of this bridge (from SU 07690 40936) the much of the channel is shaded and with steep banks preventing formation of marginal fen (Fig 4; Fig A point 2). A cattle grazed field lies to the east of the river (SU 07557 40839, Fig. 3; Fig A point 1) with some patches of *Juncus* spp in low lying hollows near the river (GM 2). These were surveyed but no *V. moulinsiana* were recovered. Downstream of a cattle crossing ford, both banks are heavily over-shaded and again with no marginal fen. To the east of the river (SU 07496 40700) lies a 4 – 5m wide inflow drain, but also shaded and with no marginal fen (Fig 5; Fig A point 3). This sector terminates at the wooden footpath bridge by the church.

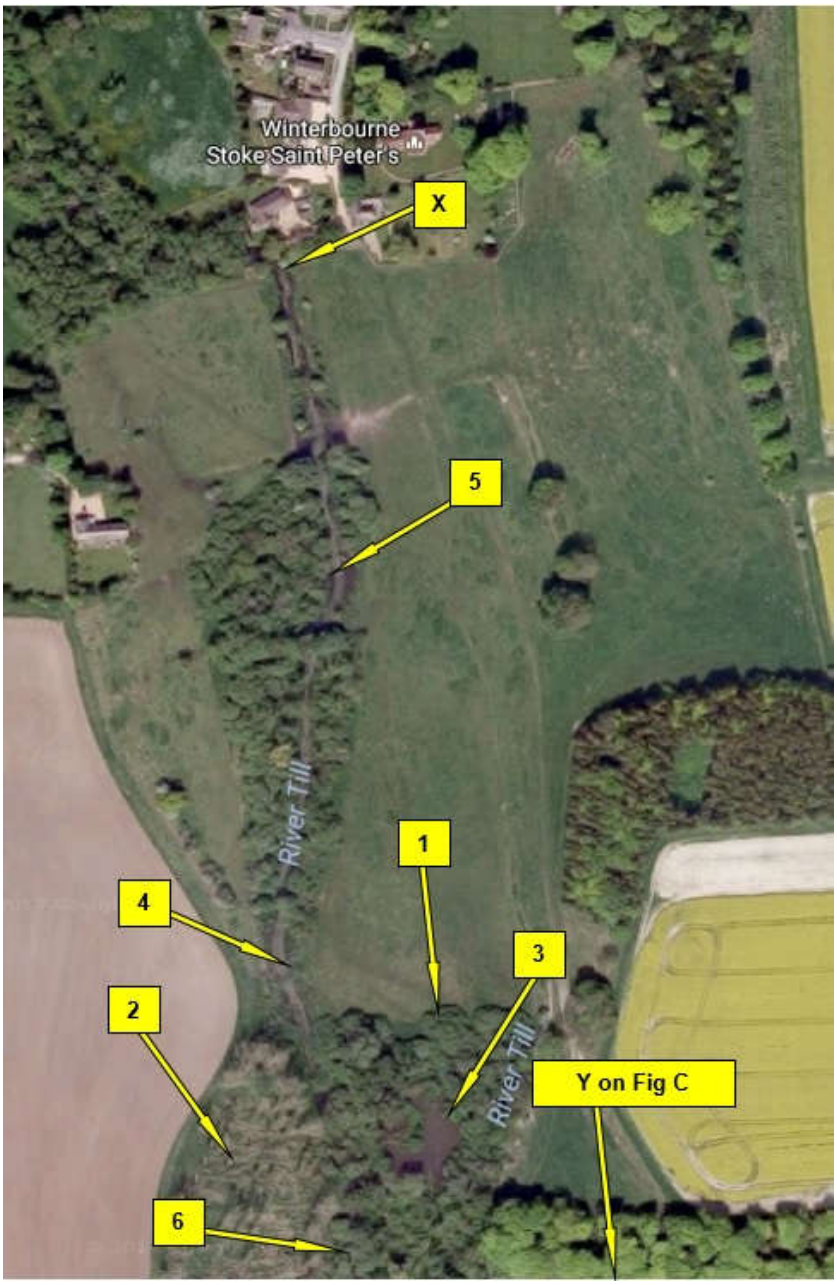

Fig B: Central Survey Block (for figured points see text)

