Control of creeping water primrose *Ludwigia grandiflora* at Breamore Marsh, in New Forest District, Hampshire, UK

A report prepared on behalf of RINSE (Reducing the Impact of Non-native Species in Europe)

Creeping water primrose *Ludwigia grandiflora* (photo: Trevor Renals)

Report prepared by Hampshire and Isle of Wight Wildlife Trust April 2013

Hampshire & Isle of Wight Wildlife Trust
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RINSE

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Summary

The invasive non-native creeping water primrose *Ludwigia grandiflora* was discovered growing in Round Pond at Breamore Marsh Site of Special Scientific Interest (SSSI) in the New Forest District of Hampshire, UK, during August 2009. *Ludwigia grandiflora* is regarded as a high priority for eradication from the wild in the UK due to its potential to cause serious damage to the aquatic environment, as experienced in France, The Netherlands and Belgium.

Hampshire and Isle of Wight Wildlife Trust (HIWWT) and other conservation organisations recognised the urgent need to eradicate the *Ludwigia grandiflora* population at Breamore Marsh, particularly due to the proximity of this site to the River Avon. The River Avon is also a SSSI and is recognised as being of international nature conservation importance through designation as a Special Area of Conservation and a Special Protection Area under the relevant EC Directives.

This report summarises the involvement by HIWWT in the control of *Ludwigia grandiflora* at Breamore Marsh. Since autumn 2009 herbicide treatment has been undertaken by professional contractors; volunteers have attempted to undertake manual control. The attempt to eradicate *Ludwigia grandiflora* from Breamore Marsh has, to date, been unsuccessful due to a number of factors. Unseasonably high rainfall has resulted in high water levels in Round Pond which has delayed or prevented herbicide treatment being undertaken. The presence of taller vegetation has protected the *Ludwigia grandiflora* from herbicide applications.

The eradication of *Ludwigia grandiflora* from the wild remains a top priority in the UK and HIWWT is currently considering alternative methods to eradicate this highly invasive species from Breamore Marsh.

1. Introduction

This report has been prepared by Hampshire and Isle of Wight Wildlife Trust to describe the attempt to control the invasive non-native plant called creeping water primrose *Ludwigia grandiflora* at Breamore Marsh in Hampshire. The report draws on the experience of the New Forest Non-Native Plants Project and the Source to Sea Project. The production of this report has been part-funded by RINSE (Reducing the Impact of Non-native Species in Europe).

2. The RINSE Project

RINSE (Reducing the Impact of Non-native Species in Europe) is a European Project which focuses on ways of controlling invasive non-native species across the Two Seas Programme area. It also aims to improve awareness of the threats posed by invasive non-native species. For further information see www.rinse-europe.eu

The Project has been funded by the European Union – Interreg IVA 2 Seas programme and has a total of nine partners from France, England, Belgium and the Netherlands.

3. Hampshire and Isle of Wight Wildlife Trust

Hampshire and Isle of Wight Wildlife Trust (HIWWT) is the leading nature conservation charity in the two counties of Hampshire and the Isle of Wight. With support from over 27,000 members and 900 volunteers, HIWWT works to protect wildlife and wild places, managing 48 nature reserves, running 3 education centres and offering advice to landowners and land managers. HIWWT is part of a UK-wide partnership of 47 local Wildlife Trusts, with a collective membership of more than 800,000 people working together to conserve our precious natural heritage.

HIWWT is a partner in the RINSE Project.

4. Creeping water primrose

Creeping water primrose *Ludwigia* species form a group of invasive aquatic plants, native to South America. They grow rapidly and can double their biomass in 15-20 days and have become a serious pest in a number of countries, including France, Belgium and The Netherlands where they smother water bodies reducing the numbers of native species and potentially increasing the risk of flooding.

Creeping water primrose was introduced to the UK as an ornamental garden plant but is now regarded as a highly invasive non-native species detrimentally affecting semi-natural habitats. It is traded under a variety of names, including floating water primrose, primrose willow and *Jussiaea* spp. and its correct taxonomic attribution is equally confused; *Ludwigia grandiflora*, *L. hexapetala* and *L. peploides* are among the names that have been applied to it. The creeping water primrose growing at Breamore Marsh and which is the subject of this report is considered to be *Ludwigia grandiflora*.

Creeping water primrose *Ludwigia grandiflora*
Photograph by Trevor Renals

Creeping water primrose thrives in ponds, lakes, watercourses, wet meadows and other wetland habitats. It can root in water up to 3 metres deep, with its stems and leaves floating at the surface, forming dense mats, shading deeper water plants, reducing their photosynthetic rate and reducing the amount of dissolved oxygen in the water. As well as detrimentally affecting biodiversity, the dense mats of floating vegetation can quickly block waterways and interfere with navigation and fishing.

As well as growing in mats on the water surface, creeping water primrose colonises seasonally-exposed bare mud. Roots and rooting stem fragments, embedded in soil or mud, send out lateral shoots that root from nodes into submerged or seasonally-exposed soils. Continued growth develops into mats of emergent vegetation, covering shallow water areas and transitional margins.

The stems extend across the water surface, producing round or oval leaves. As they mature the fleshy stems grow upright and the leaves lengthen and become lanceolate, approximately 9cm in length.

Creeping water primrose is adapted to submerged or temporarily exposed soils as well as low-oxygen (anaerobic) conditions through the presence of two distinct specialised root structures which extract oxygen and nutrients from the water. Porous, upward-growing aerenchymous roots, sometimes referred to as pneumatophores, aid its survival in anaerobic, muddy conditions and function as a conduit for the transfer of atmospheric gases. Downward-growing adventitious roots (arising from the stem) absorb nutrients in the water column, often without contact with the substrate.

Under the Wildlife and Countryside Act 1981 (as amended) [Ref 1] it is unlawful to plant creeping water primrose in the wild or otherwise cause it to grow in the wild. Responsibility to prevent the spread of creeping water primrose in the wild lies with the individual landowner.

NB: Although Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) refers to 'floating water primrose' *Ludwigia peploides,* it is understood that, due to the taxonomic uncertainty referred to above, 'creeping water primrose' *Ludwigia grandiflora* is intended to be subject to this legislation.

Creeping water primrose is currently known from 13 sites in the 'wild' within England and from one site in the 'wild' in Wales.

The serious threat of creeping water primrose to watercourses and wetland habitats in the UK has been recognised by Department for Environment, Food and Rural Affairs, the statutory environmental agencies (Natural England and the Environment Agency) and the Great Britain Non-Native Species Secretariat. It is regarded as a high priority for eradication in Great Britain and is subject to an Invasive Species Action Plan (August 2010) a copy of which is appended at Annexe 1 of this report.

