



## **The restoration of Water Voles to Bude Marshes.**



### **A feasibility study**

**Prepared by Derek Gow.**

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**Derek Gow Consultancy Ltd, Upcott Grange Farm, Broadwoodwidge, Lifton,  
Devon, PL16 OJS**

**Telephone: 01409 211249/578 - 07764 690867 Email [DerekJGow@aol.com](mailto:DerekJGow@aol.com)**

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## 1. Introduction

The once common water vole (*Arvicola amphibius*) is believed to have suffered a range decline in excess of 97% throughout its former British range. Although population estimates in 2002 indicated a surviving population of 1.2 million it is a rapidly declining species and current figures suggest a national breeding population of around 400,000 individuals (Strachan. R. Personal communication. 2012). Population predictions undertaken by the Environment Agency indicate that it is probable that the species range will continue to constrict (Leggett & Perkins, 2010). In England this process will essentially culminate in a national “die back” into landscapes where certain habitat features - extensive ditch complexes, linked water bodies or wetlands - could ensure their survival in the longer term. With the exception of the Somerset Levels these landscape types predominante in eastern England.

Outwith these landscapes water voles will only survive where populations are supported by active human intervention. This support will be to principally ensure the provision of suitable habitats and to control or eliminate predation by non-native North American Mink (*Neovison vison*).

The Vincent Wildlife Trust undertook two national water vole surveys in 1989/90 and 1996/98. Although water voles were identified in Cornwall at low densities in both surveys they had declined from a 15.5% occupancy of surveyed sites in the first to a 1.9% occupancy by the second. Some of the last records of the species were obtained by the North Cornwall Natural History Club in 1995 at Maer Lake near Bude. Extensive surveys undertaken by Cornwall Wildlife Trust have identified no surviving populations and the species is now believed to be extinct in the county (K. Hills. Personal communication).

The reintroduction of water voles as a conservation tool was initially proposed in 2000 as a partial conclusion of the Vincent Wildlife Trusts distribution study of 1996/98 (Strachan, Strachan & Jefferies, 2000).

The Water Vole Conservation Handbook (3<sup>rd</sup> edition. 2012) states that

*“In many areas the degree of fragmentation of the national population of water voles has become such that although good quality water vole habitat may exist, it is likely to remain unoccupied simply because it is too far from an existing population to be re-colonised by natural dispersal. Restoring water voles to the wider countryside...is likely to require reintroductions of individuals from captive bred populations. Reintroductions may have great benefits in re-colonising an area with water voles if conducted in a systematic fashion with large-scale mink control”*

The reintroduction of water voles into habitats which are highly suitable and where strategic mink control on a catchment based or local level is practicable is therefore a recommended component of the species national conservation strategy.



Figure 1 – Catchment of the Bude Marshes - highlighted in pink

To date several reintroduction projects in England have established extensive free-living populations of water voles. While the component parts of this process are well understood the commitment by participant organisations, local communities and individuals to an effective process of mink control is an important, long term requirement. Although a substantial programme of mink control coordinated by the British Association of Shooting and Conservations (BASC) has facilitated a natural expansion of the water vole population in the Somerset Levels there is no credible prospect that this process will culminate in their re-establishment in North Devon or Cornwall. The nearest reintroduced population of water voles in Devon is on the River Tale near Honiton.

This study has been commissioned by 'Westland Countryside Stewards' to assess the feasibility for a catchment based reintroduction project based around the Bude Marshes in North Cornwall.

## **2. The water vole.**

Water voles are Britain's largest vole species. They are adapted to life in a water edge environment where their swimming ability allows them to both forage effectively amongst semi-emergent plant life and to avoid predators by "plopping" off the river bank into the water and swimming away (Strachan & Moorhouse. 2006). With the exception of a few populations in the western isles of Scotland and a single historical record from England (Strachan. R. 1997) water voles in Britain always live in close proximity to the waters edge (circa 0-6 meters). Although most water voles are largely sedentary individuals will occasionally travel - either overland or by following stream systems - to find other colonies (Telfer, Piertney, Dallas, Stewart, Marshall, Gow & Lambin. 2003). In England a daily movement distance of 2.5 km has been recorded for a single radio collared male (Eyre. S. Personal communication). It is likely that movements of water voles are additionally prompted by periods of heavy rainfall or flood events (Tansley. D. Personal communication).

Water voles typically live in burrow systems which they excavate in the banks or rivers, ditches, ponds or streams. Where otherwise undisturbed these complex burrow systems can be generations old and a highly distinctive pattern of burrows, trails and feeding platforms created by regular water vole activity can remain etched in the bank substrate for many years. Confusion can arise regarding the current occupancy of these structures which will frequently be inhabited by field voles (*Microtus agrestis*), brown rats (*Rattus norvegicus*) and other small mammals when abandoned. Water voles are a highly territorial species which live in a series of loosely linked colonies along the course of defined wetland systems. The average territory size for an individual female in good habitat is 150 meters in the summer withdrawing to 50 meters in the winter (Strachan & Moorhouse. 2006). Males can have much larger territories and both sexes mark their territorial boundary features with piles of droppings to form highly distinctive 'latrines'.

In the winter months water voles do not hibernate but develop nest systems and food stores underground which are drawn on in periods of poor weather. Where water vole populations inhabit reed or sedge beds they can adapt their nesting abilities to weaving 'rugby ball' shaped nests above the normal level of the water table. Water voles typically occupy the under-story of well vegetated, wetland habitats. Although in an ideal environment this would constitute the fringe of semi-emergent plant life

bordering the waters edge they are adaptable and will occupy habitats from mountain tops to heavily polluted urban ditches. Water voles have been recorded as feeding on over 227 different plant species (Strachan & Moorhouse. 2006) and there is a possibility that some individuals have an omnivorous tendency (Gow. D. Personal observation).



*Figure 2 - Burrow complex*

Each female water vole is capable of producing approximately 20 juveniles in her lifespan. Although a few will remain in their natal territory most will disperse more widely throughout the summer and autumn months. This process of dispersal can be prompted by rising levels of aggression between individuals as food resources dwindle, by shortening day length and in the autumn by colder, wetter weather. Many of the dispersing individuals will not find suitable habitat and it has been estimated that even in the excellent habitat conditions of the river Itchen in Hampshire that the annual seasonal mortality can peak at around 87% (Jordan & Chestnutt. 1999).

Water vole field signs are commonly recognised as latrines (piles of droppings used by females to mark their breeding territory), burrows (holes and distinctive structures in the bankside substrate formed by water vole activity), runs (pathways worn through vegetation by water voles), feeding remains (short sections of vegetation either on the bankside or floating in a water body, cut at a distinctive 45 degree angle) and lawns (cropped grass around burrow entrances). Less well recognised features of their presence are 'burrow plugs' (composite lumps of soft mud and vegetation) which they employ to block burrows during periods of wet weather and excavated 'feeding pits' in the root systems of tubiferous plants.

Recent studies identify that very small populations of water voles are highly vulnerable and that conversely larger populations are much more robust (Strachan & Moorhouse. 2006). As water vole populations dwindle, fragmentation of meta-populations results in the isolation of smaller colonies. When these are no longer connected to any wider population in the surrounding landscape, they can rapidly

decline to extinction. For the reasons outlined the water vole is now a completely protected species under Schedule 5 of the Wildlife and Countryside Act (1981). In England this protection is administered by Natural England.



*Figure 3 - Burrow plug and burrow entrances on the River Tale in Devon*

### **3. Water voles in Cornwall.**

Historic and contemporary field sign records testify that water voles were formerly a widespread species in Cornwall. The Victoria County Histories in 1906 record them as being “*common in all suitable habitats throughout the county*”. It is believed that it was while Kenneth Grahame was on holiday, on the Fowey and Falmouth, that he was inspired to write the first drafts of the famous childrens story “The Wind in the Willows” which developed the character of Ratty based on a water vole.

The Vincent Wildlife Trusts 1989-90 National Water Vole Survey recorded the species presence on the Skewjack stream near Landsend, the Marazion Marsh and on a tributary of the river Fal. A single positive site was identified at Polmear Marsh on the Fowey river system. Activity was also located at a single site on the River Bude although no latrines were found (Strachan & Jeffries 1993). The Environmental Records Centre for Cornwall and the Isles of Scilly has a compiled list of water vole records dating back to the 1960’s. These demonstrate a historic distribution which is countywide - **Appendix A**.

As water vole populations continue to decline in the wider countryside their disappearance has quite typically followed a common pattern. When they become largely absent from the better quality, lower river or wetland habitats they continue to survive for a time in the poorer, less accessible environments of the upper tributaries.

Although studies in Scotland suggest that some of these ‘upland’ or higher catchment populations will exchange genetic material quite readily - with some individuals travelling considerable distances to do so (Telfer, et al 2003) - evidence of this behaviour in England is less emphatic. While some of these populations can persist in often unprepossessing habitats for many years it is quite likely that this survival only constitutes a final phase of decline preceding extinction.

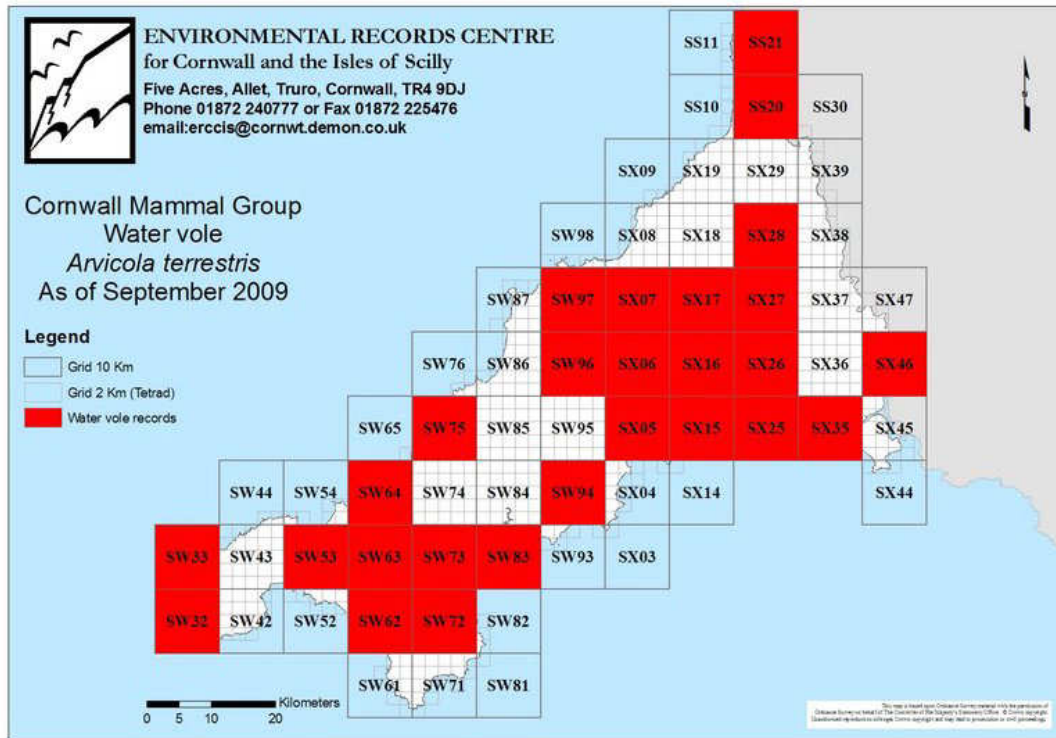


Figure 4. Historic records of water vole distribution in Cornwall

It has been variously hypothesised that water voles may never have been a common species in Devon or Cornwall due to the spate prone character of many of the regions water courses. This assumption is contrary to their recorded history. What is now clear from contemporary studies is that water voles adjust their living densities in accordance with habitat. This typically results in high densities in good quality environments and smaller populations in the more limited environments of upper watersheds.

Scottish water vole populations in these habitats exhibit a high degree of dynamism. When small colonies become extinct they may take several years to reform as a result of chance emigration (Telfer *et al.* 2003). Other colonies can form for a brief time as a result of this same dispersal tendency in very unlikely habitats such as small fire reservoirs on open moorlands (Gow, D. Personal observation). It is likely that this stochastic behaviour could have been variously compromised in Cornwall by a range of landuse modifications such as higher densities of grazing livestock in upland areas or extensive programmes of land drainage. In lower river systems the unrestricted establishment of riparian tree cover would have further dented their survival as overshadowing diminished the availability of suitable habitat.



It is therefore perfectly probable that declining habitat quality coupled with outright habitat loss would have ensured that water vole populations in Cornwall were already highly fragmented and vulnerable by the time that North American Mink began to establish their presence.

#### **4. Bude Marshes.**

The wider catchment draining into Bude Marsh is extensive. It runs from Jacobstow in the south to Kilkhampton in the north and is bounded to the east and west by the B3254 and A39 respectively. Although it is likely that there will be some suitable areas for water vole colonisation in this upper catchment, aerial analysis via Google Earth coupled with partial, physical surveys indicate that it is mainly wooded. While water voles will move through and even seasonally exploit the ground story/shrub layer vegetation of this habitat type it does not afford significant potential for extensive, permanent colonisation. Aerial surveys suggest that there are 16 pools or ponds in the upper catchment - *Appendix B*. Their suitability for occupancy by water voles is not clear. Any process of water vole re-establishment in the upper catchment could therefore be based on a process of natural expansion coupled with smaller opportunistic releases into suitable habitats once a main population was firmly established in the lower marsh. Consideration of the suitability of the habitat afforded by the marsh alone is therefore the principal object of this document.

The twenty two and a half acres of Bude Marsh is managed by North Cornwall District Council's countryside department. Part of the marsh - Pethericks Mill - is a relatively recently created flood alleviation project which was designed and installed by the Environment Agency in 1999. The main marsh is designated as a Local Nature Reserve (LNR) with the prime aims of

- Maintain and where possible enhance the ecological value of the site.
- Maintain the areas of reedbed, grassland, open water pools and Willow Carr
- Encourage the use of the Reserve and surrounding area for educational and community purposes.

A stated aim of the LNR management plan (2008 -2013) is to investigate possibility of re-introducing water voles to the reserve. It is the medium term aspiration of the LNR to further extend and develop other wetland habitats in the valley above Pethericks Mill.

#### **5. Habitat suitability.**

Bude Marsh and its surrounding river systems – the River Neet, River Strat and Bude Canal - provide a complexity of riparian habitat. The water courses identified in *Appendix C* have all been identified as permanent features capable of providing a reliable habitat resource. The total length of main - canal, pool/wetland complexes and the River Neet - and subsidiary - side ditches and smaller channels in this category within the marsh and its immediate vicinity equates to approximately 12.7 km of single bankside. The larger water bodies equate to approximately 7.4 km of the foregoing which if doubled to account for both banksides would produce a total habitat length of 20 km. This figure does not allow for the many feeder streams which flow directly into these water bodies. Ditches and channels link the main water bodies to approximately 12 ponds or wetlands. Several studies demonstrate that these offline

features provide refugia for water vole populations in environments where mink predation has eliminated them from associated main channel habitats (Strachan & Moorhouse. 2006)

Although the marsh is prone to seasonal flood events extensive sections of the existing bank systems are never totally submerged (Cann. G. Personal communication). There is a widespread availability of established scrub-cover around the perimeter. Water voles are good climbers and will readily utilise this habitat as refugia from predators and flood water if their subterranean burrow systems are submerged. They will additionally climb through dense stands of Bramble (*Rubus fruticosus*) to obtain shoots and fruit.

The bankings within the marsh are principally comprised of friable soils. There is a short section of steel and concrete reinforcement of the canal banks in the length adjacent to the Crescent car park (circa 500 meters). Although this section is not utilisable by water voles it forms an insignificant percentage of the overall available habitat. There is relatively little riparian tree cover within the main marsh and this landscape aspect extends up-river to Helebridge. The lake owned by Bude Canal Angling Association adjacent to the connection with the river Strat affords well established vegetation. The bankside vegetation elsewhere in the marsh is mature, well established and complex. Although the upper section of the marsh is grazed by cattle it is not an intensive regime and the riparian edge habitats in this area remain well vegetated. While the grass is mown in sections along the main canal towpath in other areas the semi-emergent vegetation is allowed to fully mature. Water voles are known to exploit both of these habitats in canals elsewhere in England and are generally undisturbed by footpath users.

A vegetation survey undertaken by the NCDC Countryside service in 2007 identified 219 plant species on the site of Bude Marshes LNR survey area – **Appendix D**. Of these 58 % have been recorded as important water vole food plants (Strachan. R. 1998) and it is very likely that they would simply adapt to exploit the available resource. Although some water bodies are predominantly saline these contain extensive, established communities of species such as Sea club-rush (*Bolboschoenus maritimus*) which are readily exploited by water voles. There is an abundance of common reed (*Phragmites australis*) present through the marsh. This species while providing excellent summer feeding, cover and habitat expansion capacity (ball-nesting) tends to dominate riparian plant communities to the exclusion of most other species. When it dies-back in the autumn it provides little in the way of an exploitable resource. This natural variance of plant types results simply in a lower carrying capacity of water voles in some areas where the vegetation is more uniform and a higher density in others where the plant community is more complex.

The average territorial size occupied by a water vole colony is considered to be 2 km (Strachan & Moorhouse. 2006). An estimate of the carrying capacity of the available habitat might crudely suggest a capacity for 10 colonies within the main marsh complex extending up the Helebridge. There would be capacity for the development of other colonies within the immediate catchment of the wider marsh although their distribution and extent in the headwaters would be strictly limited by the availability of suitable habitat. Water voles as a species have a cyclic population structure. This typically translates as a low over-wintering population rising with successive

generations from mid April to an autumn population peak in October/November followed by resource driven die back. At their peak in an area of optimum habitat water vole populations can number up to 48 individuals per linear km (Gow. Personal experience. Dartford Park).