4.2 **Central block**: The central block runs from X to Y (Figs B & C). Downstream of the footbridge most of the channel is again heavily over-shaded with minimal marginal fen (Fig 10; Fig B points 5 & 6). At the very top of this stretch a short unshaded margin at SU 07646 40595 supporting a small patch of *Phalaris arundinacea* and *Oenanthe crocata* on the bank (GM 1- 2); a further open stretch was present further downstream at SU 07640 40274 (Fig 6; Fig B point 4) with an area of *Glyceria maxima* (GM 5) with most as emergent vegetation in water rather than forming 'true' marginal fen. An open cattle-grazed field to west of the river at SU 07698 40256 had some *Juncus* spp (GM 2) filled hollows, but not supporting *V. moulinsiana*. At the southern end of the field and lying close to an artificial pool is a unshaded ditch (Fig 7; Fig B point 1) in-filled with *Carex riparia*, *Oenanthe crocata* and *Filipendula ulmaria* and a GM of 3 -4 (SU 07696 40234). Despite these ideal conditions *V.*

moulinsiana was not recorded. Lying to the south of this ditch is an area of mostly wooded ground enclosing an artificial pool (water fowl 'decoy pool'?) with steep dry banks and no marginal fen (SU 07686 40188, Fig 8; Fig B point 3). To the west of the river and pool is an extensive area of dry fen (GM 1 – 2) (SU 07623 40193 south to SU 07592 40015, Fig 9;). Although much of this area is now open fen aerial images (Fig B point 2) show that it was recently cleared of trees and so, until the recent clearance, would have been unsuitable for *V. moulinsiana.* The heavily shading of the river channel in this block stops abruptly at SU 07711 39814. Fields to immediate east are too dry and heavily grazed to support fen suitable for *V. moulinsiana* (Fig 11).

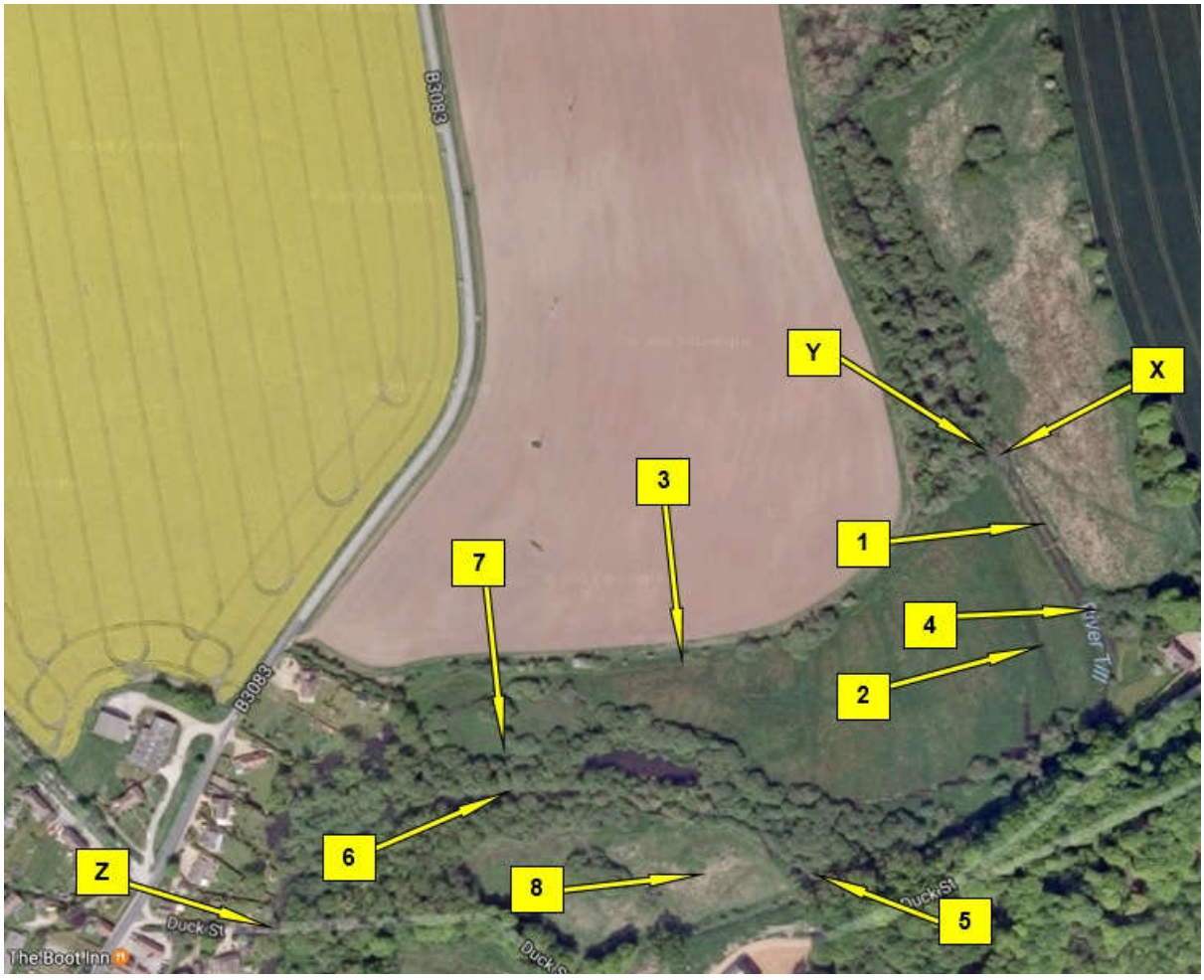

Fig C: Southern Survey Block (for figured points see text)