A recent report (CABI 2010) [Ref 2] which investigated the economic cost of invasive non-native species in Great Britain estimates the cost of eradicating current outbreaks of creeping water primrose in the wild in Great Britain as in excess of £73,000. The report recognises that removal of creeping water primrose on a single occasion is unlikely to result in its eradication and estimates that, if creeping water primrose became widespread in Great Britain, the total cost of eradication would be in excess of £241,907,565. The report emphasises that this figure should be regarded as a conservative estimate as 'complete eradication of *Ludwigia* would require a continuous effort over a longer period of time'.

During January 2013 the UK Government announced a forthcoming ban on the sale of creeping water primrose which will take effect in April 2014.

NNSS

Have you seen this plant?

WATER PRIMROSE

Ludwigia grandiflora & Ludwigia peploides

What is it?

An invasive non-native plant from South America. It has become a serious pest in other countries, including France, where it smothers water bodies reducing the numbers of native species and potentially increasing the risk of flooding.

Where might I see it?

A recent invader which has been spreading rapidly and may be found across Great Britain in ponds, lakes and slow flowing water. May be present in gardens (in which it was originally planted).

How do you distinguish it from other plants?

- Grows upright (image a and d) as well as a spreading form in water (image c).
- Leaves dark green with lighter central vein, shape varies from long and thin to oval (image c, d and e).
- Bright yellow flowers with 5 petals present July to August (image b).
- Characteristic fruits which contain seeds (image f).

for more ID go to www.nonnativespecies.org/02_Identification%20Sheets.cfm

If you find this plant in the wild, in a garden or on sale, please contact:

01208 265033

trevor.renals@environment-agency.gov.uk

www.nonnativespecies.org

Creeping water primrose is a high priority for eradication, as highlighted by this poster produced by the Great Britain Non-Native Species Secretariat

5. The New Forest

Control and eradication of invasive non-native plants in the New Forest area is a priority due to its high ecological and landscape importance. A large proportion of the New Forest area is recognised as being of national nature conservation importance through designation as Sites of Special Scientific Interest (SSSI) in accordance with the Wildlife and Countryside Act 1981 (as amended). Substantial parts of the New Forest area are regarded as being of international ecological importance through designation as Special Areas of Conservation and Special Protection Areas under the relevant EC Directives and as wetlands of international importance under the terms of the Ramsar Convention held in Iran in 1971.

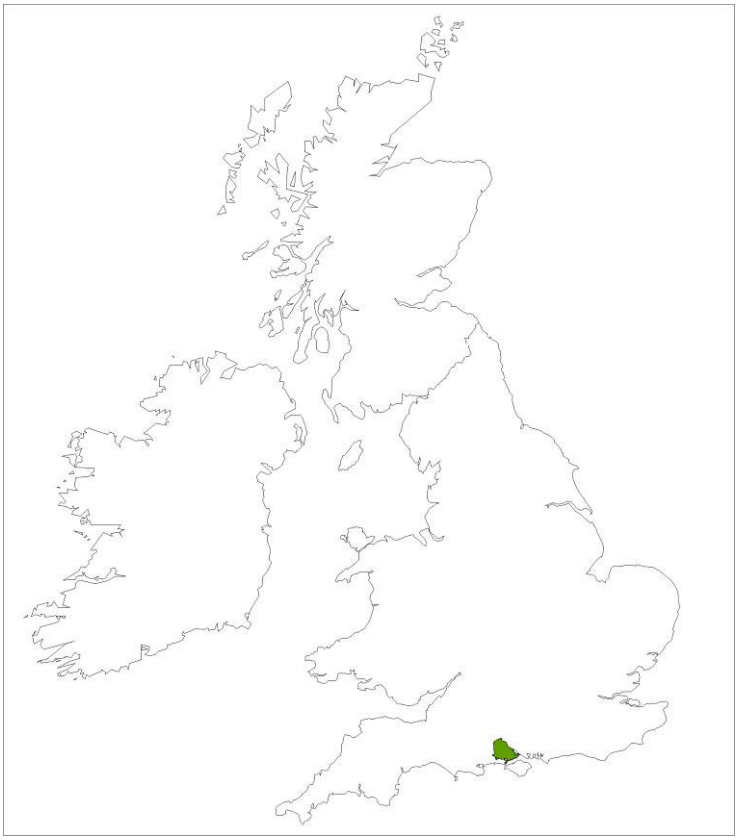

Figure 1 – location of the New Forest

6. The New Forest Non-Native Plants Project

The New Forest Non-Native Plants Project (NFNNPP) was set up in 2009 to provide advice, encouragement and practical help to landowners and land managers to control invasive non-native plants in the New Forest area, particularly along watercourses and in wetland habitats.

The NFNNPP is hosted by Hampshire and Isle of Wight Wildlife Trust (HIWWT) and funded by a partnership of local and national organisations. A full time project officer is employed by HIWWT to liaise with landowners, raise awareness of the problems caused by invasive non-native plants and arrange for practical control work to be undertaken.

7. The Source to Sea Project

The Source to Sea Project was set up in winter 2011 and is a partnership between Hampshire and Isle of Wight Wildlife Trust, Wiltshire Wildlife Trust, Dorset Wildlife Trust and the Environment Agency to stop the spread of invasive non-native plants along the River Avon and its tributaries. The project includes the entire River Avon catchment from its headwaters in the vale of Pewsey, downstream through Salisbury and into Hampshire to where it flows into the sea at Christchurch.

8. The Invasive Non-Native Species Framework Strategy for Great Britain

The work of the NFNNPP and the Source to Sea Project helps implement at the local level The Invasive Non-Native Species Framework Strategy for Great Britain [Ref 3]. This document, published in 2008 by the Department for Environment, Food and Rural Affairs recognises that "one of the greatest threats to biodiversity across the globe is that posed by invasive non-native species". The Strategy provides a high-level framework and details the key actions required to address the problems caused by invasive non-native species.

The Strategy highlights (paragraph 7.2) the importance of early detection of invasive non-native species and emphasises the need to take rapid action. As stated in the Strategy "The sooner action is taken to address any threat, the greater the chance of success and the less costly it will be both in terms of biodiversity and other resources".

The Strategy recognises that effective partnership working is critical to the successful control and eradication of invasive non-native species.