Although there will be a seasonal variation in the carrying capacity of the marshes it is possible that a water vole population of around 10 colonies comprising 960 individuals at a time of peak density could be achieved. An overwintering figure of 13% of the forgoing might be 108.

While it is unlikely that the presence of water voles would have a deleterious impact on any protected species currently present in the Bude Marsh LNR there are two potential areas of conflict which could develop.

- The annual reed cutting regime might impact upon the survival/breeding prospects of the water vole in the impacted compartment. This issue is unlikely to deleteriously impact upon an established water vole meta-population
- Water vole burrowing in the canal banks could result in subsidence of the banks in limited areas and/or undermining of the existing footpath. This issue is likely to be relatively localised and small scale. In the event that water voles do colonise the canal banks adjacent to the existing footpath in the areas of tall standing vegetation the extension of the current mowing regime would both deter their presence and lower their numbers. The installation of willow spilling and backfilling with stone would mitigate this activity as appropriate.

## **6. Mink control**

It is a recommendation of the second edition of the Water Vole Conservation Handbook (2006) that any receptor site or sites must be verifiably free of mink. The presence of this introduced predator has been strongly linked to a national decline in water vole populations. The Game and Wildlife Conservation Trust developed a highly successful “monitoring raft” for this species in 2003 which allows the identification of mink presence from the foot prints that they leave on its central tracking cartridge. These should be initially checked on a weekly basis. If mink tracks are present humane trapping using live catch mink traps should proceed for a period of 10 days or until the mink is captured and destroyed by an experienced operative. Monitoring for the presence of mink should then recommence. When no further signs of mink are observed the rafts should be maintained in monitoring mode.

Predation by North American Mink has been directly implicated on a national scale in the widespread decline of water vole populations (Strachan & Moorhouse. 2006). Independent studies in areas of good, complex riparian habitat suggest that mink as a single predator may depress water vole populations by up to 65% (Reynolds. 2007). When it is considered that water vole populations in mink free environments may decline by 87% over winter it is easy to understand how this novel predation is so devastating (Jordan & Chestnut, 1999).

The Vincent Wildlife Trust’s water vole survey of 1989/90 (Strachan and Jeffries. 1993) recorded the the highest percentage density of mink in Cornwall in the Bude marshes and its wider catchment. It is likely that presence of a significant commercial

mink farm which finished operation in 2000 near Bush would have afforded a constant potential for escape. A survey undertaken by the Derek Gow Consultancy Ltd (DGC) of the bridges in the catchment on the 24<sup>th</sup>/27<sup>th</sup> of July – *Appendix E* - identified potential mink tracks on only a single site above Helebridge. Enquiries of different landowners during the survey all indicated that while mink were common 15-20 years ago they were no longer a visible presence. The owner of the angling lakes at Hele Barton fish farm confirmed this position.

Mr W. Woodward (Master of mink hounds) advised that they last hunted the Neet from the angling lake at Helebridge to Stratton approximately 3 years ago. They found no mink. It is his belief that “*mink are becoming an increasingly rare species in Cornwall and that where otter signs predominate mink are either absent or scarce*”.

A single individual encountered by a surveyor at Woolstone - just east of Box's shop - spoke of working at the local mink farm as a young man. The mink farm was located at Bush just north of Stratton. The individual recalled that at the time when the legislation to ban mink farming in England was announced the mink farmer culled mature mink for their pelts right up until the day of the legislation coming into force. After this time all the mink which were too small to cull for their pelts were released into the local environment.

A strategic programme of mink monitoring using the footprint rafts designed by the Game and Wildlife Conservation Trust was in place in the Bude marshes in 2010/11. During the 2 years that the rafts were maintained no tracks, sightings or other field signs of mink were recorded (Cann. G. Personal communication) There are currently highly visible, breeding populations of moorhen (*Gallinula chloropus*) and Mallard (*Anas platyrhynchos*) which are both good indicators of a mink free environment present in the marsh. While it is therefore not likely that a breeding population of mink are currently present in the marsh it is probable that irregular immigrants from either the upper catchment or other adjacent water sheds could occur.

The results from other water vole reintroduction projects, surveys and studies indicate that in complicated riparian environments water vole populations will coexist with mink populations for a time. If a breeding population of mink with linked territories along watercourses are not allowed to exist in the marsh catchment it is highly unlikely that the casual predation of occasional immigrants will significantly impact a large, well dispersed water vole population. To create this situation a mink monitoring and control programme should be developed to assess the whole catchment. The strategic placement of the rafts would focus the intersections of water courses, likely immigration routes and areas of potentially suitable water vole habitat. Once these were cleared of breeding mink - through a process of weekly raft checks, followed by trapping and then reverting to monitoring - a pattern of spring and autumn trapping to exterminate migrants would be required.

It should be noted that evidence from the river Dore in Herefordshire clearly demonstrates that female mink with their kits will follow linear features in the wider countryside over water-sheds (Reynolds. J. Personal communication). If raft checks are working well then these will be quickly identified and destroyed. If they are allowed to remain then the resurrection of a breeding population of mink will occur in time. While the participation of the wider landowning community would be required

to effect the forgoing in the long term experience from the River Tale in Devon indicates that a more limited approach to mink control could be effective around the periphery and in the main marsh in the short term. A 5 year programme of mink trapping on the Tale which is connected to the main River Otter has now wiped out the formerly established population of mink. A seasonal trapping programme - in the autumn - now effectively eliminates any random migrants. Only 1-2 mink are now being killed annually and the water vole population - released in the mid 2000's - now occupies the entire river system (Kennaway. J.M. Personal communication).

While the upper catchment of the water courses flowing into Bude Marsh is extensive their character is not complex. It would be perfectly practicable with a grid of mink rafts to precisely define the existence of this species in the wider landscape and to then eliminate them relatively swiftly. This process would however be dependent on water stability to avoid the capsizing/destruction of rafts. The example prompted by the Tale suggests that protection of the main marsh itself might also be an eminently practicable prospect.

## **7. Community support**

The marshes are well used by local and tourist visitors to Bude. There is a well established infrastructure of footpaths, bird hides and viewing platforms in the main body of the marsh. The LNR management plan has undertaken visitor surveys which have produced the following results

- 27% of site visits are individuals coming to enjoy a walk around the reserve
- 23% of visits are to watch birds or enjoy the wildlife
- 18% of site users come for the peace and quiet
- 12% come to the reserve to walk their dog
- 4% of visits are families who bring their children to enjoy the reserve.

It is likely that the reintroduction of a "fondly remembered" species such as the water vole would prove popular with visitors to the Marsh. As this would be the first project of its type in Cornwall it could attract significant media attention and consideration should be given to the construction of interpretational panels regarding the project in the existing visitor centre next to the Crescent car park or in the marsh itself.

The IUCN species reintroduction guidelines (IUCN. 1998) make it clear that community support is key to the long term success of any technically led species reintroduction project. With specific regard to a project of this type this should be developed to produce the following results

- Media and interpretational coverage should request further recollections from the community regarding historic sightings of water voles, mink and otters. This requests could produce some useful anecdotal information and will allow members of the wider community to feel involved
- If the project is to extend in time into areas of the upper catchment landowners who would be supportive of water vole presence on their land should be identified
- If the project is to extend into the upper catchment landowners who would participate in a wider programme of mink rafting/culling should be identified.

- If the project is to extend into the upper catchment individuals willing to check mink rafts should be identified.

Although this process may take time to develop it is important that it should proceed.

While this effort would principally inform the wider community other more specialised training events with a focus on mink control and habitat creation could be developed for wider countryside groups such as the BASC, CLA, NFU or angling groups. It is likely that it would require an initial level of coordination which would decline in time as a pragmatic system of mink control developed and became common-place. This system has worked well on the River Tale and in the long term once funding for water vole reintroduction and general mink control has ceased will be the only effective guarantor of any reintroduced populations survival.

## **8. Water vole restoration**

The reintroduction of water voles into areas of good habitat is not a novel approach to the species restoration. The personnel of the DGC have been at the forefront of the captive breeding and reintroduction of this species since 1995. During this time they have established water vole populations which are still extant at the following sites in partnership with the listed organisations (*Appendix F*):

Barn Elms – Wildfowl and Wetlands Trust  
 Netheridge Nature Reserve – Severn Trent water  
 Kirkby in Ashfield – Severn Trent Water  
 River Dore – Game and Wildlife Conservation Trust  
 Arundel – Wildfowl and Wetlands Trust  
 River Colne – Essex Wildlife Trust  
 Langorse Lake – Environment Agency  
 Queen Elizabeth Forest Park – Forestry Commission  
 Dartford Park – Prologis Ltd  
 West Malling – Private landowner.  
 Rainham Marsh – RSPB/London Wildlife Trust  
 Upper Thames – WildCRU/BBONT (several colonies)  
 Pagham Harbour – WildCRU  
 River Tale – Tale Valley Trust  
 River Axe – Environment Agency/East Devon District Council  
 Ruxley Gravel Pits – Kent Wildlife Trust  
 Foxglove Covert – Ministry of Defence

In addition to the forgoing development mitigation projects have seen smaller partial populations re-established on the Isle of Grain, Sheppey, Goole, Belvedere, Kemsley and Dartford Bridge. Although the following have been failures - Bedfont Lakes, Syon Park and Alston - experience now suggests that if the release population is large enough, sufficiently genetically diverse, released at the right time of year, at the right age with an even sex ratio that reintroduction can work well. Captive bred water voles will quickly re-establish in areas of good habitat. Most released individuals move less than 500 meters from any point of release and an intensive re-trapping/monitoring project undertaken by WildCRU in 2006 suggests that seasonal survival rates of released populations can approach 85% in good habitat (Strachan & Moorhouse. 2006).

We now know that large scale reintroductions of water voles are possible and that restored populations can be highly successful. At Pagham harbour a combination of reintroduced and extant water vole populations successfully re-colonised over 8000 ha of habitat following a programme of habitat enhancement and mink control using rafts (Strachan & Moorhouse. 2006). In the Queen Elizabeth Forest Park near Aberfoyle the valley of the River Duchray and its attendant wetlands was cleared of mink in 2006. This population is currently believed to occupy the available habitat in the rivers 16km length. Colonies forming from this population have been identified outwith the main valley for another 20km (Anderson. D. Personal communication). On the River Dore in Herefordshire a water vole population which was reintroduced following the removal of mink by the GWCT is now believed to occupy all of the suitable habitat on the 22km long channel of the main river. It is likely that this last population is more extensive than is currently believed as no strategic survey of the linked system of field ditches has been undertaken to date (Reynolds. J. Personal communication)

The overall aim of any substantial release project would be to restore a complete water vole meta-population and to maintain the whole catchment free of breeding mink. Studies suggest that for the successful persistence of a meta-population 10 unrelated water vole colonies are required (Strachan & Moorhouse. 2006). These populations which exchange genes and individuals to form new colonies, will persist indefinitely in some areas of an overall landscape while declining and reforming in others. This process is naturally dynamic and typical for the species. Water vole populations which have a high degree of genetic variability are therefore more suitable for reintroductions than those drawn from a single source.



*Figure 8 - water vole breeding pen*

Experience from other reintroductions demonstrates that the best methodology is to release captive bred juveniles born from early litters into a suitable environment in the late summer of a given season. These individuals will breed in their year of birth and potentially through the following winter (Gow. D. Personal observation). This release would then be supported with a further reintroduction of late litter babies from the year before in the spring of the following year and if required a final release of early litter babies again as above. This process has worked well in other projects.

The DGC maintain a core release stock of water voles at their breeding site in Devon. This population is descended from over 10 founder populations which were formerly captured from sites in the east of England.

The normal breeding process is that pairs of water voles are introduced to each other in wooden framed cages (6ft long by 4ft high by 4ft broad) with solid wooded floors in March. Mates are selected to ensure relatively even weights and most females will produce litters by mid May. Providing a stable food supply is maintained water voles in large family groups are very tolerant of each other although occasionally odd individuals have to be removed due to aggression. This generally occurs after periods of cold or wet weather when a number of litters of different ages are present in each cage. The pens are checked for juveniles every three months and any early litter offspring will be removed for release. Their captive diet consists of commercial rabbit food, apples, carrots, cabbage, sweet corn, melons and pears. Fruitwood is provided for gnawing to curtail tooth growth.





*Figure 9 - Photo of release cage*

The breeding pens are meshed throughout with half-inch weld-mesh and have half opening front lids and doors to allow easy access. Their floor substrate consists of forest bark with a bale of straw at the back covered by a waterproof roofing sheet to create an artificial banking. Water voles will readily burrow into this feature creating runs, nests and chambers. Swimming water is provided via a shallow garden seed tray at the front of the pen, which is changed daily in the summer months. An independent drinking water supply is available from plastic water dispensers fixed to the external mesh of the pen.

Reintroduction methodology is via “soft” release pens, which are both food and cover supported. The release pen is a “fold up” design developed by the DGC to allow ease of set up. All the cages will contain dry straw bedding and each individual vole will be provisioned with a quarter of a sweet apple daily. These cages are 2ft in length by 2ft wide and 1ft high. Half of the surface area – sides and roof – is protected from wet weather with plastic “foamex” sheeting. Once the voles have been contained for 4 days the front section of the cage will be folded under its main body and a baffle will be fitted with 2 inch holes at either end to deter predators. The cages are then fed for another 3 days prior to being returned to storage. The situation of the release pens will be determined through assessment of vegetation cover and the availability of friable soil. This type of cage will hold groups of siblings bred in captivity to stabilise them in a new environment. Results from a number of release projects suggest strongly that this cage type works extremely well.

Monitoring of the water vole population after release will be via field sign survey of the release areas and adjacent habitats. Identification of likely habitats within re-

colonisation range would also be worthwhile to give some indication of the rate of population spread.

Although no statutory licence is currently required to release captive bred water voles into the wild the project should comply with the criteria of the IUCN Guidelines.

## **9. Health screening**

The Water Vole Handbook (2006) identifies a requirement for projects which reintroduce or translocate water voles to develop a health screening programme for the populations involved. This requirement ensures that any individuals released are likely to establish successful populations without disease impediment and that they cannot constitute a potential reservoir of transmissible disease once released for other wildlife. Although this requirement is a direct drawn down from the IUCN Guidelines on species reintroductions there was little practical guidance from wildlife vets in 2004 with regard to the nature of a water vole screening protocol. The DGC consulted with several experienced wildlife vets on this issue to develop the screening programme outlined in *Appendix G*. Although this programme was initially undertaken by the Burnham House practice in Dover, in its later stages all physical health checks and screening was supervised by the Penbode Vet group in Holsworthy, Devon. In 2007 the screening resource was used to support a further detailed investigation of the potential health issues affecting water voles which was undertaken by the Wildlife and Conservation Research Unit of Oxford University (WildCRU) - *Appendix H*. This sample identified two principal conditions of note - *Toxoplasma* and *Yersinia Tuberculosis*. These conditions were considered likely to be endemic to the species – they are common in many other small wild rodent species – and the (WildCRU) Upper Thames release proceeded without the treatment or removal of any affected individuals. As a result of the forgoing the veterinary programme has focused on the random screening of faeces and blood from approximately 33% of the captive population. Each individual will be physically inspected by a veterinary surgeon prior to release and any with respiratory conditions, tooth malformations or in generally poor condition will be euthanased.

Health screening is now undertaken annually at the DGC breeding facility by wildlife vets from the Royal Zoological Society of Scotland.

## **10. Habitat Management**

A considerable amount of experience has been built over the course of the last decade regarding the effective management of riparian habitats for water voles (Strachan & Moorhouse. 2006). A splendid case study of how a ‘joined up’ approach to the development of habitat corridors within a landscape has benefited this species was illustrated by the Chichester Coastal Plain Sustainable Farming Initiative in 2002. This project variously fenced livestock out from riparian corridors, created field corner ponds, installed sluice systems in otherwise dry ditches, coppiced trees and installed buffer strips in arable cropping areas along side water courses. It was not a lavishly funded project but was highly successful in attaining its objectives. Where possible in the Bude Marsh catchment future funding sources should be explored and expertise developed to improve the wider landscape for water voles and thus by definition for a much wider range of wetland species.

## 11. Potential timescale

- Summer 2012 – Finalise feasibility study and agree strategy with associated organisations. The principal bodies are likely to be Natural England, North Cornwall District Council, The Environment Agency, Cornwall Wildlife Trust and Westland Countryside Stewards.
- Agreement of works and project budget.
- Autumn 2012 - Extend mink control/monitoring as practicable. Mink rafts re-established in Bude Marsh and periphery as a minimum approach.
- Complete feasibility study for NE approval.
- Commence water vole breeding.
- Commence public awareness campaign.
- Extend mink control as practicable. Mink raft training for other landowners.
- June 2013 - Release of overwintered juvenile water voles.
- Field sign surveys to monitor distribution.
- Summer breeding of support population.
- August 2013 - summer releases of early litter juveniles.
- October 2013- Autumn field sign survey.
- March 2014 - Spring field sign survey.
- Extend mink control as practicable. Mink raft training for other landowners.
- May 2014 - Release of final support populations.
- July 2014. Finalisation of water vole species management plan for Marsh.