4.3 **Southern block**: This block covers the channel and adjacent floodplain; points X – Z on Figs B & C). Between SU 07724 39791 and SU 07593 39537 the river channel is unshaded with some very narrow areas of marginal emergent vegetation (*Sparganium erectum*, *Glyceria maxima*, *Mentha aquatica* and *Phalaris arundinacea),* but little growing on banks out of water flow and so little potentially suitable *V. moulinsiana* habitat (Fig 12; Fig C point 1). Flow from a spring enters the river at White Lodge (SU 07777 39678) where a fairly extensive area of *Glyceria maxima* (Fig. 13; Fig C point 4) is present, but as most is growing in water the site is also unsuitable for *V. moulinsiana.* The Till flows beneath a footbridge (Fig C point 5) and over a low weir and soon re-enters a shaded tunnel (Fig 16; Fig C point

6) of *Salix*, alders and other trees (e.g. ash) until passing under the Duck Lane road bridge at SU 07262 39507. Wooded areas to the south of the river support just a few patches of fen (e.g. at SU 07308 39452 and SU 07359 39566, Fig 17) below a scattering of small canopy breaks with various mixes of *Carex riparia*, *Oenanthe crocata, Iris sp.* and *Urtica dioica;* these are too shaded and small to support *V. moulinsiana* and sampling did not produce the snail. A heavily grazed field at lying south-east of the river contained no suitable habitat SU 07474 39498, Figs C point 8). The woodland immediately to the north of the river has a more open structure than south of the river; the area contains a number of small artificial pools, but none with suitable marginal fen (SU 07450 39604 and SU 07449 39632, Fig 20). To the north and west of the Till in this southern block lies a large field containing a couple of spring fed channels (draining into the main river) neither of which had any significant marginal fen (one spring head at SU 07729 39657, Fig 14). The ditch running along the northern boundary of this field was dry on both survey days but a number of small, now abandoned concrete bridges show that this area was formerly much wetter (SN 07644 39705, Fig 15; Fig C point 3). There are patches of fen (*Carex* spp, *Juncus* spp, *Iris* sp, *Filipendula ulmaria)* over much of this field often in hollows which maybe former water meadow channels, but they are unsuitable for *V. moulinsiana* due to a combination of dry ground conditions (mostly GM 1- 2 when surveyed) and moderately heavy sheep grazing (Fig 18). A few areas of more favourable fen meadow lie at the south-west of the area. An image displaying the effects of grazing shows the fen vegetation either side of the fence separating the grazed field from the fenced woodland / carr bordering the northern margins of the Till (near SU 07384 39633, Fig. 19)

5 Discussion (additional to main report)

5.1 Northern block:

5.1.1 Almost no suitable *V. moulinsiana* habitat is present in this upper block of the Till; margins are shaded, often drop abruptly into the river and so little marginal fen is present. Additionally no areas of fen are present on the floodplain. This zone has also been surveyed historically on at least one occasion by I.J. Killeen, but no *V. moulinsiana* were recorded. Thus Killeen (personal communication 2017), states (in relation to surveys undertaken in this section between March 1996 – 2001):

"Downstream of Winterbourne Stoke to the footbridge south of the church.

In this section the river is flanked by gardens, trees and strips of wet woodland.

As a result of the frequently heavy shade, there was very little marginal riparian habitat (apart from the occasional clump of Iris at the ends of gardens). The adjacent land along part of the left bank comprised very rough, wet pasture, but again, there was no suitable Vertigo habitat".

5.2 Central block:

5.2.1 As with the northern block there are few areas of marginal fen. This area was also surveyed by Killeen between 1996 – 2001 and again not recording any *V. moulinsiana.* Killeen writes (personal communication 2017):

"Downstream of the footbridge, south of church

Initially the river runs through open rough pasture, but is then flanked by wet swampy woodland carr along the left bank and a wooded track along the right bank. The left bank is generally heavily shaded with little riparian vegetation. There is, however, a small area of Glyceria-dominated marsh at the woodland/field boundary, although no Vertigo moulinsiana were found. Stands of rank fen dominated by Iris and tall herbs, plus marginal Glyceria and Phalaris occur discontinuously along the right bank, however, no V. moulinsiana were found, possibly as a result of the fen being too dry".