9. Breamore Marsh Site of Scientific Interest, Hampshire

Breamore Marsh was first notified as a Site of Special Scientific Interest (SSSI) during 1978 in accordance with the National Parks and Access to the Countryside Act 1949 and re-notified during 1984 in accordance with the Wildlife and Countryside Act 1981 (as amended). The SSSI citation for Breamore Marsh describes this site as

"An important surviving manorial green on which goose and cattle grazing persists. The grassland flora, whilst limited, is of interest in the extent to which its species composition has been derived from its grazing history. The marsh includes a series of shallow pools and connecting waterways which support an exceptionally rich aquatic flora. The ponds have margins of base-enriched bare mud in summers that are not excessively wet, with a near-unique assemblage of aquatic and semi-aquatic plants, including the national rarity brown cyperus *Cyperus fuscus*, common mudwort *Limosella aquatica* (which has only two or three other sites in Hampshire), and pennyroyal *Mentha pulegium*".

Figure 2- Location of Breamore Marsh Site of Special Scientific Interest (SSSI) in relation to the River Avon catchment

10. Discovery of Creeping water primrose at Breamore Marsh, Hampshire
Creeping water primrose *Ludwigia grandiflora* was discovered at Breamore Marsh in the New Forest District on 13 August 2009 by Clive Chatters, a local naturalist, whilst monitoring *Cyperus fuscus* the rare native plant that grows at this site (Chatters, 2009) [Ref 4].

The creeping water primrose was found in 'Round Pond' at approximate grid reference SU 155 183 in the north-western part of Breamore Marsh as indicated on the map below:-

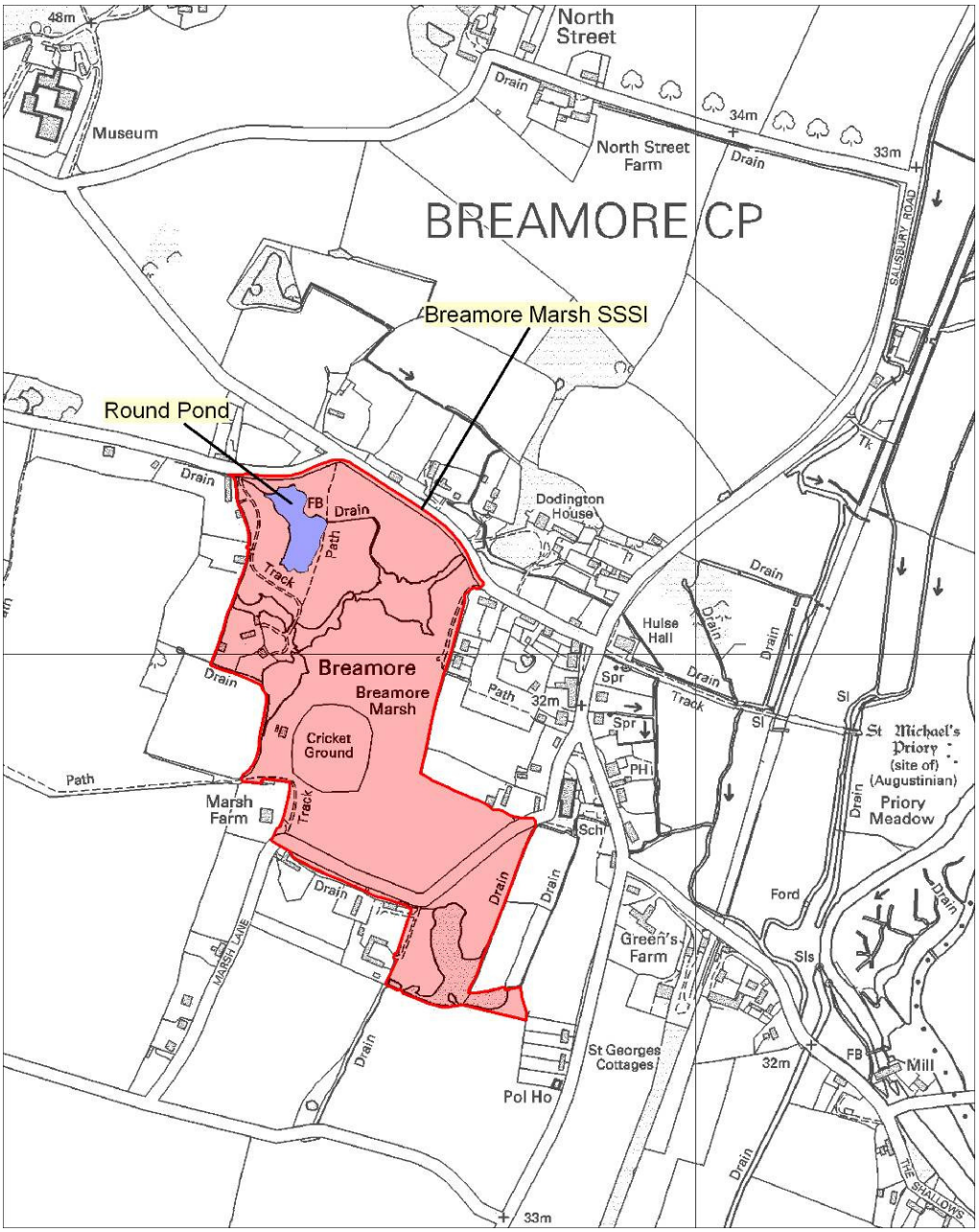

Figure 3 - Location of Round Pond where creeping water primrose was discovered at Breamore Marsh SSSI in August 2009

The Botanical Society of the British Isles' Vice County Recorder for South Hampshire (VC 11) was immediately alerted so that identification could be accurately determined and verified.

The New Forest Non-Native Plants Officer was alerted to the presence of creeping water primrose at Breamore Marsh and recognised the importance of eradicating the population at the earliest possible stage, to prevent its spread within Breamore Marsh SSSI and, potentially, into the River Avon which is designated as a SSSI, SAC and SPA.