## 12. Future

Although the price of water vole reintroduction is a constant commitment to strategic mink control other projects now suggest that this may not be an unduly onerous or unsustainable process. In catchments where water courses are not interconnected mink can only recolonise via the Sea coast or overland. This process will be gradual and if monitoring rafts are maintained their presence as a breeding species rearing juveniles across a whole catchment can be eliminated. As our knowledge of the field techniques pertinent to this process improves, control results will become easier and more precise. The characteristics which must be present in landscapes where large scale water vole reintroductions are proposed are:

- A natural topography which restricts the ability of mink to re-colonise along many different water courses,
- Low or no connectivity with feeder water courses in other catchments
- A substantial abundance of complex water vole habitat in the main site,
- Partner organisations that are based either in or close to the identified release site with a permanent presence into the foreseeable future,
- A strong commitment from the above to assist and encourage other private landowners and local communities to play a meaningful role in the project.

The Bude Marsh Catchment has all the above characteristics. It is potentially a highly suitable site for the re-establishment of a water vole meta-population. The species

survived in the complex until at least the early 1990's in the presence of what was established to be the densest population of North American mink in Cornwall at that time (Strachan and Jeffries. 2003). It is unlikely that this non-native predator is present at a significant density. It is likely that mink may occur somewhere in the upper catchment.

The statement by Gordon Woodruff in his Mammal Society booklet on the water vole written in 2000 that "*It is likely that the water vole will become rare and confined to managed areas ... not yet affected by North American mink*" has been mirrored in several documents since by other authors. Despite this clear vision of future reality our understanding of its significance has been frequently overlooked and many water vole restoration projects have historically failed due to a lack of practicality. While the complexities of habitat quality, strategic mink control and reintroduction technique will no doubt continue to afford some surprises the missing component in this technical ability is how we mould know-how into sustainable long term gain. The only way this can be achieved is by the creation of a social covenant with the communities who inhabit the landscape around them and who can with limited support be enabled to generate the necessary activities to ensure their long term survival. If we cannot create partnerships of this type within wider society then the future for many species currently teetering on the brink of extinction for a multiplicity of reasons will indeed be bleak.

While the Bude Marsh project cannot possibly at this stage provide a clear and concise vision to address this most critical requirement it will at least have the advantage of understanding its importance at inception.

## References:

- Chestnutt, A. & Jordan, M. J. (1999). *Captive breeding and restocking programmes for the water vole (Arvicola terrestris)*. Proceedings of the Water Vole Conference 1999. Peoples Trust for Endangered Species. London.
- IUCN (1998). *Guidelines for RE-introductions*. Prepared by the IUCN/ SSC Re-introduction Specialist Group. IUCN. Gland, Switzerland, and Cambridge, UK. 10pp
- Jefferies, D.J., Strachan, C. & Strachan R. (2000). *Preliminary Report on the changes in the water vole population of Britain as shown by the National surveys of 1989 – 1990 and 1996 – 1998*. The Vincent Wildlife Trust: London
- Leggett, V. & Perkins, H. (2010). *National water vole database and mapping project*. Royal Society of Wildlife Trusts, London.
- Reynolds, J. (2007). *Mink Control using the GCT Raft*. The Game Conservancy Trust.
- Stachan, R. (1997). *Water voles*. Whittet books. ISBN. 873 580 339
- Strachan, R. (1998). *Water vole Conservation Handbook*. Wildlife and Conservation Research Unit: Oxon
- Strachan, R. & Jefferies, D.J. (1993). *The water vole Arvicola terrestris in Britain 1989.1990: Its distribution and changing status*. The Vincent Wildlife Trust, London.
- Strachan, R & Moorhouse.T. (2006). *Water Conservation Handbook. Second Edition*. Wildlife Conservation and Research Unit. Oxon.
- Strachan, R., Moorhouse, T. & Gelling, M. (2011) *Water vole Conservation Handbook, Third edition*. The Wildlife Conservation Research Unit, Oxon
- Telfer, S., Piertney, S.B., Dallas, J.F., Stewart, W.A., Marshall, F., Gow, J., & Lambin, X. (2003) *Parentage assignment reveals widespread and large-scale dispersal in water voles*. *Molecular Ecology*, 12, 1939-951
- Woodruff, G. (2000). *The Water vole*. The Mammal Society

## Appendices

## **Appendix A**

### **Environmental Records Centre for Cornwall and Isle of Scilly**

Avicula terrestris before and after 2000									
File Add Edit Copy Gazetteer History Select Photos Options Small table Taxonomy All details Queries Mapping About									
Species	Common name	Coc	Full grid ref.	Recorder	Location	Date	Year	Notes	
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	BELOW COUCHE ...	3/JUN/1965	1965		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	ABOVE FLETCHER ...	30/MAY/1965	1965		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	N. OF RUTHERNB ...	16/MAY/1965	1965		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	NR GROGLEY HAL ...	16/MAY/1965	1965		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	NR TAMAR_STONE	15/MAY/1965	1965		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	S. OF DEXBEER E ...	15/MAY/1965	1965		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	NR TRELASKE LE ...	1/MAY/1967	1967		
Avicula terrestris	Water ... D ...	D	SW5031	MR S.C. MADGE	MARAZION MARSH	16/APR/1967	1967		
Avicula terrestris	Water ... D ...	D		MR S.C. MADGE	MILLENDREATH	APR.1967	1967		
Avicula terrestris	Water ... 2 ...	2		COL W.E. ALMOND	PELLENGARROW ...	JAN:1967	1967	IN OWL PELLET	
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	MENHENIOT STN. ...	14/MAY/1967	1967		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	DE LANK RIVER	7/JUN/1970	1970	SEVERAL	
Avicula terrestris	Water ... 2 ...	2		MR B. BOOTHBY	PORTHCO THNAN	1970 over 10 Y ...	1970		
Avicula terrestris	Water ... 2 ...	2		G.B. CORBET	LIZARD PENINSULA	1971	1971		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	GOSSMOOR	31/MAY/1971	1971		
Avicula terrestris	Water ... 2 ...	2		MRS J.A. PATON	UPPER FOWEY VA ...	18/JUL/1971	1971		
Avicula terrestris	Water ... 2 ...	2		MR H.P.K. ROBINSON	SWANPOOL	1971	1971		
Avicula terrestris	Water ... 1 ...	1		MR A. PARKER	LOSTWITHIEL AREA	Spring:1973	1973		
Avicula terrestris	Water ... 1 ...	1	SW8031	MR K. PLUMMER	SWANPOOL	24/FEB/1974	1974		
Avicula terrestris	Water ... 2 ...	2	SW393320	MISS P. J. RENWICK	NEAR BOSTRAZE	1974	1974	EARLY 1974 - PLOP MUCH LIKE A VOLE	
Avicula terrestris	Water ... 1 ...	1	SW8031	MR K. PLUMMER	SWANPOOL	4/APR/1974	1974		
Avicula terrestris	Water ... Y ...	Y	SW6725	MRS S.M. TURK	NANCEMERRIN HE ...	29/SEP/1979	1979		
Avicula terrestris	Water ... 4 ...	4		R. CARLOSS		1986	1986	FORMERLY WIDESPREAD: NO RECENT RECORDS	
Avicula terrestris	Water ... P ...	P	SW7632	MR J.M. WALTERS	ARGAL RESEVOIR	2/JUN/1988	1988		
Avicula terrestris	Water ... P ...	P	SX3657	A. BLONDEN	ST GERMAN'S	30/DEC/1989	1989		
Avicula terrestris	Water ... P ...	P	SW652421	MR B.E. JACKSON	RED RIVER VALLE ...	14/AUG/1989	1989		
Avicula terrestris	Water ... P ...	P	SX1770	MR R.M. BELRINGER	PENKESTLE BRID ...	13/AUG/1989	1989		
Avicula terrestris	Water ... P ...	P	SX4361	MR R.M. BELRINGER	LANDULPH MARSH	23/SEP/1989	1989		
Avicula terrestris	Water ... W ...	W	SW705264	ANON	HELDFORD RIVER ...	5/NOV/1990	1990	CWLL FED. W.I. - THE ALLSOP CUP COMPETITIO ...	
Avicula terrestris	Water ... D ...	D	SS2007	G. SUTTON	MAER LAKE	30/JUL/1995	1995	PERS COMM TO AA FOR N.C.N.H.C. RECORDS	
Avicula terrestris	Water ... D ...	D	SS2007	G. SUTTON	MAER LAKE	1/AUG/1995	1995	PERS COMM. TO A.A. FOR N.C.N.H.C. RECORDS	
Avicula terrestris	Water ... D ...	D	SS2007	G. SUTTON	MAER LAKE	2/AUG/1995	1995	PERS. COMM. TO A.A. FOR N.C.N.H.C. RECORDS	



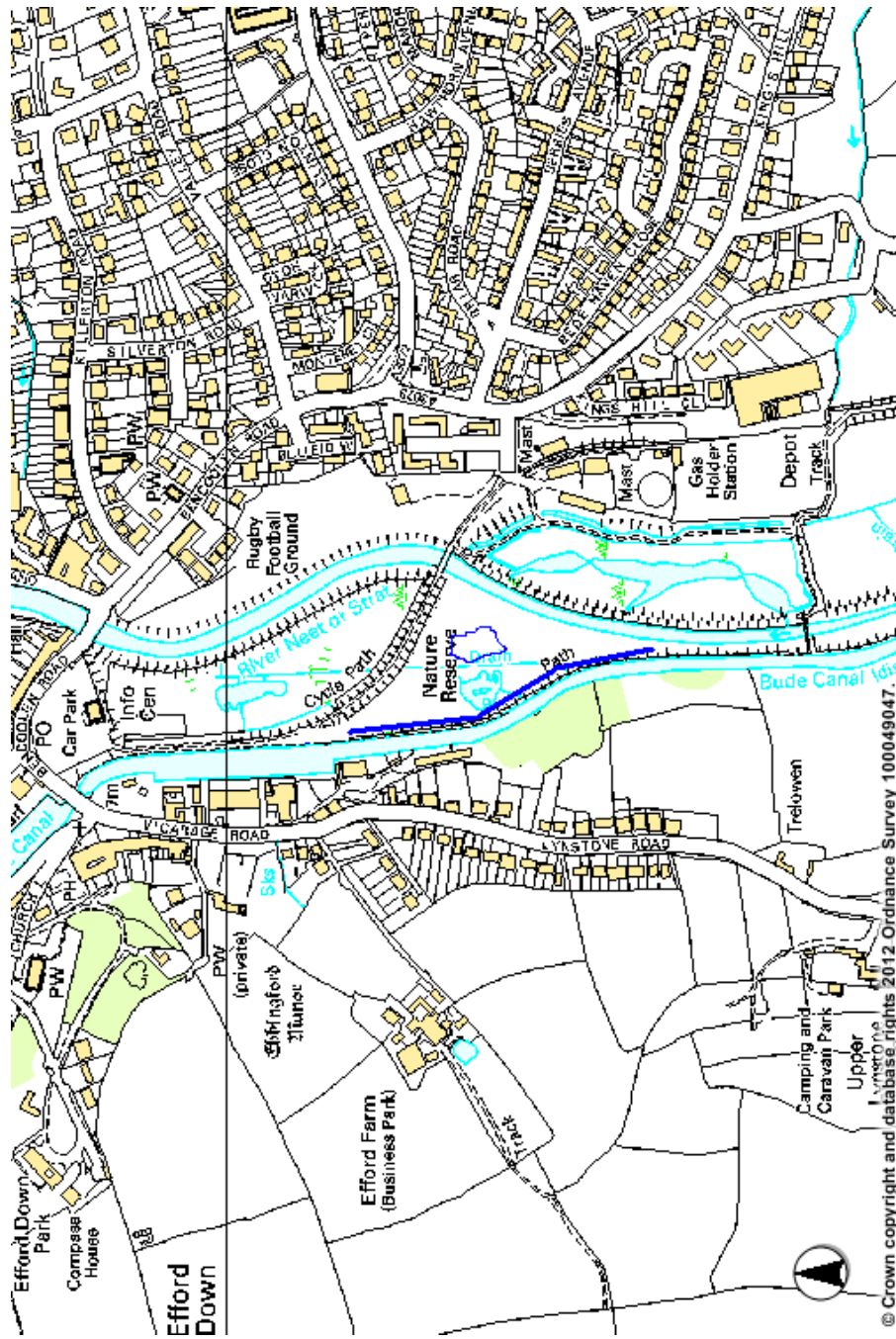
## **Appendix B**

**Map showing 16 ponds/lakes recorded from aerial survey**

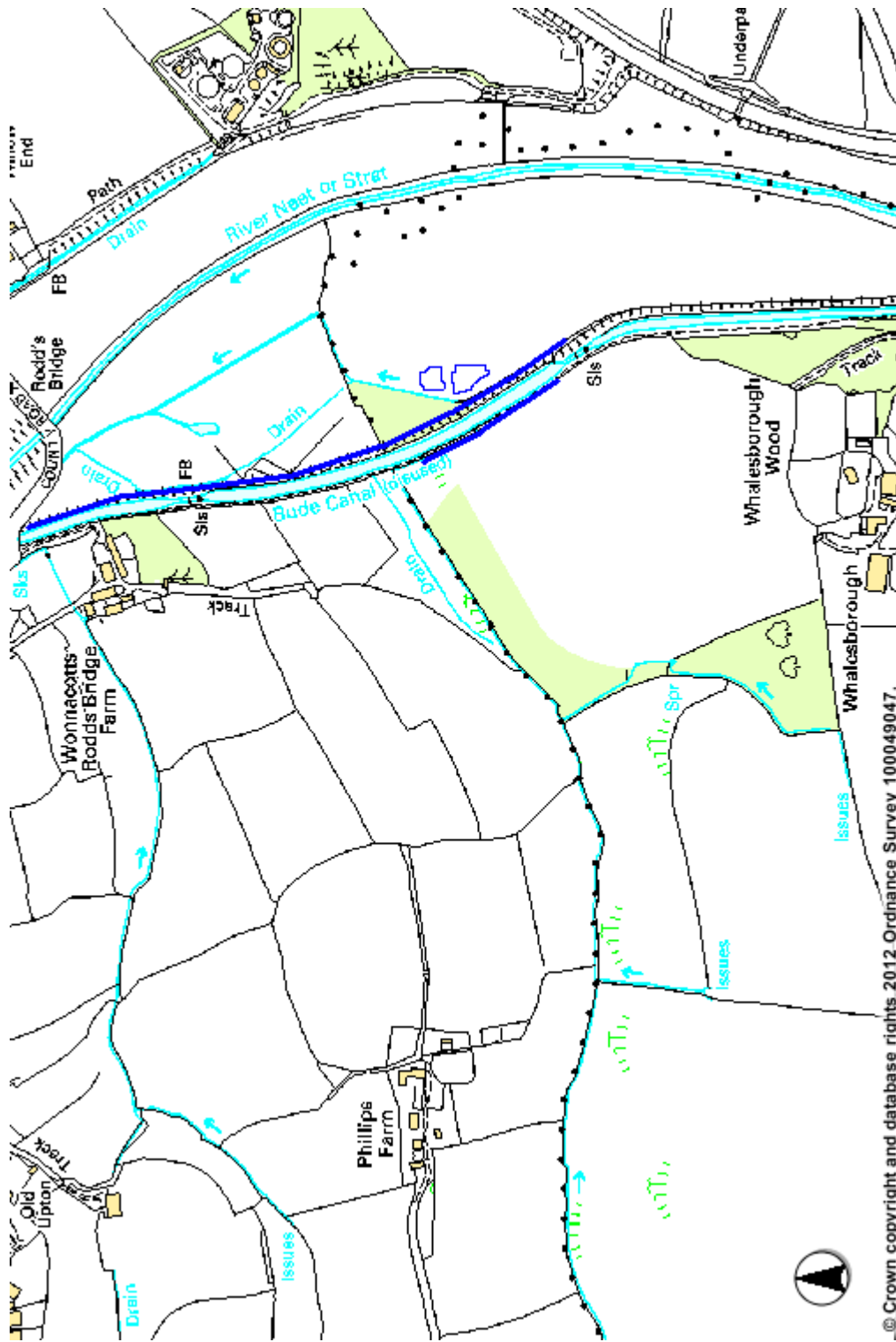


## **Appendix C**

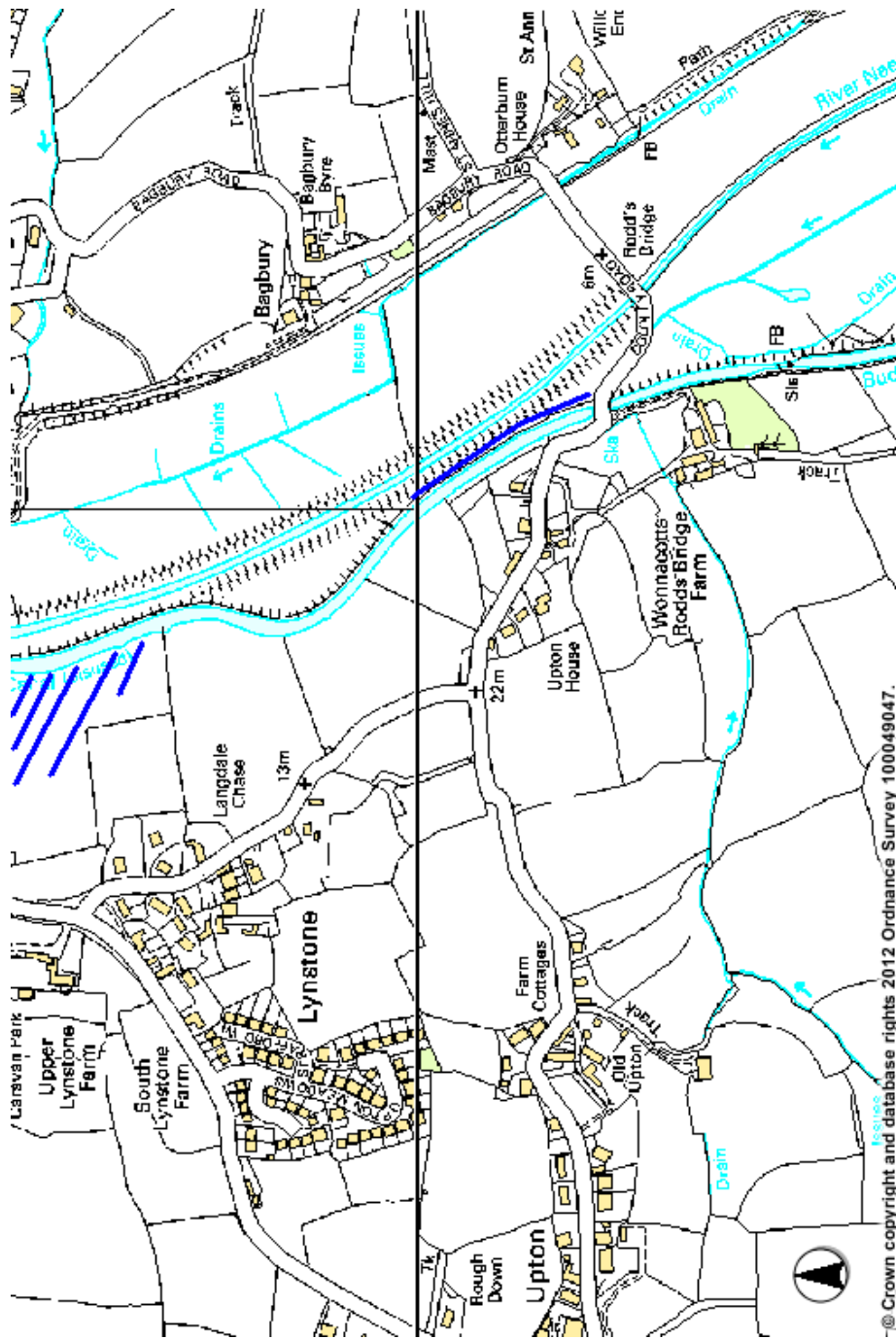
### **Maps of immediate water course around Bude Marshes**