5.2.2 The 'area of *Glyceria*-dominated marsh' at the woodland/field boundary' mentioned by Killeen is assumed to relate to a similar area of *Glyceria* described in 4.2 above at SU 07640 40274 (Fig 6).

5.3 Southern block:

5.3.1 River margins in this southern block are either shaded and / or too steep to support a sufficient width of marginal fen to support *V. moulinsiana*. *Alnus*/*Salix* carr areas at the south-western corner support small shaded areas of fen that are not suited to support the snail. The large open field lying to the west and north of the River Till contains pockets of fen (especially at the S.W. corner closest to a fence enclosing the *Salix*/*Alnus* carr to the north of the river) that appear potentially suitable for *V. moulinsiana.* None were found and it is believed to be due to two factors:

(1) dry ground conditions;

(2) moderately heavy grazing (sheep during survey period).

5.3.2 Evidence of low ground water is seen across much of this site with ground moisture (GM) levels mostly at 1 – 2 (when surveyed). The boundary ditch at the north of the field was completely dry (Fig 15) when visited on the survey days. The impact of grazing upon fen vegetation can clearly be seen where open fen runs continuously from the field carr margins at the south-west end of the site. Fig. 19 shows the impact of grazing, which is likely to impact negatively on any *V. moulinsiana* populations.

5.3.3 This area has been surveyed for *V. moulinsiana* in the past, at least once by I.Killeen between 1996 – 2001 and then the southern sector (as defined in this report) by MJW in spring 2010. In March 1996 Killeen (Killeen 1997a) recorded the presence of the snail at Berwick St James thus:

"T2 SU 073 396. Berwick St James. Area of dense Carex acutiformis along ditch and extending east to the river bank and south into marginal alder woodland.

Vertigo moulinsiana sparsely distributed".

5.3.4 The grid reference given (which was not taken with a GPS) lies in the *Salix*/*Alnus* carr rather than open fen, but is presumed to lie in the open field to the north where dry fen is currently present. A later survey in 2001 (Killeen 2002) Killeen again notes the presence of *V. moulinsiana* at Berwick St James between SU 072 389 and SU 077 396 (Fig 21). This again reports the presence of the snail in the 'fen-meadow'

at the south-west of 2017 survey block 3. This 2001 reference also indicates the presence of the snail along the River Till to the south of Duck Lane bridge and so outside the survey remit of this project. The whole of southern block 3 was also surveyed by MJW in spring 2010 (Willing 2011) as part of a wider *V. moulinsiana* survey of the Till (and other parts of the Avon catchment) for Natural England. This survey did not record the snail in this block (or anywhere else on the River Till) despite the presence, at that time, of seemingly suitable habitat. It would therefore seem that *V. moulinsiana* may have been lost from this area lying immediately north of Berwick St James between 2001 and 2010. It is also probable that the snail is also no longer present anywhere else in the River Till catchment.

6 References (additional to main report)

Killeen, I. J. 2002. Surveys of EU Habitats Directive *Vertigo* species in England: 3. *Vertigo moulinsiana* Part 2: The River Avon SAC . *English Nature Research Reports*, Peterborough.

7 Acknowledgements (additional to main report)

Note from Author: Dr. M.J.Willing

7.1.1 Ian Morrissey (Atkins) is thanked for managing this project extension and, as during the first phase of the work, Ellen Derbyshire (Atkins) is further thanked for providing survey maps, making contact with landowners and acting as a daily H&S ‘contact’.

7.1.2 I thank various landowners and managers who allowed surveys on their land. In particular thanks are due to: Robert & Fiona Turner for access to Jubilee Cottages and Manor Farm land and for allowing parking again at Manor Farm; Mr. & Mrs. Smith; Wiltshire Council, Mr & Mrs Gatling (White Lodge) and Mike Doggrell land manager of the Guinness Estate.