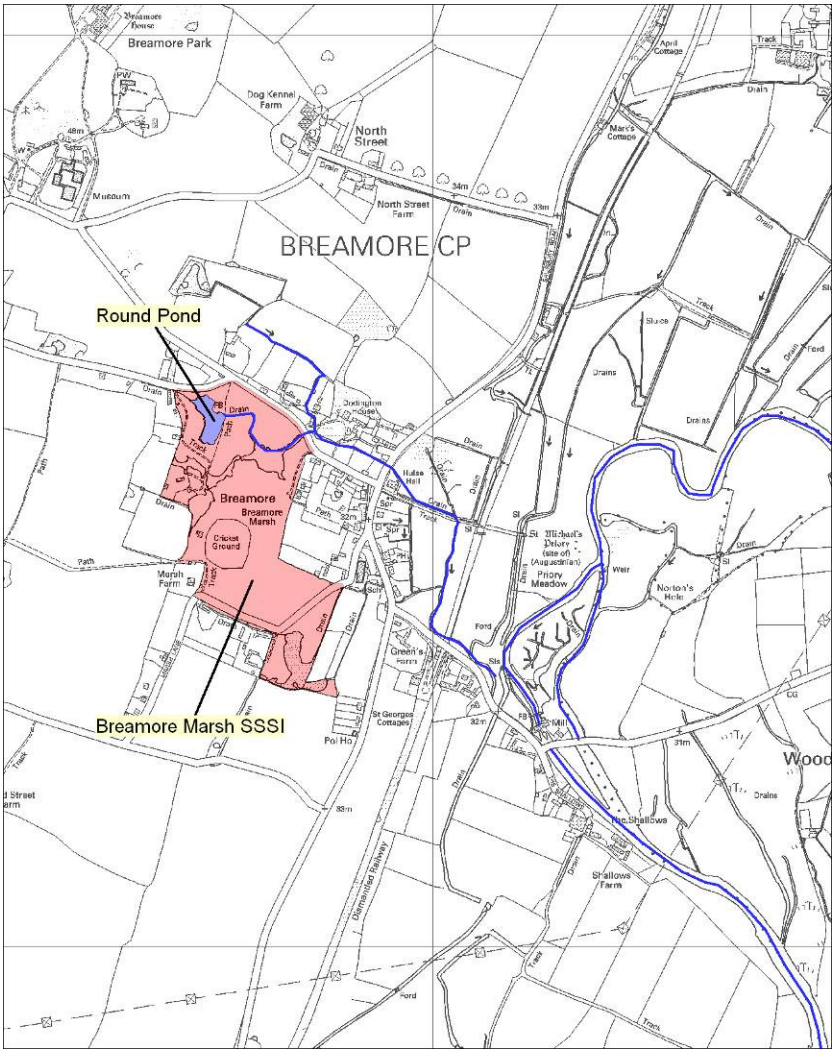

Figure 4 – Map highlighting the watercourses linking Round Pond within Breamore Marsh to the River Avon

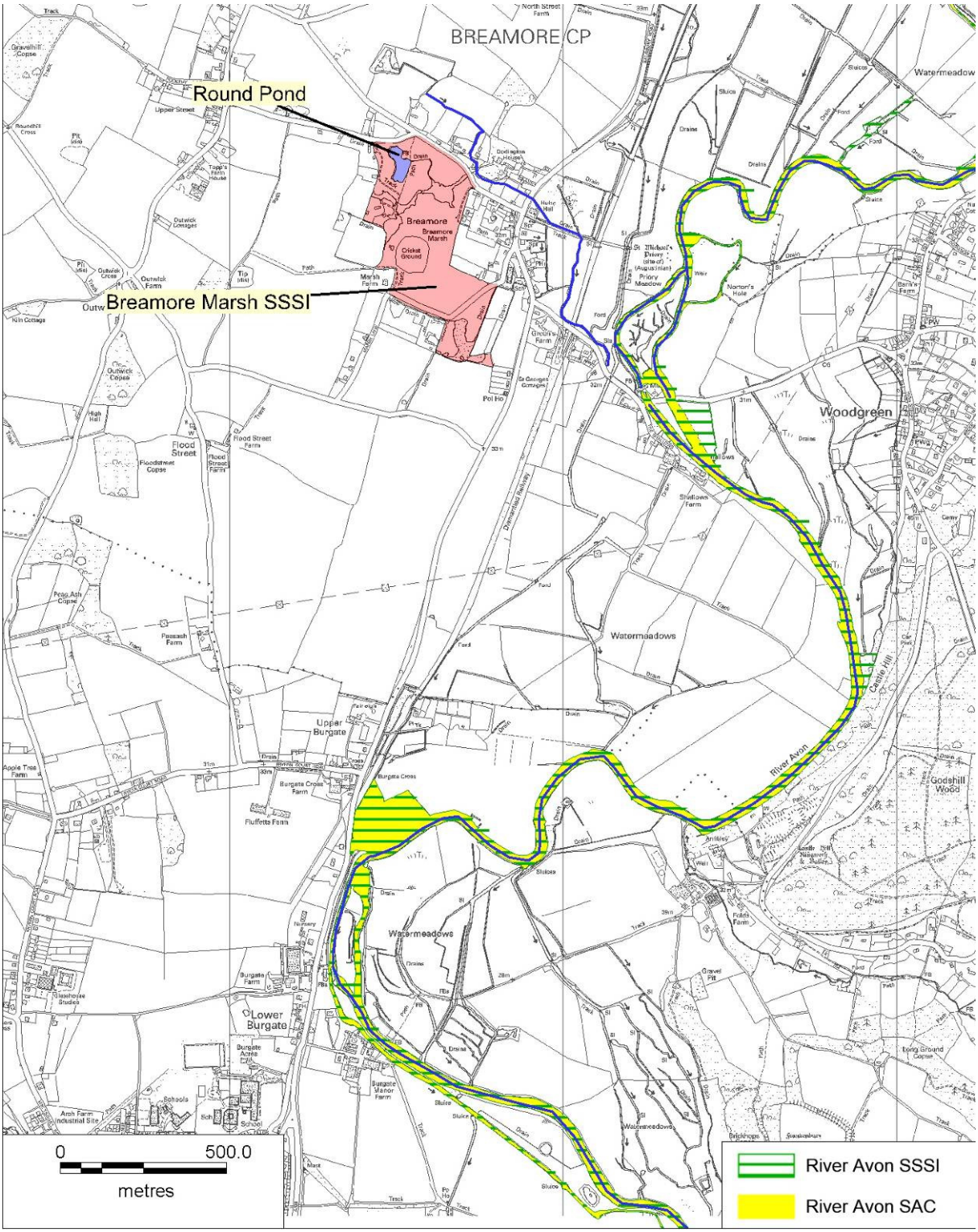

Figure 5 – map highlighting the proximity of Breamore Marsh SSSI to the River Avon SSSI / SAC

Natural England's local officer with responsibility for this area was alerted on 14 August 2009, with a request that Natural England alert the Environment Agency. The botanist who discovered the creeping water primrose at Breamore Marsh remarked to Natural England that "The botanical interest of the pond concerned is high but ephemeral and comprises species that will readily grow from the seedbank. I would recommend comprehensive herbicide use erring on the side of eradication rather than tinkering. The water levels are low at present and there is time to eradicate these species *[Ludwigia grandiflora and Crassula helmsii]* before the winter wetting of the ponds and the associated floods that could move these species to the remainder of the pond complex".