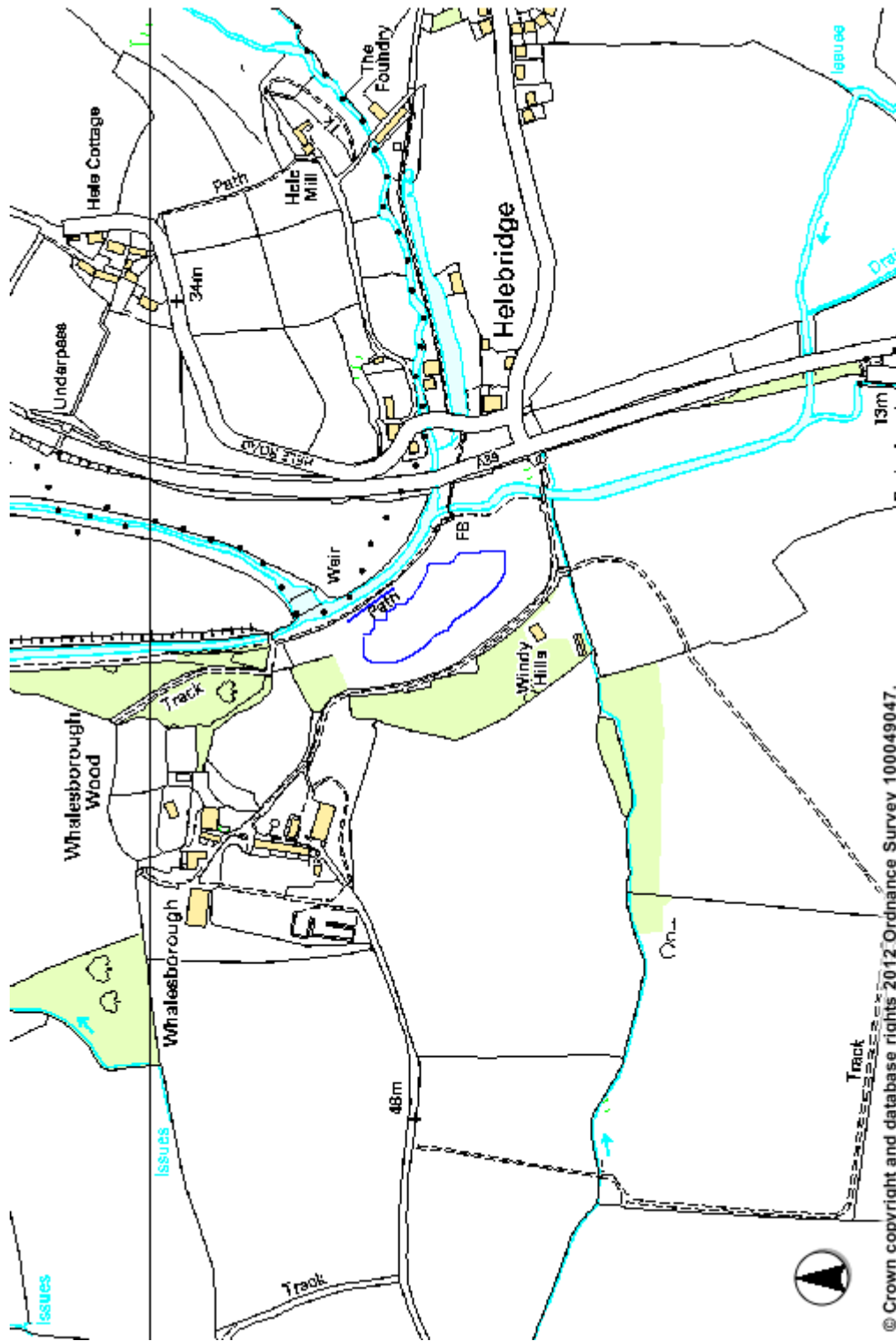
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## **Appendix D**

### **Botanical Survey of Bude Marshes Local nature Reserve**



**Botanical Survey of Bude Marshes  
Local Nature Reserve**

**Ian J. Bennallick**

**September 2007**

**Report to North Cornwall District Council**

## 1. Summary

### Results

- ◆ No Nationally notable species were found in the survey area but the Cornwall Scarce Trifid Bur-marigold *Bidens tripartita*, Grass Vetchling *Lathyrus nissolia*, Bee Orchid *Ophrys apifera*, Beaked Tasselweed *Ruppia maritima*, Pink Water-speedwell *Veronica catenata* and Horned Pondweed *Zannichellia palustris* and Cornwall Local species Greater Burdock *Arctium lappa*, White Willow *Salix alba* and Wood Club-rush *Scirpus sylvaticus* were recorded.
- ◆ The following invasive non-native species were recorded in the survey area – Water Fern *Azolla filiculoides*, Nuttall's Waterweed *Elodea nuttallii*, Montbretia *Crocsmia x crocosmiiflora*, Himalayan Balsam *Impatiens glandulifera* and Curly Water-thyme *Lagarosiphon major*.
- ◆ The survey includes lists of vascular plants found (with frequency) in 42 compartments.
- ◆ The survey includes brief notes of each compartment mapped with Phase one habitat definitions.

### Recommendations on monitoring and evaluation

- ◆ **Monitor the populations of the six Cornwall Scarce species found in the survey area – Trifid Bur-marigold *Bidens tripartita*, Grass Vetchling *Lathyrus nissolia*, Bee Orchid *Ophrys apifera*, Beaked Tasselweed *Ruppia maritima*, Pink Water-speedwell *Veronica catenata* and Horned Pondweed *Zannichellia palustris* and the Cornwall Local species Greater Burdock *Arctium lappa*, White Willow *Salix alba* and Wood Club-rush *Scirpus sylvaticus*.**
- ◆ It is recommended that the populations of the invasive non-native species be monitored though only Himalayan Balsam *Impatiens glandulifera* appears to be increasing at present.
- ◆ Monitor the vegetation within Petherick's Mill Marsh A Phase two survey identifying vegetation communities, using the National Vegetation Classification methodology would identify changes.

### **Management suggestions**

- ◆ Continue periodic cutting or mowing along the path sides.
- ◆ Continue some cutting of reeds to create open areas within the reedbeds and along ditches and target Bude Marsh 6a and 11a first.
- ◆ Create shallow scrapes parts of Petherick's Mill Marsh 9a, 9b, 15, 16 and 17.

- ◆ Consider some clearance of scrub areas with trees (Bude Marsh 1, 2, 5a, 5b) along the embankments if required as viewing points looking into the marshes, and consider some scrub clearance in Bude Marsh 11.
- ◆ Maintain short grassland in Bude Marsh 10 and keep scrub from encroaching into 10a and current management appears favourable so should continue.
- ◆ Consider some removal or reduction of invasive non-native species.

## 2. Contents

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### Appendices

**MAP 1 – Boundary of survey area**

**MAP 2 – Compartment numbers for Bude Marsh**

**MAP 3 – Compartment numbers for Petherick’s Mill Marsh**

### 3. Purpose of survey

The purpose of the survey was to complete a Phase One and botanical survey of Bude Marshes Local Nature Reserve and would include -

- ◆ Full list of vascular plants associated with a phase one habitat map with target notes including -
- ◆ All notable species recorded with an eight-figure grid reference
- ◆ An invasive species survey with eight-figure grid reference for each location.

Included in the report are recommendations on monitoring and evaluating the site.

### 4. Methodology and coverage

‘Bude Marshes’ was surveyed in two separate parts with the area northwest of the River Neet and east of the Bude Canal referred to as ‘Bude Marsh’ and the part of the reserve within the embankment southeast of the River Neet as ‘Petherick’s Mill Marsh (Map1.).

Surveying was undertaken on two dates – 10<sup>th</sup> August and 11<sup>th</sup> September 2007.

Both parts of Bude Marshes were treated as separate sites when mapping the compartments during the Phase One survey and in the survey results each compartment is named Bude Marsh 1 (to Bude Marsh 12) or Petherick’s Mill Marsh 1 (to Petherick’s Mill Marsh 19).

An initial walk around each of the sites identified which areas could be chosen as compartments of similar vegetation and composition. Each compartment was mapped in the field and a list of vascular species present within noted with frequency following the DAFOR scale (where a species is assessed to be Dominant, Abundant, Frequent, Occasional or Rare) within that compartment. The frequencies of species were judged in the field and are from general observations at the time of the survey. If more detailed sampling is undertaken in the future using National Vegetation Classification methodologies and applying the DOMIN scale for coverage, the plant communities within each compartment could be identified.

The larger blocks of open water, swamp and inundation vegetation are relatively easily mapped by Phase One methodology, but choosing boundaries between two compartments can be problematic. This was found especially where habitats seem to be in transition, such as the Petherick’s Mill Marsh compartments 15 and 16 where Sea Club-rush *Bolboschoenus maritimus* areas (16) could be mapped as ‘swamp’ but the drier Fiorin *Agrostis stolonifera* areas between (15) mapped as ‘inundation vegetation’. It is suspected that the amount of inundation from the River Neet, the level of salinity of the water, and the amount of time the water

remains within Petherick's Mill Marsh, will alter over time what vegetation becomes abundant or dominant. Mapping linear man-made features such as the embankments, ditches and pathside verges is also difficult due to the narrowness of the compartment, but the broadly similar vegetation can be distinctly uniform, so where possible these linear features are mapped, especially in Petherick's Mill Marsh. Where the path bisects areas of similar vegetation they are mapped and labelled separately (eg. 3 and 3a, 4 and 4a etc.) to aid digitisation of maps where polygons need individual numbers.

The Phase One habitat definitions for each compartment are listed against the compartment numbers in the survey results in 5.4. Each compartment has a detailed species list with frequency so no separate 'target' notes are given. Any feature worth noting will be in 5.4.

Due to the recording being undertaken in the late summer, species that are found in the spring, which die back by early summer, will not have been recorded. In the habitats of the survey area possibly only Lesser Celandine *Ranunculus ficaria* may not have been recorded. A short spring survey of the survey area (April/May) would add more species to the total list. However by surveying later in the year a lot of the marsh species are more easily identified as they have inflorescences and fruit, usually critical in identification.

The apomictic groups (Dandelion *Taraxacum* agg. and Bramble *Rubus* agg.) were recorded to 'aggregate' but two difficult hybrids were identified. The hybrid rush *Juncus x diffusus* is the hybrid between Hard Rush *Juncus inflexus* and Soft-rush *J. effusus* and one plant was found at the edge of pond 18 with both parents. It is common generally in Britain where both species grow together, but in Cornwall Hard Rush *Juncus inflexus* is usually found near the coast and not often with Soft-rush *Juncus effusus*. The hybrid between Grey Willow *Salix cinerea* subsp. *oleifolia* and Eared Willow *Salix aurita* (*Salix x multinervis*) was also recorded. On a Botanical Cornwall Group meeting in August 2003 with the *Salix* expert Desmond Meikle, the Bude Canal area and marshes was surveyed for willows and the area had several species and hybrids. It is probably the best area in Cornwall for this group of plants. Shore Horsetail *Equisetum x litorale* (the hybrid between Water Horsetail *Equisetum fluviatile* and Field Horsetail *E. arvense*) was also recorded but one of the parents (Water Horsetail *E. fluviatile*) wasn't seen. It is probably in the vicinity outside of the survey area or may have been overlooked whilst surveying.

## 5. Survey results

### 5.1 Notable Species

**No nationally notable species in the Red Data List (Cheffings & Farrell, 2005) or in the most recent UK Biodiversity Action Plan (JNCC, 2007) were recorded within the Bude Marshes Local Nature Reserve survey area.**

**No Cornwall Rare (Botanical Cornwall Group, 2006) species were recorded within the Bude Marshes Local Nature Reserve survey area. A Cornwall Rare species is a species found in three or less sites in Cornwall since 1990.**

**Six Cornwall Scarce species were recorded within the Bude Marshes Local Nature Reserve survey area. A Cornwall Scarce species is a species found in four to ten sites in Cornwall since 1990.**

**These were –**

- ◆ **Trifid Bur-marigold *Bidens tripartita***  
**One plant was found along a ditch at SS20830572, between two previously open areas within Bude Marshes 6. It has been recorded from scattered sites throughout Cornwall, but is now found only in a few river valleys, usually at the lower stretches on mud or in marshes. It hasn't been recorded for Bude Marshes previous to the 2007 survey, but an old record for Bude exists for 1873 (W. M. Hind).**
  
- ◆ **Grass Vetchling *Lathyrus nissolia***  
**Several plants were found growing on the grassy embankment (Petherick's Mill 1) at SS20990558 and SS20990560. Restricted to a few coastal sites (and along one inland road verge) it has been recorded for SS20 in the past (Widemouth Bay, SS2002, L.J.Margetts, before 1980) but not in the Bude Marshes area. It has very narrow leaves which could be mistaken for grass (its common name is Grass-leaved Vetchling) and may be overlooked when not flowering.**
  
- ◆ **Bee Orchid *Ophrys apifera***  
**First recorded in the grassy area immediately south of the Bude Visitor's centre in July 2002 during a Botanical Cornwall Group field meeting, when twelve flowering spikes were counted. This species was new to SS20 and northeast Cornwall, but it can colonise suitable new sites many miles away from established ones (it produces many small, mobile seeds) and may well appear in other sites in Cornwall in future. Fruiting spikes were recorded during the survey in 2007 in Bude Marsh 10. It is only found in a few sites in the extreme southeast and west of Cornwall, usually in a calcareous situation.**

- ◆ **Beaked Tasselweed *Ruppia maritima***  
**First recorded in Bude Marshes in July 2002 during a Botanical Cornwall Group field meeting. This species was new to SS20 and northeast Cornwall, and during the survey in 2007 it was abundant in the ponds (Petherick's Mill Marsh 18 and 19) and ditch (Petherick's Mill Marsh 6b). It is only found in three other sites in east Cornwall, associated with brackish pools or ditches and appears to have become extinct in the three sites in west Cornwall where it has not been seen for many years.**
  
- ◆ **Pink Water-speedwell *Veronica catenata***  
**Recorded in only five sites in east Cornwall, usually near the lower reaches of rivers close to the sea or other coastal habitats. In 2007 it was found in two ditches in the survey area (Petherick's Mill Marsh 2 and 11) where it was first recorded on a Botanical Cornwall Group field meeting in July 2002. It had been recorded in nearby Maer Lake (SS2007) in 1981 BY L. J. Margetts.**
  
- ◆ **Horned Pondweed *Zannichellia palustris***  
**Like Beaked Tasselweed *Ruppia maritima*, in Cornwall this species is found in brackish pools or streams near the coast. Since 1990 it has been recorded in only nine sites, in east and west Cornwall. L.J. Margetts first recorded it for the Bude Canal before 1980. During the 2007 survey it was recorded in the slightly brackish or freshwater ditches (Petherick's Mill Marsh 2, 6, 6a, 6b and 11).**

**Three Cornwall Local species were recorded within the Bude Marshes Local Nature Reserve survey area. A Cornwall Local species is a species found in eleven to twenty sites in Cornwall since 1990.**

**These were –**

- ◆ **Greater Burdock *Arctium lappa***  
**Once recorded in several places throughout Cornwall it is now only regularly found around Bude SS20 and Wadebridge SW97, with a few records from southeast and west Cornwall. It appears to be associated with the lower reaches of river valleys with less acid soils. During the 2007 survey it was found on grass verges along the paths or on grassy embankments (Bude Marsh 1, 3, 7 and Petherick's Mill Marsh 5 and 12). It has been known from the Bude area since at least 1873 (W.M. Hind).**
  
- ◆ **White Willow *Salix alba***  
**Scattered throughout Cornwall and probably mostly planted but considered native to Cornwall. It has been known from the Bude area since at least 1886 (W.M.Rogers). It is found along the embankment and path running through Bude Marsh, as well as in the reedbed (Bude Marsh 1 and 12)**

◆ Wood Club-rush *Scirpus sylvaticus*

**Found only in northeast Cornwall in the catchment of the upper Tamar (with a record from near Crackington Haven SX19 not in the Tamar catchment). It can be locally abundant where it occurs but sites are few. In 2007 it was recorded along the marshy side of Bude Canal (Bude Marsh 5a) and in swampy conditions in Bude Marsh 6. It has been recorded from Bude since at least 1960.**

**Other species found in the survey area of note recorded include –**

Wild Celery *Apium graveolens*

**In Cornwall restricted to the upper parts of salt marshes or brackish conditions, never common anywhere.**

Crosswort *Cruciata laevipes*

**Not regarded as native in the Cornish Flora) but known from the pathsides through Bude Marsh for many years.**

Saltmarsh Rush *Juncus gerardii*

**Which has not been recorded in SS20 before though Hind made a very old record for ‘northeast Cornwall’ in 1873.**

Tree-mallow *Lavatera arborea*, a species restricted to coastal habitats and once thought of as Nationally Scarce but proved not to be.