8. Appendix: Images of Survey Sites

Fig 1: Northern Survey Block: habitat at top of survey showing lack of marginal fen

Fig 2: Northern Survey Block: immediately upstream of Church Street Bridge

Fig 3: Northern Survey Block: field lying to east of river

Fig 4: Northern Survey Block: showing heavily over-shaded margins with lack of marginal fen

Fig 5: Northern Survey Block: over-shaded side channel

Fig 6: Central Survey Block: showing *Glyceria* growing in water at river margins

Fig 7: Central Survey Block: Fen filled ditch – a potential *Vertigo moulinsiana* habitat

Fig 8: Fig 7: Central Survey Block: Artificial pond with no marginal fen

Fig 9: Fig 7: Central Survey Block: dry fen developing in recently tree-cleared area

Fig 10: Central Survey Block: showing over-shaded margins with lack of marginal fen

Fig 11: Central Survey Block: dry, heavily -grazed field to east of river

Fig 12: Southern Survey Block: unshaded channel at upstream end with some marginal fen

Fig 13: Southern Survey Block: point of spring inflow on far bank with *Glyceria maxima*

Fig 14: Southern Survey Block: Spring in heavily-grazed field

Fig 15: Southern Survey Block: abandoned walk-way supports over dry perimeter ditch

Fig 16: Southern Survey Block: showing over-shaded margins with lack of marginal fen

Fig 17: Southern Survey Block: small areas of shaded fen in carr on southern margins of river

Fig 18: Southern Survey Block: heavily grazed field

Fig 19: Southern Survey Block: Note effects of grazing on fen vegetation lying in field to left (west) of fence – ungrazed to the right of fence

Fig 20: Southern Survey Block: artificial pools in carr to north of river – no marginal fen – *Carex* shown growing in standing water

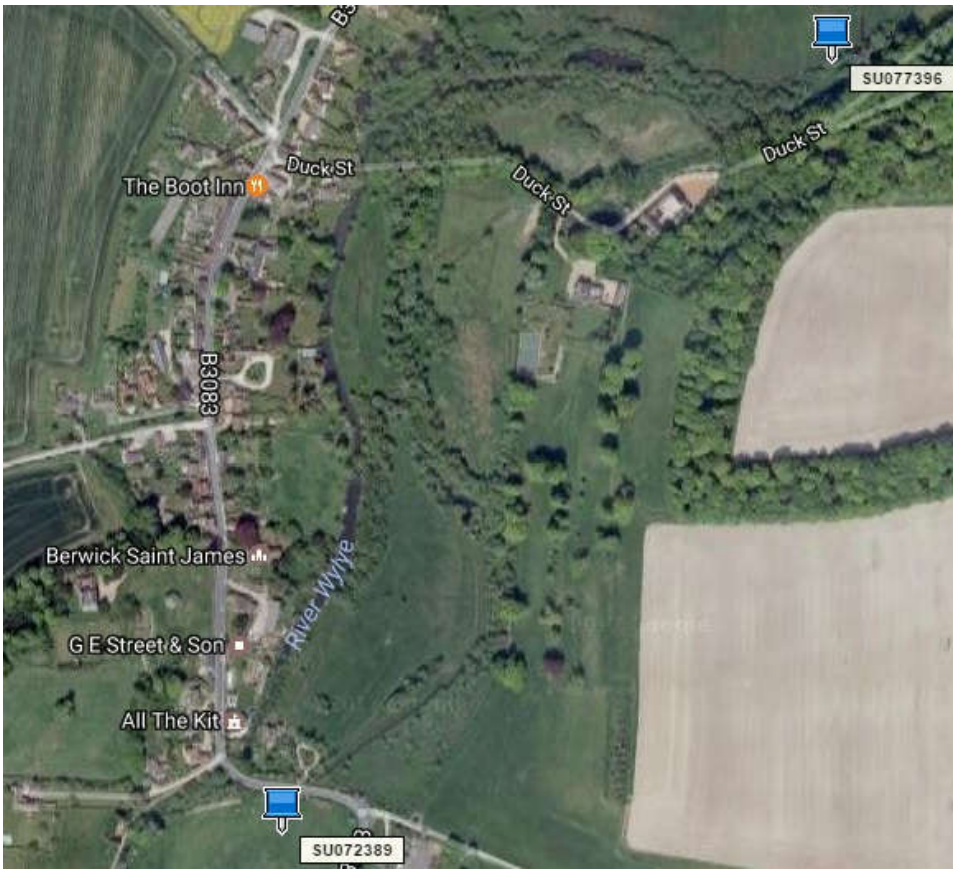

Fig 21: *Vertigo moulinsiana* reported to occur between marked OS grid reference points (I. Killeen surveys in 2001). Note – only the top point lies within the 2017 survey area

Arup Atkins Joint Venture Approvals

Version	Role	Name	Signature	Date
P0.1	Author	Martin Willing Ian Morrissey	[redacted]	05 June 2017
	Checker	Liz Brown	[redacted]	18 August 2017
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