On 16 August 2009 the BSBI Vice County Recorder visited Breamore Marsh to collect a sample and verify identification as *Ludwigia grandiflora*.

On 18 August 2009 the Environment Agency's invasive non-native species specialist suggested to Natural England that funding associated with the Water Framework Directive could be used to eradicate the creeping water primrose at this site and Natural England's Species Recovery Programme Manager agreed to 'mobilise' funds (up to £2,000) accordingly.

11. Control of creeping water primrose at Breamore Marsh SSSI

Control of creeping water primrose during 2009

Natural England selected Kingcombe Aquacare Ltd as an appropriate contractor to undertake herbicide treatment of the creeping water primrose at Breamore Marsh SSSI. This company had proven experience of controlling other invasive non-native aquatic plant species and was known to Natural England and the Environment Agency.

Natural England's local officer obtained a quotation dated 4 September 2009 from Kingcombe Aquacare Ltd. The covering letter stated "the Ludwigia responds very well to treatment using Glyphosate (Roundup Pro Biactive) and Topfilm, however there is no 'silver bullet' and it will take repeated visits to control the colonisation, yet being caught early we stand in good stead to achieve control. Ludwigia is still a little of a learning curve, as active control has only been happening for the last twelve months in this country, however our own treatments are working well, and now in year two we are dealing with new, smaller regrowth from nodes on the older stems, a huge reduction in biomass….One factor we discussed on site was the exclusion of grazing animals from the area; this has more to do with the effects of poaching pushing fragments of the plants under ground preventing them from being sprayed and also building up a 'cache' of propagules ready to replace those chemically controlled".

Natural England's Species Recovery Programme Manager confirmed the provision of funding for two herbicide treatments to be undertaken to control the creeping water primrose at Breamore Marsh.

Kingcombe Aquacare submitted the necessary forms to notify the Environment Agency of the intention to use an approved herbicide near water and approval was given by the EA during September 2009.

Natural England agreed to arrange for consent to be issued, in accordance with the Wildlife and Countryside Act 1981 (as amended), for herbicide treatment to be undertaken within the SSSI.

On 29 September 2009 Kingcombe Aquacare Ltd informed the New Forest Non-Native Plants Officer that (weather permitting) the first herbicide treatment was scheduled to occur during the week beginning 5 October 2009, with the second treatment being undertaken during the second week of November 2009.

On 30 September 2009 the New Forest Non-Native Plants Officer issued a Purchase Order to Kingcombe Aquacare Ltd for two herbicide treatments to be undertaken during 2009.

On 1 October 2009 the project officer visited Breamore Marsh with Trevor Renals of the Environment Agency and Sophie Thomas of the plant conservation charity called Plantlife. Trevor Renals is the author of the Environment Agency's helpful publication 'Managing invasive non-native plants in or near fresh water' published in April 2010 [Ref 5] which gives advice on control of creeping water primrose.

Sophie Thomas of Plantlife with creeping water primrose at Breamore Marsh on 1 October 2009

The *Ludwigia grandiflora* was dominant over large parts of Round Pond, spreading across bare mud, forming dense mats of foliage and flowering amongst other vegetation as shown in the following photographs:-

Ludwigia grandiflora photographed at Round Pond on 1 October 2009
(photographs: Trevor Renals)

Ludwigia grandiflora photographed at Round Pond on 1 October 2009
(photographs: Trevor Renals)

Ludwigia grandiflora photographed at Round Pond on 1 October 2009
(photographs: Trevor Renals)

Ludwigia grandiflora at Round Pond, Breamore Marsh on 1 October 2009
(photographs: Trevor Renals)

Kingcombe Aquuacare Ltd planned to undertake the first herbicide treatment on Tuesday 6 October 2009 but unfortunately the weather that day was very wet and the work had to be postponed until 29 October 2009 as herbicide treatment is only effective in dry conditions.

Scott Rice and George Hyde of Kingcombe Aquacare Ltd preparing the herbicide for treatment of creeping water primrose at Breamore Marsh SSSI on 29 October 2009

The creeping water primrose at Breamore Marsh was treated with the Glyphosate-based herbicide Roundup Pro Biactive and an adjuvant called 'Topfilm'

Herbicide treatment being undertaken at Breamore Marsh on 29 October 2009

On 19 November 2009 the New Forest Non-Native Plants Officer and a representative of Plantlife visited Round Pond to mark out the creeping water primrose which required further herbicide treatment. ‘Flags’ made from red adhesive tape were attached to the top of garden canes to mark out areas where further herbicide treatment was necessary. Although some patches of creeping water primrose had clearly been affected by the herbicide treatment, there was evidence of fresh, new growth from many of these patches.

Sophie Thomas of Plantlife at Breamore Marsh on 19 November 2009 marking out areas where more herbicide treatment is required

Although there was no rain for the 24 hour period immediately following the herbicide treatment undertaken on 29 October 2009, there had since been a lot of rain so areas which were bare mud or terrestrial vegetation at the time of the herbicide treatment were under water on 19 November 2009. By 19 November 2009 the vast majority of the creeping water primrose was submerged.

Creeping water primrose *Ludwigia grandiflora* leaves submerged on 19 November 2009

The New Forest Non-Native Plants Officer asked Kingcombe Aquacare Ltd to select a suitable date (depending on weather conditions) for a second herbicide treatment during 2009. On 24 November 2009 the contractors informed the project officer that a second treatment was planned for 26 November 2009 but the weather forecast was not favourable. The contractors regarded the treatment of the creeping water primrose as a high priority and stated that 'as soon as the weather breaks' they would arrange a day to undertake the second treatment.

The contractors advised that "Once the Ludwigia and Crassula are submerged there really is very little we can do…we can still treat anything exposed or clear of the water…The Ludwigia should start dying back as soon as we get some colder weather; it does survive the winter but only just! Therefore I think it would be a good idea to try and hit it as early as possible next year as soon as a) the weather allows and b) the plants show signs of starting to grow, probably in late May. If we have everything in place by then, we should have the whole summer to maximise the control".