## 5.2 Non-native Species

**Several non-native species were recorded within the survey area but most are non-invasive (as far as we know in 2007).**

**However the following more invasive non-native species were recorded –**

◆ Water Fern *Azolla filiculoides*

**A small amount of this species was found in the open area near the bird hide in Bude Marsh 6a. It was first recorded for Bude Canal before 1990 (T.J. Dingle). It is reduced in very cold weather and can appear in large numbers when conditions are right. Of the invasive non-native aquatic species it**



probably poses the least threat to other native species, as its population and coverage varies from year to year.

- ◆ Nuttall's Waterweed *Elodea nuttallii*  
Much more frequently reported in Cornwall (and the British Isles) now than the very similar Canadian Pondweed *Elodea canadensis* (which was either over-recorded or has genuinely declined in the British Isles), this species was growing along the ditch (Petherick's Mill 2) with Horned Pondweed *Zannichellia palustris* and Blunt-fruited Water-starwort *Callitriche obtusangula*. It doesn't appear to be having a negative effect on the native species it grows with.
  
- ◆ Montbretia *Crocsmia x crocosmiiflora*  
Very common and widespread in Cornwall, usually in places where there has been disturbance (old mining sites on heathland, hedges, roadsides etc.). A small amount was found in the survey area on a grassy embankment (Petherick's Mill Marsh 7), where it doesn't at present pose a threat to native species in the site.
  
- ◆ Himalayan Balsam *Impatiens glandulifera*  
Locally abundant on most major river systems in Cornwall, several plants were found growing alongside the River Neet in reedbeds and on verges (Bude Marshes 3, 3b, 4, 5a, 6, 6a, 7, 8a, 8b, 8c and 8d). Difficult to remove from a site as its fruits 'explode' when ripe, hurling seeds many metres away. In riverine habitats seeds can be carried downstream, so unless ALL plants are removed upstream it will continue to spread – seeds from one plant could colonise an area quickly over time. It is seen as one of the most invasive species and does indeed seem to be abundant where it grows. In the survey area it would take considerable manpower to remove every last plant and as the site is at the bottom of a river catchment it is likely that the site would be colonised shortly after clearance.
  
- ◆ Curly Water-thyme *Lagarosiphon major*  
Common in Cornwall, especially in deeper waters such as flooded quarries or fish pools, it has been recorded since 1954. A small amount was found in the ditch in reedbeds (Bude Marsh 6a). It was first recorded in Bude Canal in 1974 (J. Paton).

5.3 Species list of all vascular plants found on Bude Marshes Local Nature Reserve survey area

**The following is a list of all species recorded within the boundary of the Bude Marshes Local Nature Reserve area. Native species that have been planted, which are also found naturally within the survey area, need no comment on status.**

**The notes on status include -**

- 1. Native – planted. Species native to Cornwall, which have been planted, but may have not occurred naturally in the Bude Marshes.**
- 2. Non-native planted. Species not native to Cornwall which have been planted.**
- 3. Non-native probably not planted (naturalised). Species not native to Cornwall, which have not been planted but have been unintentionally, introduced by human or other means, or natural spread, and has become established.**

<b>Species name</b>	<b>Common name</b>	<b>Present in Bude Marsh</b>	<b>Present in Petherick's Mill Marsh</b>	<b>Note on status</b>
<i>Acer pseudoplatanus</i>	Sycamore	Y		
<i>Achillea millefolium</i>	Yarrow	Y	y	
<i>Agrostis capillaris</i>	Common Bent-grass	Y		
<i>Agrostis stolonifera</i>	Fiorin	Y	y	
<i>Alisma plantago-aquatica</i>	Water-plantain	Y	y	
<i>Alliaria petiolata</i>	Garlic Mustard	Y	y	
<i>Alnus glutinosa</i>	Alder	Y	y	
<b>Species name</b>	<b>Common name</b>	<b>Present in Bude Marsh</b>	<b>Present in Petherick's Mill Marsh</b>	<b>Note on status</b>
<i>Alopecurus geniculatus</i>	Marsh Foxtail		y	
<i>Anagallis arvensis</i> subsp. <i>arvensis</i>	Scarlet Pimpernel	Y	y	
<i>Angelica sylvestris</i>	Wild Angelica	Y	y	
<i>Anisantha sterilis</i>	Barren Brome	Y		
<i>Anthriscus sylvestris</i>	Cow Parsley	Y	y	
<i>Apium graveolens</i>	Wild Celery	Y		
<i>Apium nodiflorum</i>	Fool's-water-cress	Y		
<i>Aquilegia vulgaris</i>	Columbine		y	probably introduced
<i>Arctium lappa</i>	Greater Burdock	Y	y	
<i>Arctium minus</i>	Lesser Burdock	Y		
<i>Arrhenatherum elatius</i>	False Oat-grass	Y	y	
<i>Artemisia vulgaris</i>	Mugwort	Y		
<i>Arum maculatum</i>	Lords-and-ladies	Y		
<i>Aster aggregate</i>	Michaelmas Daisy	Y		Non-native probably planted
	Unidentified			not

<b>Species name</b>	<b>Common name</b>	<b>Present in Bude Marsh</b>	<b>Present in Petherick's Marsh</b>	<b>Note on status</b>
				(naturalised)
<i>Athyrium filix-femina</i>	Lady-fern	Y		
<i>Atriplex prostrata</i>	Hastate Orache	Y	y	
<i>Azolla filiculoides</i>	Water Fern	Y		Non-native not (naturalised) probably planted
<i>Beta vulgaris</i> subsp. <i>maritima</i>	Sea Beet	Y	y	
<i>Bidens tripartita</i>	Trifid Bur-marigold	Y		
<i>Bolboschoenus maritimus</i>	Sea Club-rush	Y	y	
<i>Brachypodium sylvaticum</i>	Slender False Brome	Y		
<i>Brassica nigra</i>	Black Mustard	Y	y	
<i>Brassica rapa</i>	Turnip	Y		
<i>Buddleja davidii</i>	Butterfly-bush	Y	y	Non-native not (naturalised) probably planted
<i>Callitriche obtusangula</i>	Blunt-fruited starwort	Water- Y	y	
<i>Callitriche stagnalis</i>	Common starwort	Water- Y		
<i>Calystegia sepium</i> subsp. <i>roseata</i>	Rosy Hedge Bindweed	Y		
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	Y	y	
<i>Calystegia silvatica</i>	Large Bindweed	Y	y	
<i>Cardamine flexuosa</i>	Wavy Bitter-cress		y	
<i>Cardamine hirsuta</i>	Hairy Bitter-cress	Y		
<i>Cardamine pratensis</i>	Cuckooflower	Y		
<i>Carex flacca</i>	Glaucous Sedge	Y		
<i>Carex hirta</i>	Hairy Sedge	Y	y	
<i>Carex otrubae</i>	False Fox-sedge	Y	y	
<i>Carex pendula</i>	Pendulous Sedge	Y		
<i>Carex remota</i>	Remote Sedge	Y		
<i>Carex riparia</i>	Great Pond-sedge	Y		
<i>Centaurea nigra</i>	Common Knapweed	Y		
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	Common Mouse-ear Chickweed	Y	y	
<i>Chaerophyllum temulum</i>	Rough Chervil	Y		
<i>Chamerion angustifolium</i>	Rosebay Willowherb	Y		
<i>Chenopodium polyspermum</i>	Many-seeded Goosefoot		y	
<i>Chrysosplenium oppositifolium</i>	Opposite-leaved Golden-saxifrage	Y		
<i>Cirsium arvense</i>	Creeping Thistle	Y	y	
<i>Cirsium vulgare</i>	Spear Thistle	Y	y	
<i>Conium maculatum</i>	Hemlock	Y	y	

<i>Convolvulus arvensis</i>	Field Bindweed	Y	y	
<i>Conyza canadensis</i>	Canadian Fleabane	Y		Non-native probably not planted (naturalised)
<i>Crataegus monogyna</i>	Hawthorn	Y	y	
<i>Crepis capillaris</i>	Smooth Hawk's-beard	Y	y	
<i>Crocoshmia crocosmiiflora</i>	x Montbretia		y	<i>Crocoshmia pottsii</i> x <i>C. aurea</i> - Non-native probably not planted (naturalised)
<i>Cruciata laevipes</i>	Crosswort	Y		Non-native probably not planted (naturalised)
<i>Cynosurus cristatus</i>	Crested Dog's-tail	Y		
<i>Dactylis glomerata</i>	Cock's-foot	Y	y	
<i>Daucus carota</i>	Wild Carrot	Y		
<i>Deschampsia cespitosa</i>	Tufted Hair-grass		y	
<i>Dryopteris dilatata</i>	Broad Buckler-fern	Y		
<i>Dryopteris filix-mas</i>	Male-fern	Y		
<i>Eleocharis palustris</i>	Common Spike-rush		y	

Species name	Common name	Present in Bude Marsh	Present in Petherick's Mill Marsh	Note on status
<i>Elodea nuttallii</i>	Nuttall's Waterweed		y	Non-native probably not planted (naturalised)
<i>Elytrigia repens</i>	Common-couch	Y	y	
<i>Elytrigia repens</i> var. <i>aristata</i>	var. Awned Common Couch Grass	Y	y	
<i>Epilobium hirsutum</i>	Great Willowherb	Y	y	
<i>Epilobium montanum</i>	Broad-leaved Willowherb		y	
<i>Epilobium obscurum</i>	Short-fruited Willowherb	Y	y	
<i>Equisetum arvense</i>	Field Horsetail	Y	y	
<i>Equisetum x litorale</i>	Shore Horsetail	Y		<i>Equisetum fluviatile</i> x <i>E. arvense</i>
<i>Eupatorium cannabinum</i>	Hemp-agrimony	Y	y	
<i>Festuca arundinacea</i>	Tall Fescue	Y	y	
<i>Festuca gigantea</i>	Giant Fescue	Y		
<i>Festuca rubra</i> agg.	Red Fescue	Y	y	
<i>Filipendula ulmaria</i>	Meadowsweet	Y	y	
<i>Fraxinus excelsior</i>	Ash	Y		
<i>Fumaria bastardii</i>	Tall Ramping-fumitory	Y		
<i>Galeopsis tetrahit</i>	Common Hemp-nettle		y	
<i>Galium aparine</i>	Goosegrass	Y	y	

<i>Galium mollugo</i>	Great Hedge Bedstraw	Y	y		
<i>Galium palustre</i> subsp. <i>elongatum</i>	Great Marsh-bedstraw	Y			
<i>Geranium dissectum</i>	Cut-leaved bill	Crane's- Y	y		
<i>Geranium molle</i>	Dove's-foot bill	Crane's- Y	y		
<i>Geranium robertianum</i>	Herb-Robert	Y			
<i>Glechoma hederacea</i>	Ground-ivy	Y			
<i>Glyceria fluitans</i>	Flote-grass		y		
<i>Hedera helix</i> subsp. <i>hibernica</i>	Atlantic Ivy	Y	y		
<i>Heracleum sphondylium</i>	Cow Parsnip	Y	y		
<i>Holcus lanatus</i>	Yorkshire-fog	Y	y		
<i>Holcus mollis</i>	Creeping Soft-grass	Y			
<i>Hordeum murinum</i>	Wall Barley	Y	y		
<i>Hypericum perforatum</i>	Perforate St John's-wort		y		
<b>Species name</b>	<b>Common name</b>	<b>Present in Bude Marsh</b>	<b>Present in Petherick's Mill Marsh</b>	<b>Note on status</b>	
<i>Hypericum tetrapterum</i>	Square-stemmed John's-wort	St Y			
<i>Hypochaeris radicata</i>	Cat's-ear	Y	y		
<i>Impatiens glandulifera</i>	Himalayan Balsam	Y	y	Non-native not (naturalised)	probably planted
<i>Iris foetidissima</i>	Gladdon	Y	y		
<i>Iris pseudacorus</i>	Yellow Iris	Y	y		
<i>Juncus articulatus</i>	Jointed Rush	Y	y		
<i>Juncus bufonius</i>	Toad Rush	Y			
<i>Juncus effusus</i>	Soft-rush	Y	y		
<i>Juncus gerardii</i>	Saltmarsh Rush		y		
<i>Juncus inflexus</i>	Hard Rush	Y	y		
<i>Juncus x diffusus</i>	hybrid rush		y		<i>Juncus inflexus</i> x <i>J. effusus</i>
<i>Lagarosiphon major</i>	Curly Water-thyme	Y		Non-native not (naturalised)	probably planted
<i>Lapsana communis</i>	Nipplewort	Y			
<i>Lathyrus nissolia</i>	Grass Vetchling		y		
<i>Lathyrus pratensis</i>	Meadow Vetchling	Y	y		
<i>Lavatera arborea</i>	Tree-mallow		y		
<i>Lemna minor</i>	Common Duckweed	Y	y		
<i>Leontodon saxatilis</i>	Lesser Hawkbit	Y			
<i>Linaria vulgaris</i>	Common Toadflax	Y			
<i>Lolium perenne</i>	Perennial Rye-grass	Y	y		
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	Y			

<i>Lotus pedunculatus</i>	Large Bird's-foot-trefoil	Y	y		
<i>Lychnis flos-cuculi</i>	Ragged-Robin	Y			
<i>Lycopus europaeus</i>	Gypsywort	Y			
<i>Lythrum salicaria</i>	Purple-loosestrife	Y	y		
<i>Malus domestica</i>	Apple	Y			Non-native not (naturalised) probably planted
<i>Malva sylvestris</i>	Common Mallow	Y			
<i>Matricaria discoidea</i>	Pineapple Mayweed	Y			
<i>Medicago arabica</i>	Spotted Medick	Y			
<i>Medicago lupulina</i>	Black Medick	Y	y		
<i>Melilotus altissimus</i>	Tall Melilot	Y			
<i>Mentha aquatica</i>	Water Mint	Y	y		
<b>Species name</b>	<b>Common name</b>	<b>Present in Bude Marsh</b>	<b>Present in Petherick's Marsh</b>	<b>in Note</b>	<b>on status</b>
<i>Mentha spicata</i>	Spear Mint		y		
<i>Myosotis laxa</i> subsp. caespitosa	Tufted Forget-me-not	Y	y		
<i>Odontites vernus</i> subsp. serotinus	Common Red Bartsia	Y			
<i>Oenanthe crocata</i>	Hemlock dropwort	Y	y		
<i>Ononis repens</i>	Common Restharrow	Y			
<i>Ophrys apifera</i>	Bee Orchid	Y			
<i>Papaver somniferum</i>	Opium Poppy	Y			Non-native not (naturalised) probably planted
<i>Persicaria hydropiper</i>	Water-pepper	Y	y		
<i>Persicaria maculosa</i>	Willow Weed		y		
<i>Phalaris arundinacea</i>	Reed Canary-grass	Y	y		
<i>Phleum bertolonii</i>	Smaller Cat's-tail	Y			
<i>Phleum pratense</i>	Timothy		y		
<i>Phragmites australis</i>	Common Reed	Y	y		
<i>Phyllitis scolopendrium</i>	Hart's-tongue Fern	Y	y		
<i>Picris echioides</i>	Bristly Oxtongue	Y	y		
<i>Plantago lanceolata</i>	Ribwort Plantain	Y	y		
<i>Plantago major</i>	Greater Plantain	Y	y		
<i>Poa annua</i>	Annual Meadow-grass	Y	y		
<i>Poa pratensis</i>	Smooth Meadow-grass	Y			
<i>Poa trivialis</i>	Rough Meadow-grass	Y			
<i>Polygonum aviculare</i>	Knotgrass	Y	y		
<i>Polystichum setiferum</i>	Soft Shield-fern	Y			
<i>Potentilla anserina</i>	Silverweed	Y	y		
<i>Potentilla reptans</i>	Creeping Cinquefoil	Y	y		
<i>Prunella vulgaris</i>	Selfheal	Y	y		
<i>Prunus spinosa</i>	Blackthorn	Y	y		