On 4 December 2009 the contractor visited Breamore Marsh to assess the water levels and determine whether further herbicide treatment would be feasible during 2009. He explained "The water level is now right up (probably 2-3" flowing out) and there was even a good cover of ice! We saw your flags and looked around them and

could see…some small examples of Ludwigia. The Ludwigia did not look in the best of condition so I would think the cold weather is starting to have an effect on this, however everything we saw was underwater making it impossible to treat. I think it would be good to keep the areas marked if practicable and as soon as the water drops we can look at getting the second treatment on. We are happy to be as flexible as we can, you probably know the site better than I, is the water level likely to drop given a sensible dry spell? If we can stay in touch and keep and eye on water levels we can get the second spray on. Even if it's early in the spring it ill still be worthwhile even if the effects take longer to show, because of the slower plant metabolism. Let's hope the monsoon season stops soon and we at least get a really cold dry winter; it all helps!"

The project officer sought advice from the local naturalist who had originally discovered the creeping water primrose at Breamore Marsh. He had visited the site annually since the 1980s to monitor the *Cyperus fuscus* and explained that, in his experience, water levels at Round Pond would be unlikely to fall until at least May the following year. In the circumstances, the project officer and Natural England agreed to postpone any proposals for further herbicide treatment until spring/summer 2010 and the project officer removed the marker canes from Round Pond.

Control of creeping water primrose during 2010

During January 2010 the project officer asked the contractors to quote for herbicide treatment during spring 2010 when water levels had fallen sufficiently. Natural England agreed to arrange for further funding to be available for herbicide treatment to be undertaken and the project officer asked Natural England to arrange for consent (for herbicide treatment within the SSSI) to be issued to the landowner in accordance with the Wildlife and Countryside Act 1981 (as amended).

On 3 February 2010 the project officer received the quotation. The contractors recommended 'a minimum of two visits over the course of the season and preferably three or four'. On 14 February 2010 the project officer commissioned the first herbicide treatment of 2010 and stated 'it is likely that water levels will be too high to undertake the treatment until May 2010 but even this might be too early in the year. I will keep you informed regarding water levels so we can agree a suitable time of year for the work to be undertaken'. The project officer asked the contractors to complete and submit the necessary paperwork to notify the Environment Agency of the intention to use an approved herbicide near water.

Water levels did not fall sufficiently until August. Herbicide treatment was planned for 6 August 2010 but, due to an unfavourable weather forecast, it was postponed until 9 August 2010. As rain was predicted, the contractors arrived at the site early and finished the treatment by early afternoon. The contractors advised the project officer that the full effect of the herbicide treatment would be observed two to three weeks following application and that it would then be appropriate to schedule the next herbicide treatment during early September 2010.

During May 2010 Joanne Gore of Hampshire and Isle of Wight Wildlife Trust joined the New Forest Non-Native Plants Project as a Project Officer and became the Wildlife Trust's main point of contact for the control of the creeping water primrose at this site.

During 2010 the Project Officer discussed various treatments methods with Natural England. Cutting was suggested to reduce the amount of rush *Juncus* spp present in the pond as the rush cover had made spraying difficult in the past and had allow creeping water primrose to survive sufficiently to start re-sprouting. However this suggestion was dismissed as a) it would be very difficult to cut the vegetation until the pond was dry enough and b) there was a risk of spreading the creeping water primrose further as a result of the cut fragments being flung around the pond.

The possibility of mechanical dredging of the pond was discussed to physically remove the creeping water primrose but concern was expressed by Trevor Renals of the Environment Agency that this may lead to compaction on the sensitive SSSI.

During August 2010 Natural England indicated that funding would be provided for a further two herbicide treatments during 2010, 2011 and 2012 and the project officer issued a purchase order for the second herbicide treatment of 2010.

Clive Chatters, who had first discovered the creeping water primrose at Breamore Marsh, visited the site and observed lots of creeping water primrose growing amongst the rushes *Juncus* spp. In early September the contractors contacted the Wildlife Trust to confirm that they were planning to undertake the herbicide treatment and agreed to treatment Round Pond thoroughly (by walking through the site in 'transects') to ensure comprehensive treatment of all the *Ludwigia*, including those plants growing amongst the rushes.

By mid September 2010 Round Pond remained dry and the second herbicide treatment of 2010 was undertaken on 16 September. A purchase order was issued on 29 September 2010 and the third treatment that year was undertaken on 15 October 2010. Throughout the treatment season the Project Officer made visits every two weeks to Round Pond and was very pleased at the reduction in the amount of creeping water primrose.

A volunteer working party was arranged and led by the project officer on 3 November 2010 to hand-pull remaining plants to help raise awareness of the problems caused by this invasive non-native plant. Posters were displayed around Breamore Marsh and leaflets were delivered to a number of nearby houses. Two local residents volunteered to help the project officer and in two hours (six 'man-hours') they had filled six refuse sacks. On arrival at the site, the initial impression was that the herbicide treatment had effectively killed all the creeping water primrose but when a dead-looking stem was pulled up and scraped, it was apparent that it was still alive. Some creeping water primrose plants were sprouting where they had disappeared out of view under rushes *Juncus* spp. Effort was focussed on the area near the outlet.

Local residents who helped the project officer hand-pull *Ludwigia grandiflora* at Round Pond on 3 November 2010

Following the volunteer work party the project officer concluded that hand-pulling was probably an effective method to help check the spread of the *Ludwigia* in the vicinity of the outlet but considered that more drastic measures, such as scraping out the pond, would be required to eradicate the *Ludwigia*. It appeared that the herbicide treatment undertaken at Round Pond had effectively killed *Ludwigia* plants in areas where there was no rush *Juncus* spp; the project officer therefore considered that scraping out the pond would help increase the effectiveness of future herbicide treatments as a reduction in rush *Juncus* spp cover would increase the amount of chemical coming into contact with the *Ludwigia* foliage. If the *Juncus*-dominated vegetation could be removed, any *Ludwigia* plants which had not been killed by the herbicide treatment could then more easily seen and controlled with a regular hand pull.

Control of creeping water primrose during 2011

Hampshire and Isle of Wight Wildlife Trust were intending to trial the use of aquatic dye to eradicate New Zealand pygmyweed *Crassula helmsii* in New Forest ponds and sought advice from Dr Jonathan Newland of Waterland Management Ltd during February 2011 regarding the likelihood of aquatic dye being an effective method to control *Ludwigia grandiflora* in Round Pond. Dr Newman did not consider aquatic dye to be an effective potential method for eradicating *Ludwigia grandiflora*. He considered that the *Ludwigia* would respond to aquatic dye treatment by growing to the surface and becoming emergent; Dr Newman advised using 2,4-D amine on the floating 'rosette type' leaves at a concentration of 9 litres/hectare of product ('Depitox').

The project officer decided to continue with the glyphosate herbicide treatment using Roundup Pro Biactive and the adjuvant 'Topfilm' and proposed three herbicide treatments during August, September and October 2011.

By the beginning of August the water level in Round Pond had fallen, exposing the creeping water primrose and a date was set for the first treatment to take place in the first week of August.

On 18 August 2011 torrential rain was experienced in Hampshire and when Clive Chatters visited Breamore Marsh on 19 August, in the hope of undertaking his annual survey of *Cyperus fuscus*, the water levels were far too high for herbicide treatment to be undertaken and he considered that 'a rather brutal approach' would be needed to control the *Ludwigia* in Round Pond and prevent its spread.

Torrential rain fell in Hampshire on 18 August 2011.
When this photograph was taken on 19 August 2011, water levels in Round Pond were uncharacteristically high for this time of the year.

Martin Rand, BSBI Vice County Recorder visited Breamore Marsh on 21 August 2011 and observed that the *Ludwigia* was 'dominating tracts' of the south and west parts of the pond and 'although plants are still young and non-flowering' their vigour looked undiminished. Although the *Ludwigia* was not covering the area where it had been most extensive during 2009 and 2010, he considered it had the potential to do so if not treated within the following few weeks. He offered to assist with hand-pulling during 2011 and wondered 'whether a hand-pull on a small contained site like this might be the most effective strategy'.

The unfavourable weather conditions prevented any herbicide treatment being undertaken during August 2011 and it was then not possible for the pond to be treated until September. By this time, the warm wet summer weather had caused the population of creeping water primrose to explode. However due to the drier weather earlier in the season only one or two upright flowering stalks were seen.

The first chemical treatment of the pond during 2011 using Roundup Probiactive with 'Topfilm' as the adjuvant took place on 16 September; further treatments were undertaken on 5 October and 28 October.

The project officer organised and led a volunteer work party to hand-pull the *Ludwigia* on 1 November 2011. The work party was advertised on the notice board in a local village shop and a local resident also advertised the event in the parish magazine. A total of seven volunteers attended including Martin Rand the BSBI Vice County Recorder, a representative of the Environment Agency and five local residents who live adjacent to Breamore Marsh.

A total of forty refuse bags of creeping water primrose were removed. The Project Officer considered that hand pulling after the chemical treatment was very effective. At least 50% of Round Pond was tackled by the work party during November 2011 and hand-pulling was undertaken in the water where the pond had started to refill.

Control of creeping water primrose during 2012

Further herbicide treatments, combined with hand-pulling, were planned for 2012. However, during summer and autumn 2012 Hampshire experienced very high rainfall and consequently the water level in Round Pond was too high for any herbicide treatment to be undertaken that year. The following photographs, taken at Breamore Marsh on 9 September 2012, indicate the height of the water and the growth of the *Ludwigia*.

Round Pond on 9 September 2012. Water levels remained too high for herbicide treatment to be undertaken during 2012.

The high water levels in Round Pond during 2012 prevented any herbicide treatment being undertaken that year and allowed the *Ludwigia grandiflora* to grow profusely as shown in this photograph taken on 9 September 2012

Photograph taken on 9 September 2012 showing a) the white, porous upward-growing aerenchymous roots (pneumatophores) which provide a conduit for atmospheric gases to be transferred throughout the plant in anaerobic conditions and b) the downward-growing adventitious roots (arising from the stem) which absorb nutrients in the water column, often without contact with the substrate.

Control of creeping water primrose during 2013 and beyond

As 2012 was the last year of funding being available for 'special projects' under the Breamore Estate Higher Level Stewardship agreement the Project Officer had approached Natural England with regards to further funding. Whilst investigating the possibility of further funding to support the control work during 2013 and beyond, Natural England asked the Project Officer to obtain quotes from contractors for mechanical removal of the creeping water primrose, using matting to protect the SSSI from compaction.

Hampshire and Isle of Wight Wildlife Trust invited Johan van Valkenburg of The Netherlands Plant Protection Service (one of the partners in the RINSE Project) to visit Breamore Marsh on 21 March 2013 to give advice on eradicating the creeping water primrose.

'Source to Sea' Project Officer Jo Gore (third from right) with Johan van Valkenburg of The Netherlands Plant Protection Service (third from left)) *et al* by Round Pond on Breamore Marsh discussing control of creeping water primrose on 21 March 2013

Johan referred to useful advice [Ref 6] prepared jointly by The Netherlands Plant Protection Service and the Centre for Ecology and Hydrology which is available at http://www.q-bank.eu/Plants/Controlsheets/Ludwigia_grandiflora_office_guide.pdf

This advice available at www.q-bank.eu refers to a number of management techniques including mechanical excavation and dredging, chemical control, biological control and environmental control.

Johan noted that although Breamore Marsh is grazed by domestic geese and cattle, grazing by cattle or wild geese elsewhere in Europe has not had an impact on creeping water primrose. Johan noted that although herbicide treatment had been undertaken to control creeping water primrose in Round Pond on a number of occasions, this had not been effective. Creeping water primrose growing amongst taller vegetation had been 'protected' from the herbicide treatments. The high water levels had delayed or prevented some of the scheduled herbicide treatments being undertaken.

He referred to an example in The Netherlands where a site infested with creeping water primrose had been excavated to a depth of 30cm; the contaminated soil was then buried under 'clean' soil to a depth of 1 metre in a hole which had been dug nearby.

In the light of his experience, Johan recommended that successful eradication of the creeping water primrose at Breamore Marsh would necessitate dredging Round Pond to a depth of 30cm and disposal of the excavated material.

Initially, Johan suggested that half of Round Pond could be dredged, followed by manual-pulling and herbicide treatment, and the remaining half of the Pond dredged the following year. However it was noted that by dredging half of the Pond, this would create ideal conditions for the spread of creeping water primrose and the *Crassula helmsii* which is also present in Round Pond. Martin Rand, the Botanical Society of the British Isles Vice-County Recorder for South Hampshire was present at the site visit and advised that no *Cyperus fuscus* (and no other rare, scarce or notable plants) occurred in Round Pond. Johan therefore concluded that dredging the entire Pond in a single operation would be preferable to a phased approached.