<i>Pulicaria dysenterica</i>	Common Fleabane	Y	y		
<i>Quercus cerris</i>	Turkey Oak	Y		Non-native not (naturalised)	probably planted
<i>Quercus petraea</i>	Sessile Oak	Y			
<i>Quercus</i> sp.	Oak		y		
<i>Ranunculus acris</i>	Meadow Buttercup	Y	y		
<i>Ranunculus flammula</i> subsp. <i>flammula</i>	Lesser Spearwort	Y			
<i>Ranunculus repens</i>	Creeping Buttercup	Y	y		
<b>Species name</b>	<b>Common name</b>	<b>Present in Bude Marsh</b>	<b>Present in Petherick's Mill Marsh</b>	<b>in Note</b>	<b>on status</b>
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup	Y			
<i>Rubus fruticosus</i> agg.	Blackberry	Y	y		
<i>Rumex acetosa</i>	Common Sorrel		y		
<i>Rumex conglomeratus</i>	Clustered Dock	Y	y		
<i>Rumex crispus</i>	Curled Dock	Y	y		
<i>Rumex obtusifolius</i>	Broad-leaved Dock	Y	y		
<i>Rumex sanguineus</i>	Wood Dock	Y	y		
<i>Ruppia maritima</i>	Beaked Tasselweed		y		
<i>Salix alba</i>	White Willow	Y			
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	Y	y		
<i>Salix fragilis</i> var. <i>furcata</i>	Crack Willow	Y			
<i>Salix viminalis</i>	Common Osier	Y	y		
<i>Salix x multinervis</i>	hybrid willow	Y	y		<i>Salix cinerea</i> subsp. <i>oleifolia</i> x <i>S. aurita</i>
<i>Sambucus nigra</i>	Elder	Y			
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush		y		
<i>Scirpus sylvaticus</i>	Wood Club-rush	Y			
<i>Scrophularia auriculata</i>	Water Figwort	Y	y		
<i>Scutellaria galericulata</i>	Skull-cap	Y			
<i>Senecio erucifolius</i>	Hoary Ragwort	Y	y		
<i>Senecio jacobaea</i>	Common Ragwort	Y	y		
<i>Silene dioica</i>	Red Campion	Y			
<i>Sison amomum</i>	Stone Parsley		y		
<i>Solanum dulcamara</i>	Bittersweet	Y			
<i>Sonchus arvensis</i>	Perennial Sow-thistle	Y	y		
<i>Sonchus asper</i>	Prickly Sow-thistle	Y	y		
<i>Sonchus oleraceus</i>	Milk-thistle	Y	y		
<i>Sorbus aria</i>	Common Whitebeam	Y			
					<b><i>Non-native planted</i></b>
<i>Sparganium erectum</i>	Branched Bur-reed	Y	y		
<i>Stachys palustris</i>	Marsh Woundwort	Y	y		
<i>Stachys sylvatica</i>	Hedge Woundwort	Y	y		
<i>Stellaria graminea</i>	Lesser Stitchwort		y		

<i>Stellaria uliginosa</i>	Bog Stitchwort	Y		
<i>Symphytum x uplandicum</i>	Russian Comfrey	Y		<i>Symphytum officinale</i> x <i>S. asperum</i>
<i>Taraxacum officinale</i> agg.	Common Dandelion	Y	y	
<i>Torilis japonica</i>	Upright Hedge-parsley	Y		
<i>Trifolium dubium</i>	Lesser Trefoil		y	
<i>Trifolium pratense</i>	Red Clover	Y	y	
<b>Species name</b>	<b>Common name</b>	<b>Present in Bude Marsh</b>	<b>Present in Petherick's Mill Marsh</b>	<b>Note on status</b>
<i>Trifolium repens</i>	White Clover	Y	y	
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	Y	y	
<i>Tripleurospermum maritimum</i>	Sea Mayweed	Y	y	
<i>Tussilago farfara</i>	Colt's-foot	Y		
<i>Typha latifolia</i>	Great Reedmace	Y	y	
<i>Ulex europaeus</i>	Gorse	Y		
<i>Urtica dioica</i>	Common Nettle	Y	y	
<i>Valeriana officinalis</i>	Common Valerian	Y		
<i>Veronica beccabunga</i>	Brooklime	Y		
<i>Veronica catenata</i>	Pink Water-speedwell		y	
<i>Viburnum opulus</i>	Guelder-rose		y	<i>Native – planted</i>
<i>Vicia cracca</i>	Tufted Vetch	Y	y	
<i>Vicia hirsuta</i>	Hairy Tare	Y		
<i>Vicia sativa</i> subsp. <i>segetalis</i>	Common Vetch	Y	y	
<i>Vicia sepium</i>	Bush Vetch	Y		
<i>Vicia tetrasperma</i>	Smooth Tare	Y	y	
<i>Viola odorata</i>	Sweet Violet	Y		
<i>Zannichellia palustris</i>	Horned Pondweed		y	

#### 5.4 Notes on compartments with Phase one habitat definitions

##### Compartment numbers Phase one habitat definition

**BUDE MARSHES 1** - Narrow strip of B2 (Neutral grassland) on pathside with A2 (Scrub) on side EMBANKMENT 1 of embankment with C3.1 (Tall ruderal) between scrub. Not an easy habitat ALONG PATH FROM to define as it has developed on old rail bed, so could also be mapped as J SS20920580 TO (Miscellaneous)  
SS20760610

**BUDE MARSHES 2** - Narrow strip of B2 (Neutral grassland) on pathside with A2 (Scrub) on side EMBANKMENT 2 of embankment with C3.1 (Tall ruderal) between scrub. Not an easy habitat ALONG PATH FROM to define as it has developed on old rail bed, so could also be mapped as J SS20920578 TO (Miscellaneous)  
SS20770589



**BUDE MARSHES 3** - Narrow strip of B2 (Neutral grassland) on river side of embankment which has probably developed as it is mown. Otherwise it would be best defined as MOWN EMBANKMENT 3 ON F2.1 (Marginal vegetation). The grassland is subject to some inundation but WESTERN SIDE OF proximity to sea and some saline conditions means some species of brackish RIVERBANK FROM conditions (Wild Celery *Apium graveolens* and Sea Club-rush SS20920578 TO *Bolboschoenus maritimus*) are found here SS20860562

**BUDE MARSHES 4** - The narrow strip of unmown vegetation along the riverbank and below the UNMOWN canal is best defined as F2.1 (Marginal vegetation) though a strip of A2 EMBANKMENT 4 ON (scrub) with some shade-tolerant species has developed on the higher part of WESTERN SIDE OF the adjacent embankment RIVERBANK FROM SS20860562 TO SS20850541

**BUDE MARSHES 5a** - Narrow strip of B2 (Neutral grassland) on pathside with A2 (Scrub) on side EMBANKMENT 5a ON of embankment with C3.1 (Tall ruderal) between scrub. Not an easy habitat EAST CANAL FROM to define as it has developed on old canal embankment so could also be SS20840542 TO mapped as J (Miscellaneous) SS20840561

**BUDE MARSHES 5b** - Narrow strip of B2 (Neutral grassland) on pathside with more A2 (Scrub) on SCRUBBY side of embankment than Bude Marsh 5a, with C3.1 (Tall ruderal) between EMBANKMENT 5b scrub. Not an easy habitat to define as it has developed on old canal EAST OF CANAL embankment so could also be mapped as J (Miscellaneous) FROM SS20840561 TO SS20760590

**BUDE MARSHES 6** - F1 (Swamp) though previously cut areas and small open patches within the REEDBED 6 - swamp have more species diversity SS208057, CLOSED REEDBED WITH SOME PREVIOUSLY CUT AREAS AND DITCHES

**BUDE MARSHES 6a** - F1 (Swamp) though previously cut areas and small open patches within the OPEN AREA IN swamp have more species diversity and some small areas of G1 (Standing REEDBED 6a - water) are present SS208057, OPEN AREA NEAR BIRD HIDE AND AROUND PONDS

**BUDE MARSHES 7** - Narrow strip of B2 (Neutral grassland) on river side of embankment which MOWN has probably developed as it is mown. Otherwise it would be best defined as EMBANKMENT 7 ON F2.1 (Marginal vegetation). The grassland is subject to some inundation but WEST SIDE OF RIVER proximity to sea and some saline conditions means some species of brackish FROM SS20920580 TO conditions (Sea Beet *Beta vulgaris subsp. maritima*) are found here SS20840611

**BUDE MARSHES 8** - F1 (Swamp) almost solid and species poor Common Reed *Phragmites* REEDBED 8 - SS208058 community

**BUDE MARSHES 9** - A small area used regularly mown and trampled probably best defined as MOWN AREA 9 EAST J1.2 (Amenity grassland), as Perennial Rye-grass *Lolium perenne* is OF VISITOR'S CENTRE abundant with White Clover *Trifolium repens*  
- SS20830612

**BUDE MARSHES 10** - A good range of species including Bee Orchid *Ophrys apifera*, probably ROUGH GRASSLAND best defined as B2 (Neutral grassland) which has developed on waste 10 SOUTH OF ground and kept fairly short from periodic cutting  
VISITOR'S CENTRE -  
SS208060

**BUDE MARSHES 10a** - Gradually grades into Bude Marsh 10 on the drier side and into Bude Marsh ROUGH MARSHY 11 on the wetter side, this area is mostly tall herbs, sedges and rushes and is GRASSLAND 10a best defined as B5 (Marshy grassland)  
SOUTH OF VISITOR'S  
CENTRE - SS208060

**BUDE MARSHES 11** - F1 (Swamp) though previously cut areas and small open patches within the REEDBED 11 WITH swamp have more species diversity and some small areas of G1 (Standing OPEN AREAS AND water) are present  
SCRUB - SS207059

**BUDE MARSHES 11a** - Mown area within transition zone of B5 (Marshy grassland) and F1 OPEN AREA AROUND (Swamp) best defined as modified B5 by mowing  
POND 11a - SS20790599

**BUDE MARSH 12** - Much used by waterfowl and heavily fertilised - species poor G1 (Standing POND 12 - SS20790599 water)

**PETHERICK'S MILL B2** (Neutral grassland) mown periodically with more ruderal species in 1b **MARSH 1a and 1b** - close to recent disturbance, and more marginal vegetation towards ditch  
EMBANKMENT 1a  
AND 1b - SS20990568  
TO SS20990541

**PETHERICK'S MILL** Some G2 (Standing water) in the ditch but the vegetation is characteristic of **MARSH 2 - DITCH 2** - F2.1 (Marginal vegetation)  
SS20990568 TO  
SS20990543

**PETHERICK'S MILL** Mostly F2.1 (Marginal vegetation) but a strip of B2 (Neutral grassland) **MARSH 3a** - DITCH along pathside,  
MARGIN AND GRASS  
VERGE 3 AND 3a -  
SS20990568 TO  
SS20990543

**PETHERICK'S MILL B2** (Neutral grassland), kept short by regular mowing  
**MARSH 4 and 4a** -  
EMBANKMENT AND  
VERGE 4 AND 4a -  
SS20980542 TO  
SS20890541

**PETHERICK'S MILL** B2 (Neutral grassland) with patches of taller vegetation, more so in the  
**MARSH 5** - GRASS southern part of 3a, with path sides regularly mown  
VERGE 5 - SS20980568  
TO SS20960543

**PETHERICK'S MILL** Some G2 (Standing water) in ditch but probably best defined as F2.1  
**MARSH 6** - DITCH 6 - (Marginal vegetation) with abundant Sea Club-rush *Bolboschoenus*  
SS20980568 TO *maritimus*  
SS20960543

**PETHERICK'S MILL** F2.1 (Marginal vegetation) with abundant Common Reed *Phragmites*  
**MARSH 6a** - DITCH 6a  
- SS20960543 TO  
SS20930542

**PETHERICK'S MILL** G2 (Standing water) in ditch but probably best defined as F2.1 (Marginal  
**MARSH 6b** - DITCH 6b vegetation) with abundant Beaked Tasselweed *Ruppia maritima*, this ditch  
- SS20930542 TO links to the brackish pond 18  
SS20890543

**PETHERICK'S MILL** B2 (Neutral grassland) along embankment with some encroaching by  
**MARSH 7** - Bramble *Rubus fruticosus* agg. and ruderal spp.  
EMBANKMENT 7 -  
SS20920571 TO  
SS20880542

**PETHERICK'S MILL** Narrow strip of B2 (Neutral grassland) on river side of embankment which  
**MARSH 8a** - has probably developed as it is mown. Otherwise it would be best defined as  
**RIVERBANK 8a** - F2.1 (Marginal vegetation). The grassland is subject to some inundation but  
SS20930576 TO proximity to sea and some saline conditions means some species of brackish  
SS20880560 conditions (*Sea Beet Beta vulgaris subsp. maritima*) are found here

**PETHERICK'S MILL** Probably F2.1 (Marginal vegetation) developed from a narrow strip of B2  
**MARSH 8b** - (Neutral grassland) on river side of embankment which has become  
**RIVERBANK 8b** - colonised with Common Reed *Phragmites*  
SS20870551 TO  
SS20880560

**PETHERICK'S MILL** Probably F2.1 (Marginal vegetation)  
**MARSH 8c and 8d** -  
**RIVERBANK 8c AND**  
8d - SS20870551 TO  
SS20890538

**PETHERICK'S MILL** Flat area adjacent to brackish ponds 18 and 19 dominated by Fiorin *Agrostis*  
**MARSH 9a** - *MARSH stolonifera* is subject to periodic inundation best defined as F2.2 (Inundation  
9a - SS20890544 TO vegetation)  
SS20890559

**PETHERICK'S MILL** Flat area adjacent to brackish pond 19 dominated by Fiorin *Agrostis*  
**MARSH 9b** - *MARSH stolonifera* is subject to periodic inundation best defined as F2.2 (Inundation  
9b - SS20910558 TO vegetation)  
SS20920571

**PETHERICK'S MILL** Abundant area of Common Reed *Phragmites* within F2.2 (Inundation  
**MARSH 9c** - *MARSH 9c* vegetation)  
- SS20910564

**PETHERICK'S MILL** Abundant area of Common Reed *Phragmites* within F2.2 (Inundation **MARSH 9d** - MARSH vegetation)

9d - SS20930569

**PETHERICK'S MILL** B2 (Neutral grassland) along embankment with ruderal spp. and almost **MARSH 10a and 10b** - grass dominated in 10b

EMBANKMENT 10a

AND 10b - SS20920571

TO SS20940575

**PETHERICK'S MILL** Some G2 (Standing water) in the ditch but the vegetation is characteristic of **MARSH 11** - DITCH 11 F2.1 (Marginal vegetation)

- SS20950575 TO

SS20980569

**PETHERICK'S MILL** B2 (Neutral grassland) along embankment

**MARSH 12** -

EMBANKMENT 12 -

SS20990569 TO

SS20960575

**PETHERICK'S MILL** Narrow strips of B2 (Neutral grassland) along pathsides which are mown **MARSH 13 and 13a** - periodically

VERGE 13 AND 13a -

SS20950575 TO

SS20970569

**PETHERICK'S MILL** Some G2 (Standing water) in ditch but probably best defined as F2.1 **MARSH 14** - DITCH 14 (Marginal vegetation) with abundant Sea Club-rush *Bolboschoenus*

- SS20930571 TO *maritimus*

SS20940573 TO

SS20970568

**PETHERICK'S MILL** Flat area dominated by Fiorin *Agrostis stolonifera* is subject to periodic **MARSH 15** - MARSH inundation best defined as F2.2 (Inundation vegetation)

15 - SS20940573 TO

SS20950551

**PETHERICK'S MILL** Species poor Sea Club-rush *Bolboschoenus maritimus* vegetation on slightly **MARSH 16** - MARSH lower-lying parts of Petherick's Mill Marsh alongside brackish ditches and

16 - SS20940573 TO ponds is best defined as F1 (Swamp) and probably is waterlogged during

SS20890543 long periods. The dry areas between (15) have developed into F2.2 (Inundation vegetation), but if the water level becomes elevated for longer periods the F2.2 would probably develop into F1.