Advice provided by Johan van Valkenburg during site visit on 21 March 2013:-

- remove bushes and brambles growing around the margin of Round Pond (as such vegetation is likely to be harbouring creeping water primrose) and spot-treat any creeping water primrose (revealed after the removal of the bushes and brambles) with herbicide;
- excavate Round Pond to a depth of 30cm during July (prior to growth of creeping water primrose accelerating during August and September), taking extreme care to avoid inadvertently spreading fragments of creeping water primrose during the dredging operation;
- bury contaminated soil and vegetation on site.

Although burial of contaminated soil and arisings on site would significantly reduce the cost of disposal of the arisings, it was noted that burying the excavated material on site might not be realistic due to the impact on the Site of Special Scientific, aesthetic considerations and the attitude of the landowner and local residents.

Consideration would need to be given to identifying a suitable site to dispose of the excavated material.

Johan emphasised the need for biosecurity during the dredging operation and during the disposal of arisings to prevent fragments of vegetation causing further contamination. He also stressed the need for the person undertaking the dredging to work meticulously to ensure that all fragments of creeping water primrose are removed from Round Pond; he stated “a job half done is no good whatsoever; if you do anything you have to do it rigorously”.

Further action to be taken by Hampshire and Isle of Wight Wildlife Trust following site visit on 21 March 2013:-

- continue with herbicide treatment during 2013 (as feasible, depending on water levels in late summer/early autumn 2013);
- investigate feasibility of dredging Round Pond during 2014;
- explore proposals for dredging and disposal of arisings with landowner, local residents and relevant statutory authorities (Natural England, Environment Agency and local planning authority);
- secure necessary permits, authorisations, consents from relevant statutory authorities;
- secure necessary funding.

Johan van Valkenburg considering control of creeping water primrose in Round Pond during site visit to Breamore Marsh on 21 March 2013

12. Acknowledgements
Clive Chatters who discovered creeping water primrose at Round Pond during August 2009 and brought it to the attention of Natural England and the Environment Agency

Martin Rand, Vice County Recorder for VC 11 (South Hampshire) on behalf of the Botanical Society of the British Isles who verified identification as *Ludwigia grandliflora*

Eric Clement who verified identification as *Ludwigia grandliflora*

Johan van Valkenburg who visited Breamore Marsh in March 2013 and gave advice

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Trevor Renals, Environment Agency

Julie Stubbs, formerly of Natural England

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Ruth Kernohan, HIWWT, for preparing maps used in this report

Great Britain Non-Native Species Secretariat

13. References

Ref 1 Wildlife and Countryside Act 1981 (as amended). In accordance with Section 14 (2) of the Wildlife and Countryside Act 1981 (as amended) it is unlawful to plant in the wild, or otherwise cause to grow in the wild, those species listed in Schedule 9, Part II.

Ref 2 Williams F, Eschen R, Harris A, Djeddour D, Pratt C, Shaw R S, Varia S, Lamontagne-Godwin J, Thomas, S E, Murphy S T The Economic Cost of Invasive Non-Native Species on Great Britain CABI November 2010 (CABI/001/09)

Ref 3 The Invasive Non-Native Species Framework Strategy for Great Britain. Department for Environment, Food and Rural Affairs, 2008

Ref 4 Chatters, Clive 2009 Brown Galingale at Breamore Marsh *British Wildlife* Vol 20 Number 6 August 2009 : 400 – 404

Ref 5 Managing invasive non-native plants in or near fresh water. Environment Agency. Revised version April 2010

Ref 6 *Ludwigia grandiflora (Michx.) Grueter & Burdet* A guide to Identification, Risk Assessment and Management. Plant Protection Service, Wageningen, NL and Centre for Ecology and Hydrology, Wallingford, UK. June 2011

14. Annexes

Annexe 1: Invasive Species Action Plan for *Ludwigia grandiflora*

Invasive Species Action Plans are used to help co-ordinate the response to key invasive non-native species across England, Scotland and Wales. The plans provide a short and strategic overview, identifying the key aims, objectives and actions. They are developed by stakeholders and co-ordinated by Great Britain Non-Native Species Secretariat. The Invasive Species Action Plan (ISAP) for *Ludwigia grandiflora* is a two page document. Page 1 is appended at Anenxe 1 of this report. The full ISAP can be viewed and down-loaded from the GB Non-Native Species Secretariat website at www.nonnativespecies.org

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Annexe 1 – Invasive Species Action Plan

INVASIVE SPECIES ACTION PLAN

Version: 1.1. Last updated: August 2010

Water Primrose (*Ludwigia grandiflora*)

GB Priority - **HIGH**

Timescale - Immediate

Aim: To eradicate *Ludwigia grandiflora** from GB and prevent its re-invasion.

Objectives:

1. Consider use of legislation to prevent sale, release and improper disposal in GB
2. Increase public awareness about this species
3. Eradicate the known populations in England and south Wales
4. Set up suitable monitoring of water bodies in Wales and England
5. Maintain surveillance in Scotland and rapidly respond if found
6. Minimise the risk of re-establishment from releases and movement from existing locations

Aim	Action	Where	Co-ordinating body	Support	Start date
Prevention	Commence **Public Awareness Campaign** for water users and gardeners	GB	NNSS	Various	**Complete**
	Discourage sale and proliferate the message that this species **should not be planted or released in GB** and appropriate **disposal** methods should be used to remove it wherever it grows	GB	NNSS	plantlife EA, OATA, HTA	Ongoing
	Provide advice on **recognition** and **disposal**	GB	NNSS	plantlife	Ongoing
Surveil-lance / early detection / rapid re-sponse	**Monitor** existing/controlled sites	E / W	EA / NNSIP	BSBI / plantlife	Ongoing
	Survey suitable locations	E / W	EA / NNSIP	BSBI / plantlife	Ongoing
	Eradicate in England and Wales	E / W	EA	plantlife	Ongoing
	Watching brief and **contingency plan for eradica-tion** in Scotland	S	SNH / SEPA	RAFTS	Ongoing
Legislation	Consider adding to **Schedule 9** subject to normal consultation process.	GB	Defra, WAG, SG	-	**Complete**
	Consider **banning the sale of this species** subject to normal consultation process.	GB	Defra, WAG, SG	-	Ongoing
Research	Investigate **management techniques** (e.g. DeCLAIM project)	GB/ Netherlands	Defra	-	Mar 2009

*References to *Ludwigia grandiflora* include the following:
Ludwigia peploides synonyms: *Jussiaea californica. J. patibilcensis, J.peploides, J.polygonoides, J.repens.* sub-species: *L.peploides, L. glabrescens, L. montevidensis. Ludwigia grandiflora* synonyms: *Jussiaea grandiflora, L. uruguayensis, J.uruguayensis. Ludwigia hexapetala*