**PETHERICK'S MILL** Flat area with Fiorin *Agrostis stolonifera* is subject to periodic inundation **MARSH 17** - MARSH best defined as F2.2 (Inundation vegetation), but the presence of Flote-grass

17 - SS209054 *Glyceria fluitans*, Soft-rush *Juncus effusus* and Purple-loosestrife *Lythrum salicaria* suggests that the south eastern corner of Petherick's Mill Marsh is less influenced by saline conditions

**PETHERICK'S MILL** G2 (Standing water) which is brackish with abundant Beaked Tasselweed **MARSH 18** - POND 18 - *Ruppia maritima*

SS20930548 TO

SS20880544

**PETHERICK'S MILL** G2 (Standing water) which is brackish with frequent Beaked Tasselweed  
**MARSH 19** - POND 19 - *Ruppia maritima*

SS20930548 TO

SS20930568

5.5 Lists of vascular plants found in Bude Marshes Local Nature Reserve  
 survey area in compartments with frequency

<b>BUDE MARSHES - EMBANKMENT 1 ALONG PATH FROM SS20920580 TO SS20760610</b>		
<i>Acer pseudoplatanus</i>	Sycamore	OCCASIONAL
<i>Achillea millefolium</i>	Yarrow	FREQUENT
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Alnus glutinosa</i>	Alder	RARE
<i>Anagallis arvensis</i> subsp. <i>arvensis</i>	Scarlet Pimpernel	OCCASIONAL
<i>Anisantha sterilis</i>	Barren Brome	OCCASIONAL
<i>Arctium lappa</i>	Greater Burdock	RARE
<i>Arctium minus</i>	Lesser Burdock	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	FREQUENT
<i>Artemisia vulgaris</i>	Mugwort	RARE
<i>Arum maculatum</i>	Lords-and-ladies	RARE
<i>Aster aggregate</i>	Michaelmas Daisy Unidentified	RARE
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Brassica nigra</i>	Black Mustard	RARE
<b>BUDE MARSHES - EMBANKMENT 1 ALONG PATH FROM SS20920580 TO SS20760610</b>		
<i>Brassica rapa</i>	Turnip	RARE
<i>Buddleja davidii</i>	Butterfly-bush	OCCASIONAL
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	OCCASIONAL
<i>Calystegia silvatica</i>	Large Bindweed	OCCASIONAL
<i>Centaurea nigra</i>	Common Knapweed	OCCASIONAL
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	Common Mouse-ear Chickweed	OCCASIONAL
<i>Chaerophyllum temulum</i>	Rough Chervil	OCCASIONAL
<i>Chamerion angustifolium</i>	Rosebay Willowherb	RARE
<i>Cirsium arvense</i>	Creeping Thistle	OCCASIONAL
<i>Cirsium vulgare</i>	Spear Thistle	OCCASIONAL
<i>Conium maculatum</i>	Hemlock	RARE
<i>Convolvulus arvensis</i>	Field Bindweed	RARE

<i>Crataegus monogyna</i>	Hawthorn	OCCASIONAL
<i>Cruciata laevipes</i>	Crosswort	RARE
<i>Dactylis glomerata</i>	Cock's-foot	OCCASIONAL
<i>Dryopteris filix-mas</i>	Male-fern	RARE
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Epilobium hirsutum</i>	Great Willowherb	OCCASIONAL
<i>Equisetum arvense</i>	Field Horsetail	OCCASIONAL
<i>Eupatorium cannabinum</i>	Hemp-agrimony	OCCASIONAL
<i>Festuca arundinacea</i>	Tall Fescue	OCCASIONAL
<i>Festuca rubra</i> agg.	Red Fescue	FREQUENT
<i>Filipendula ulmaria</i>	Meadowsweet	RARE
<i>Fraxinus excelsior</i>	Ash	OCCASIONAL
<i>Galium aparine</i>	Goosegrass	FREQUENT
<i>Galium mollugo</i>	Great Hedge Bedstraw	RARE
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	RARE
<i>Geranium molle</i>	Dove's-foot Crane's-bill	RARE
<i>Geranium robertianum</i>	Herb-Robert	RARE
<i>Hedera helix</i> subsp. <i>hibernica</i>	Atlantic Ivy	OCCASIONAL
<i>Heracleum sphondylium</i>	Cow Parsnip	FREQUENT
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Holcus mollis</i>	Creeping Soft-grass	OCCASIONAL
<i>Hordeum murinum</i>	Wall Barley	RARE
<i>Iris foetidissima</i>	Gladdon	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	FREQUENT
<i>Matricaria discoidea</i>	Pineapple Mayweed	RARE
<i>Medicago lupulina</i>	Black Medick	OCCASIONAL
<i>Odontites vernus</i> subsp. <i>serotinus</i>	Common Red Bartsia	RARE
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	RARE
<i>Papaver somniferum</i>	Opium Poppy	RARE
<i>Phragmites australis</i>	Common Reed	OCCASIONAL
<i>Phyllitis scolopendrium</i>	Hart's-tongue Fern	OCCASIONAL
<i>Picris echioides</i>	Bristly Oxtongue	RARE
<i>Plantago lanceolata</i>	Ribwort Plantain	OCCASIONAL
<i>Plantago major</i>	Greater Plantain	OCCASIONAL
<i>Poa annua</i>	Annual Meadow-grass	OCCASIONAL
<b>BUDE MARSHES - EMBANKMENT 1 ALONG PATH FROM SS20920580 TO SS20760610</b>		
<i>Polygonum aviculare</i>	Knotgrass	OCCASIONAL
<i>Potentilla anserina</i>	Silverweed	OCCASIONAL
<i>Potentilla reptans</i>	Creeping Cinquefoil	OCCASIONAL
<i>Prunus spinosa</i>	Blackthorn	OCCASIONAL
<i>Pulicaria dysenterica</i>	Common Fleabane	OCCASIONAL
<i>Quercus cerris</i>	Turkey Oak	RARE
<i>Rubus fruticosus</i> agg.	Blackberry	ABUNDANT
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Rumex crispus</i>	Curled Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Rumex sanguineus</i>	Wood Dock	RARE

<i>Salix alba</i>	White Willow	FREQUENT
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	OCCASIONAL
<i>Sambucus nigra</i>	Elder	RARE
<i>Solanum dulcamara</i>	Bittersweet	RARE
<i>Sonchus oleraceus</i>	Milk-thistle	RARE
<i>Sorbus aria</i>	Common Whitebeam	RARE
<i>Stachys sylvatica</i>	Hedge Woundwort	RARE
<i>Symphytum x uplandicum</i>	Russian Comfrey	FREQUENT
<i>Taraxacum officinale</i> agg.	Common Dandelion	OCCASIONAL
<i>Torilis japonica</i>	Upright Hedge-parsley	RARE
<i>Trifolium pratense</i>	Red Clover	OCCASIONAL
<i>Trifolium repens</i>	White Clover	OCCASIONAL
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	RARE
<i>Tussilago farfara</i>	Colt's-foot	RARE
<i>Ulex europaeus</i>	Gorse	RARE
<i>Urtica dioica</i>	Common Nettle	FREQUENT
<i>Vicia cracca</i>	Tufted Vetch	FREQUENT
<i>Vicia hirsuta</i>	Hairy Tare	RARE
<i>Vicia sepium</i>	Bush Vetch	RARE

**BUDE MARSHES - EMBANKMENT 2 ALONG PATH FROM SS20920578 TO SS20770589**

<i>Acer pseudoplatanus</i>	Sycamore	RARE
<i>Achillea millefolium</i>	Yarrow	RARE
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Anisantha sterilis</i>	Barren Brome	OCCASIONAL
<i>Anthriscus sylvestris</i>	Cow Parsley	RARE
<i>Arctium minus</i>	Lesser Burdock	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	FREQUENT
<i>Artemisia vulgaris</i>	Mugwort	RARE
<i>Arum maculatum</i>	Lords-and-ladies	OCCASIONAL
<i>Brassica nigra</i>	Black Mustard	RARE
<i>Calystegia silvatica</i>	Large Bindweed	OCCASIONAL
<i>Cirsium arvense</i>	Creeping Thistle	OCCASIONAL
<i>Conium maculatum</i>	Hemlock	RARE
<i>Crataegus monogyna</i>	Hawthorn	FREQUENT
<i>Cruciata laevipes</i>	Crosswort	RARE

**BUDE MARSHES - EMBANKMENT 2 ALONG PATH FROM SS20920578 TO SS20770589**

<i>Dactylis glomerata</i>	Cock's-foot	FREQUENT
<i>Dryopteris filix-mas</i>	Male-fern	RARE
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Eupatorium cannabinum</i>	Hemp-agrimony	RARE
<i>Festuca rubra</i> agg.	Red Fescue	OCCASIONAL
<i>Galium aparine</i>	Goosegrass	FREQUENT
<i>Galium mollugo</i>	Great Hedge Bedstraw	FREQUENT
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	OCCASIONAL
<i>Geranium robertianum</i>	Herb-Robert	RARE
<i>Hedera helix</i> subsp. <i>hibernica</i>	Atlantic Ivy	FREQUENT

<i>Heracleum sphondylium</i>	Cow Parsnip	FREQUENT
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Hordeum murinum</i>	Wall Barley	RARE
<i>Iris foetidissima</i>	Gladdon	OCCASIONAL
<i>Lathyrus pratensis</i>	Meadow Vetchling	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	FREQUENT
<i>Malus domestica</i>	Apple	RARE
<i>Odontites vernus</i> subsp. <i>serotinus</i>	Common Red Bartsia	RARE
<i>Phalaris arundinacea</i>	Reed Canary-grass	OCCASIONAL
<i>Phyllitis scolopendrium</i>	Hart's-tongue Fern	RARE
<i>Plantago major</i>	Greater Plantain	OCCASIONAL
<i>Poa trivialis</i>	Rough Meadow-grass	OCCASIONAL
<i>Potentilla reptans</i>	Creeping Cinquefoil	OCCASIONAL
<i>Quercus cerris</i>	Turkey Oak	RARE
<i>Quercus petraea</i>	Sessile Oak	RARE
<i>Ranunculus repens</i>	Creeping Buttercup	RARE
<i>Rubus fruticosus</i> agg.	Blackberry	ABUNDANT
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	FREQUENT
<i>Sambucus nigra</i>	Elder	RARE
<i>Symphytum x uplandicum</i>	Russian Comfrey	RARE
<i>Taraxacum officinale</i> agg.	Common Dandelion	RARE
<i>Trifolium repens</i>	White Clover	FREQUENT
<i>Urtica dioica</i>	Common Nettle	FREQUENT
<i>Vicia cracca</i>	Tufted Vetch	FREQUENT
<i>Vicia sepium</i>	Bush Vetch	RARE
<i>Viola odorata</i>	Sweet Violet	RARE
<b>BUDE MARSHES - MOWN EMBANKMENT 3 ON WESTERN SIDE OF RIVERBANK FROM SS20920578 TO SS20860562</b>		
<i>Achillea millefolium</i>	Yarrow	RARE
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Anthriscus sylvestris</i>	Cow Parsley	OCCASIONAL
<i>Apium graveolens</i>	Wild Celery	RARE
<i>Arctium lappa</i>	Greater Burdock	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL
<b>BUDE MARSHES - MOWN EMBANKMENT 3 ON WESTERN SIDE OF RIVERBANK FROM SS20920578 TO SS20860562</b>		
<i>Calystegia sepium</i> subsp. <i>roseata</i>	Rosy Hedge Bindweed	OCCASIONAL
<i>Carex riparia</i>	Great Pond-sedge	FREQUENT
<i>Cirsium arvense</i>	Creeping Thistle	RARE
<i>Elytrigia repens</i> var. <i>aristata</i>	Awned Common Couch Grass	OCCASIONAL
<i>Epilobium obscurum</i>	Short-fruited Willowherb	RARE
<i>Festuca arundinacea</i>	Tall Fescue	OCCASIONAL
<i>Festuca rubra</i> agg.	Red Fescue	RARE
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	RARE



<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL
<i>Holcus lanatus</i>	Yorkshire-fog	OCCASIONAL
<i>Impatiens glandulifera</i>	Himalayan Balsam	OCCASIONAL
<i>Juncus articulatus</i>	Jointed Rush	RARE
<i>Juncus effusus</i>	Soft-rush	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	FREQUENT
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Phragmites australis</i>	Common Reed	FREQUENT
<i>Picris echioides</i>	Bristly Oxtongue	RARE
<i>Plantago major</i>	Greater Plantain	RARE
<i>Potentilla anserina</i>	Silverweed	OCCASIONAL
<i>Pulicaria dysenterica</i>	Common Fleabane	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	RARE
<i>Salix viminalis</i>	Common Osier	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	OCCASIONAL
<i>Sonchus oleraceus</i>	Milk-thistle	RARE
<i>Symphytum x uplandicum</i>	Russian Comfrey	RARE
<i>Tripleurospermum maritimum</i>	Sea Mayweed	RARE
<i>Vicia tetrasperma</i>	Smooth Tare	RARE

**BUDE MARSHES - UNMOWN EMBANKMENT 4 ON WESTERN SIDE OF RIVERBANK FROM SS20860562 TO SS20850541**

<i>Alnus glutinosa</i>	Alder	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	FREQUENT
<i>Brachypodium sylvaticum</i>	Slender False Brome	RARE
<i>Calystegia sepium</i> subsp. <i>roseata</i>	Rosy Hedge Bindweed	FREQUENT
<i>Cardamine hirsuta</i>	Hairy Bitter-cress	RARE
<i>Carex riparia</i>	Great Pond-sedge	OCCASIONAL
<i>Chaerophyllum temulum</i>	Rough Chervil	RARE
<i>Eupatorium cannabinum</i>	Hemp-agrimony	RARE
<i>Festuca gigantea</i>	Giant Fescue	RARE
<i>Galium aparine</i>	Goosegrass	RARE
<i>Hedera helix</i> subsp. <i>hibernica</i>	Atlantic Ivy	RARE
<i>Impatiens glandulifera</i>	Himalayan Balsam	ABUNDANT
<i>Iris foetidissima</i>	Gladdon	RARE
<i>Lapsana communis</i>	Nipplewort	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE

**BUDE MARSHES - UNMOWN EMBANKMENT 4 ON WESTERN SIDE OF RIVERBANK FROM SS20860562 TO SS20850541**

<i>Oenanthe crocata</i>	Hemlock dropwort	Water-	OCCASIONAL
<i>Phalaris arundinacea</i>	Reed Canary-grass		OCCASIONAL
<i>Phragmites australis</i>	Common Reed		ABUNDANT
<i>Polystichum setiferum</i>	Soft Shield-fern		RARE
<i>Rubus fruticosus</i> agg.	Blackberry		OCCASIONAL
<i>Salix fragilis</i> var. <i>furcata</i>	Crack Willow		RARE
<i>Salix viminalis</i>	Common Osier		RARE
<i>Salix x multinervis</i>	hybrid willow		RARE

<i>Silene dioica</i>	Red Campion	RARE
<i>Solanum dulcamara</i>	Bittersweet	RARE
<i>Urtica dioica</i>	Common Nettle	OCCASIONAL
<b>BUDE MARSHES - EMBANKMENT 5a ON EAST CANAL FROM SS20840542 TO SS20840561</b>		
<i>Alnus glutinosa</i>	Alder	RARE
<i>Angelica sylvestris</i>	Wild Angelica	OCCASIONAL
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Artemisia vulgaris</i>	Mugwort	RARE
<i>Calystegia sepium</i> subsp. <i>roseata</i>	Rosy Hedge Bindweed	OCCASIONAL
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	OCCASIONAL
<i>Carex riparia</i>	Great Pond-sedge	OCCASIONAL
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	Common Mouse-ear Chickweed	RARE
<i>Cirsium arvense</i>	Creeping Thistle	OCCASIONAL
<i>Crataegus monogyna</i>	Hawthorn	RARE
<i>Dactylis glomerata</i>	Cock's-foot	OCCASIONAL
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Equisetum arvense</i>	Field Horsetail	FREQUENT
<i>Equisetum x litorale</i>	Shore Horsetail	RARE
<i>Festuca arundinacea</i>	Tall Fescue	OCCASIONAL
<i>Festuca rubra</i> agg.	Red Fescue	OCCASIONAL
<i>Filipendula ulmaria</i>	Meadowsweet	OCCASIONAL
<i>Galium aparine</i>	Goosegrass	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Impatiens glandulifera</i>	Himalayan Balsam	RARE
<i>Iris pseudacorus</i>	Yellow Iris	OCCASIONAL
<i>Juncus articulatus</i>	Jointed Rush	RARE
<i>Juncus effusus</i>	Soft-rush	RARE
<i>Lathyrus pratensis</i>	Meadow Vetchling	RARE
<i>Linaria vulgaris</i>	Common Toadflax	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	OCCASIONAL
<i>Lotus pedunculatus</i>	Large Bird's-foot-trefoil	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Oenanthe crocata</i>	Hemlock Water- dropwort	OCCASIONAL
<i>Phragmites australis</i>	Common Reed	OCCASIONAL
<i>Plantago lanceolata</i>	Ribwort Plantain	RARE
<i>Plantago major</i>	Greater Plantain	RARE
<b>BUDE MARSHES - EMBANKMENT 5a ON EAST CANAL FROM SS20840542 TO SS20840561</b>		
<i>Poa annua</i>	Annual Meadow-grass	RARE
<i>Potentilla anserina</i>	Silverweed	OCCASIONAL
<i>Potentilla reptans</i>	Creeping Cinquefoil	RARE
<i>Pulicaria dysenterica</i>	Common Fleabane	OCCASIONAL
<i>Ranunculus acris</i>	Meadow Buttercup	FREQUENT
<i>Rubus fruticosus</i> agg.	Blackberry	FREQUENT

<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	OCCASIONAL
<i>Scirpus sylvaticus</i>	Wood Club-rush	OCCASIONAL
<i>Stachys palustris</i>	Marsh Woundwort	RARE
<i>Taraxacum officinale</i> agg.	Common Dandelion	RARE
<i>Trifolium pratense</i>	Red Clover	OCCASIONAL
<i>Urtica dioica</i>	Common Nettle	FREQUENT
<i>Vicia cracca</i>	Tufted Vetch	OCCASIONAL
<i>Vicia sativa</i> subsp. <i>segetalis</i>	Common Vetch	RARE

**BUDE MARSHES - SCRUBBY EMBANKMENT 5b EAST OF CANAL FROM SS20840561 TO SS20760590**

<i>Acer pseudoplatanus</i>	Sycamore	RARE
<i>Achillea millefolium</i>	Yarrow	OCCASIONAL
<i>Agrostis capillaris</i>	Common Bent-grass	RARE
<i>Agrostis stolonifera</i>	Fiorin	OCCASIONAL
<i>Alliaria petiolata</i>	Garlic Mustard	RARE
<i>Anagallis arvensis</i> subsp. <i>arvensis</i>	Scarlet Pimpernel	RARE
<i>Angelica sylvestris</i>	Wild Angelica	RARE
<i>Arctium minus</i>	Lesser Burdock	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	FREQUENT
<i>Artemisia vulgaris</i>	Mugwort	RARE
<i>Arum maculatum</i>	Lords-and-ladies	RARE
<i>Brassica nigra</i>	Black Mustard	RARE
<i>Calystegia silvatica</i>	Large Bindweed	OCCASIONAL
<i>Carex remota</i>	Remote Sedge	RARE
<i>Carex riparia</i>	Great Pond-sedge	RARE
<i>Centaurea nigra</i>	Common Knapweed	OCCASIONAL
<i>Cirsium vulgare</i>	Spear Thistle	OCCASIONAL
<i>Conyza canadensis</i>	Canadian Fleabane	RARE
<i>Crataegus monogyna</i>	Hawthorn	OCCASIONAL
<i>Dactylis glomerata</i>	Cock's-foot	OCCASIONAL
<i>Dryopteris dilatata</i>	Broad Buckler-fern	RARE
<i>Elytrigia repens</i>	Common-couch	OCCASIONAL
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Equisetum arvense</i>	Field Horsetail	FREQUENT
<i>Eupatorium cannabinum</i>	Hemp-agrimony	RARE
<i>Festuca rubra</i> agg.	Red Fescue	OCCASIONAL
<i>Filipendula ulmaria</i>	Meadowsweet	RARE
<i>Fraxinus excelsior</i>	Ash	RARE
<i>Fumaria bastardii</i>	Tall Ramping-fumitory	RARE
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	RARE

**BUDE MARSHES - SCRUBBY EMBANKMENT 5b EAST OF CANAL FROM SS20840561 TO SS20760590**

<i>Geranium robertianum</i>	Herb-Robert	RARE
<i>Glechoma hederacea</i>	Ground-ivy	FREQUENT
<i>Hedera helix</i> subsp. <i>hibernica</i>	Atlantic Ivy	ABUNDANT
<i>Hypochaeris radicata</i>	Cat's-ear	RARE
<i>Impatiens glandulifera</i>	Himalayan Balsam	OCCASIONAL

<i>Iris pseudacorus</i>	Yellow Iris	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	FREQUENT
<i>Matricaria discoidea</i>	Pineapple Mayweed	RARE
<i>Medicago lupulina</i>	Black Medick	RARE
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	OCCASIONAL
<i>Phyllitis scolopendrium</i>	Hart's-tongue Fern	RARE
<i>Picris echioides</i>	Bristly Oxtongue	RARE
<i>Plantago lanceolata</i>	Ribwort Plantain	FREQUENT
<i>Polystichum setiferum</i>	Soft Shield-fern	RARE
<i>Potentilla reptans</i>	Creeping Cinquefoil	RARE
<i>Prunella vulgaris</i>	Selfheal	RARE
<i>Prunus spinosa</i>	Blackthorn	RARE
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Ranunculus repens</i>	Creeping Buttercup	RARE
<i>Rubus fruticosus</i> agg.	Blackberry	FREQUENT
<i>Rumex crispus</i>	Curled Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Salix viminalis</i>	Common Osier	FREQUENT
<i>Senecio jacobaea</i>	Common Ragwort	OCCASIONAL
<i>Silene dioica</i>	Red Campion	RARE
<i>Sonchus asper</i>	Prickly Sow-thistle	RARE
<i>Stachys sylvatica</i>	Hedge Woundwort	RARE
<i>Symphytum x uplandicum</i>	Russian Comfrey	RARE
<i>Trifolium repens</i>	White Clover	FREQUENT
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	RARE
<i>Urtica dioica</i>	Common Nettle	ABUNDANT
<i>Valeriana officinalis</i>	Common Valerian	RARE
<i>Vicia sepium</i>	Bush Vetch	RARE

**BUDE MARSHES - REEDBED 6 - SS208057, CLOSED REEDBED WITH SOME PREVIOUSLY CUT AREAS AND DITCHES**

<i>Alisma plantago-aquatica</i>	Water-plantain	RARE
<i>Angelica sylvestris</i>	Wild Angelica	RARE
<i>Apium nodiflorum</i>	Fool's-water-cress	RARE
<i>Athyrium filix-femina</i>	Lady-fern	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	RARE
<i>Callitriche obtusangula</i>	Blunt-fruited Water-starwort	RARE
<i>Callitriche stagnalis</i>	Common Water-starwort	RARE
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	OCCASIONAL
<i>Cardamine hirsuta</i>	Hairy Bitter-cress	RARE
<i>Carex otrubae</i>	False Fox-sedge	RARE
<i>Carex riparia</i>	Great Pond-sedge	FREQUENT

**BUDE MARSHES - REEDBED 6 - SS208057, CLOSED REEDBED WITH SOME PREVIOUSLY CUT AREAS AND DITCHES**

<i>Chrysosplenium oppositifolium</i>	Opposite-leaved Golden-saxifrage	RARE
<i>Epilobium hirsutum</i>	Great Willowherb	RARE

<i>Eupatorium cannabinum</i>	Hemp-agrimony	OCCASIONAL
<i>Filipendula ulmaria</i>	Meadowsweet	OCCASIONAL
<i>Galium palustre</i> subsp. <i>elongatum</i>	Great Marsh-bedstraw	FREQUENT
<i>Geranium robertianum</i>	Herb-Robert	RARE
<i>Impatiens glandulifera</i>	Himalayan Balsam	FREQUENT
<i>Iris pseudacorus</i>	Yellow Iris	RARE
<i>Juncus articulatus</i>	Jointed Rush	RARE
<i>Juncus bufonius</i>	Toad Rush	RARE
<i>Juncus inflexus</i>	Hard Rush	RARE
<i>Lemna minor</i>	Common Duckweed	RARE
<i>Lotus pedunculatus</i>	Large Bird's-foot-trefoil	RARE
<i>Lychnis flos-cuculi</i>	Ragged-Robin	OCCASIONAL
<i>Lycopus europaeus</i>	Gypsywort	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Mentha aquatica</i>	Water Mint	FREQUENT
<i>Myosotis laxa</i> subsp. <i>caespitosa</i>	Tufted Forget-me-not	FREQUENT
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	OCCASIONAL
<i>Persicaria hydropiper</i>	Water-pepper	RARE
<i>Phragmites australis</i>	Common Reed	DOMINANT
<i>Pulicaria dysenterica</i>	Common Fleabane	RARE
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	OCCASIONAL
<i>Salix viminalis</i>	Common Osier	OCCASIONAL
<i>Scirpus sylvaticus</i>	Wood Club-rush	RARE
<i>Scrophularia auriculata</i>	Water Figwort	RARE
<i>Scutellaria galericulata</i>	Skull-cap	RARE
<i>Solanum dulcamara</i>	Bittersweet	RARE
<i>Sparganium erectum</i>	Branched Bur-reed	OCCASIONAL
<i>Stachys palustris</i>	Marsh Woundwort	RARE
<i>Stellaria uliginosa</i>	Bog Stitchwort	RARE
<i>Typha latifolia</i>	Great Reedmace	OCCASIONAL
<i>Urtica dioica</i>	Common Nettle	RARE
<i>Valeriana officinalis</i>	Common Valerian	RARE

**BUDE MARSHES - OPEN AREA IN REEDBED 6a - SS208057, OPEN AREA NEAR BIRD HIDE AND AROUND PONDS**

<i>Angelica sylvestris</i>	Wild Angelica	RARE
<i>Apium graveolens</i>	Wild Celery	RARE
<i>Azolla filiculoides</i>	Water Fern	OCCASIONAL
<i>Bidens tripartita</i>	Trifid Bur-marigold	RARE
<i>Carex otrubae</i>	False Fox-sedge	OCCASIONAL
<i>Carex remota</i>	Remote Sedge	RARE
<i>Galium palustre</i> subsp. <i>elongatum</i>	Great Marsh-bedstraw	FREQUENT
<i>Holcus lanatus</i>	Yorkshire-fog	OCCASIONAL

**BUDE MARSHES - OPEN AREA IN REEDBED 6a - SS208057, OPEN AREA NEAR BIRD HIDE AND AROUND PONDS**

<i>Impatiens glandulifera</i>	Himalayan Balsam	FREQUENT
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<i>Iris pseudacorus</i>	Yellow Iris	OCCASIONAL
<i>Juncus effusus</i>	Soft-rush	OCCASIONAL
<i>Lagarosiphon major</i>	Curly Water-thyme	OCCASIONAL
<i>Lemna minor</i>	Common Duckweed	RARE
<i>Lychnis flos-cuculi</i>	Ragged-Robin	RARE
<i>Mentha aquatica</i>	Water Mint	OCCASIONAL
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	FREQUENT
<i>Phragmites australis</i>	Common Reed	ABUNDANT
<i>Ranunculus acris</i>	Meadow Buttercup	RARE
<i>Ranunculus flammula</i> subsp. <i>flammula</i>	Lesser Spearwort	RARE
<i>Ranunculus repens</i>	Creeping Buttercup	OCCASIONAL
<i>Typha latifolia</i>	Great Reedmace	OCCASIONAL
<i>Veronica beccabunga</i>	Brooklime	RARE
<b>BUDE MARSHES - MOWN EMBANKMENT 7 ON WEST SIDE OF RIVER FROM SS20920580 TO SS20840611</b>		
<i>Anisantha sterilis</i>	Barren Brome	OCCASIONAL
<i>Arctium lappa</i>	Greater Burdock	OCCASIONAL
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Beta vulgaris</i> subsp. <i>maritima</i>	Sea Beet	RARE
<i>Brassica nigra</i>	Black Mustard	OCCASIONAL
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	FREQUENT
<i>Calystegia silvatica</i>	Large Bindweed	FREQUENT
<i>Cirsium arvense</i>	Creeping Thistle	FREQUENT
<i>Epilobium hirsutum</i>	Great Willowherb	OCCASIONAL
<i>Heracleum sphondylium</i>	Cow Parsnip	FREQUENT
<i>Phragmites australis</i>	Common Reed	FREQUENT
<i>Pulicaria dysenterica</i>	Common Fleabane	RARE
<i>Rubus fruticosus</i> agg.	Blackberry	FREQUENT
<i>Rumex crispus</i>	Curled Dock	OCCASIONAL
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	OCCASIONAL
<i>Stachys palustris</i>	Marsh Woundwort	FREQUENT
<i>Symphytum x uplandicum</i>	Russian Comfrey	RARE
<i>Urtica dioica</i>	Common Nettle	OCCASIONAL
<b>BUDE MARSHES - REEDBED 8 - SS208058</b>		
<i>Alisma plantago-aquatica</i>	Water-plantain	RARE
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	OCCASIONAL
<i>Epilobium hirsutum</i>	Great Willowherb	OCCASIONAL
<i>Eupatorium cannabinum</i>	Hemp-agrimony	OCCASIONAL
<i>Juncus effusus</i>	Soft-rush	OCCASIONAL
<i>Lemna minor</i>	Common Duckweed	RARE
<i>Lycopus europaeus</i>	Gypsywort	OCCASIONAL
<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Myosotis laxa</i> subsp. <i>caespitosa</i>	Tufted Forget-me-not	RARE
<b>BUDE MARSHES - REEDBED 8 - SS208058</b>		

<i>Oenanthe crocata</i>	Hemlock Water- dropwort	RARE
<i>Phalaris arundinacea</i>	Reed Canary-grass	OCCASIONAL
<i>Phragmites australis</i>	Common Reed	DOMINANT
<i>Scrophularia auriculata</i>	Water Figwort	RARE
<i>Solanum dulcamara</i>	Bittersweet	RARE
<i>Sparganium erectum</i>	Branched Bur-reed	RARE
<i>Urtica dioica</i>	Common Nettle	OCCASIONAL
<b>BUDE MARSHES - MOWN AREA 9 EAST OF VISITOR'S CENTRE - SS20830612</b>		
<i>Achillea millefolium</i>	Yarrow	FREQUENT
<i>Centaurea nigra</i>	Common Knapweed	FREQUENT
<i>Heracleum sphondylium</i>	Cow Parsnip	FREQUENT
<i>Holcus lanatus</i>	Yorkshire-fog	ABUNDANT
<i>Lolium perenne</i>	Perennial Rye-grass	ABUNDANT
<i>Malva sylvestris</i>	Common Mallow	OCCASIONAL
<i>Medicago arabica</i>	Spotted Medick	RARE
<i>Medicago lupulina</i>	Black Medick	OCCASIONAL
<i>Ranunculus repens</i>	Creeping Buttercup	ABUNDANT
<i>Rumex obtusifolius</i>	Broad-leaved Dock	OCCASIONAL
<i>Trifolium repens</i>	White Clover	ABUNDANT
<b>BUDE MARSHES - ROUGH GRASSLAND 10 SOUTH OF VISITOR'S CENTRE - SS208060</b>		
<i>Agrostis capillaris</i>	Common Bent-grass	OCCASIONAL
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	OCCASIONAL
<i>Calystegia silvatica</i>	Large Bindweed	OCCASIONAL
<i>Carex flacca</i>	Glaucous Sedge	FREQUENT
<i>Carex hirta</i>	Hairy Sedge	OCCASIONAL
<i>Centaurea nigra</i>	Common Knapweed	FREQUENT
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	Common Mouse-ear Chickweed	FREQUENT
<i>Cirsium arvense</i>	Creeping Thistle	RARE
<i>Convolvulus arvensis</i>	Field Bindweed	RARE
<i>Crataegus monogyna</i>	Hawthorn	RARE
<i>Crepis capillaris</i>	Smooth Hawk's-beard	OCCASIONAL
<i>Cynosurus cristatus</i>	Crested Dog's-tail	OCCASIONAL
<i>Dactylis glomerata</i>	Cock's-foot	FREQUENT
<i>Daucus carota</i>	Wild Carrot	FREQUENT
<i>Festuca arundinacea</i>	Tall Fescue	OCCASIONAL
<i>Festuca rubra</i> agg.	Red Fescue	ABUNDANT
<i>Hedera helix</i> subsp. <i>hibernica</i>	Atlantic Ivy	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Hypericum tetrapterum</i>	Square-stemmed St John's-wort	OCCASIONAL

<i>Juncus inflexus</i>	Hard Rush	OCCASIONAL
<i>Lathyrus pratensis</i>	Meadow Vetchling	OCCASIONAL
<b>BUDE MARSHES - ROUGH GRASSLAND 10 SOUTH OF VISITOR'S CENTRE - SS208060</b>		
<i>Leontodon saxatilis</i>	Lesser Hawkbit	FREQUENT
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil	OCCASIONAL
<i>Medicago lupulina</i>	Black Medick	OCCASIONAL
<i>Melilotus altissimus</i>	Tall Melilot	OCCASIONAL
<i>Mentha aquatica</i>	Water Mint	RARE
<i>Odontites vernus</i> subsp. <i>serotinus</i>	Common Red Bartsia	RARE
<i>Ononis repens</i>	Common Restharrow	FREQUENT
<i>Ophrys apifera</i>	Bee Orchid	RARE
<i>Phleum bertolonii</i>	Smaller Cat's-tail	OCCASIONAL
<i>Picris echioides</i>	Bristly Oxtongue	OCCASIONAL
<i>Plantago lanceolata</i>	Ribwort Plantain	OCCASIONAL
<i>Poa pratensis</i>	Smooth Meadow-grass	FREQUENT
<i>Potentilla anserina</i>	Silverweed	OCCASIONAL
<i>Potentilla reptans</i>	Creeping Cinquefoil	FREQUENT
<i>Prunella vulgaris</i>	Selfheal	FREQUENT
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Rubus fruticosus</i> agg.	Blackberry	OCCASIONAL
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Senecio erucifolius</i>	Hoary Ragwort	FREQUENT
<i>Senecio jacobaea</i>	Common Ragwort	RARE
<i>Trifolium pratense</i>	Red Clover	OCCASIONAL
<i>Urtica dioica</i>	Common Nettle	OCCASIONAL
<i>Vicia cracca</i>	Tufted Vetch	OCCASIONAL
<b>BUDE MARSHES - ROUGH MARSHY GRASSLAND 10a SOUTH OF VISITOR'S CENTRE - SS208060</b>		
<i>Angelica sylvestris</i>	Wild Angelica	OCCASIONAL
<i>Arrhenatherum elatius</i>	False Oat-grass	FREQUENT
<i>Carex hirta</i>	Hairy Sedge	FREQUENT
<i>Carex otrubae</i>	False Fox-sedge	FREQUENT
<i>Cirsium arvense</i>	Creeping Thistle	FREQUENT
<i>Epilobium hirsutum</i>	Great Willowherb	FREQUENT
<i>Filipendula ulmaria</i>	Meadowsweet	RARE
<i>Iris pseudacorus</i>	Yellow Iris	OCCASIONAL
<i>Juncus inflexus</i>	Hard Rush	FREQUENT
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Melilotus altissimus</i>	Tall Melilot	ABUNDANT
<i>Mentha aquatica</i>	Water Mint	FREQUENT
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	FREQUENT
<i>Phalaris arundinacea</i>	Reed Canary-grass	FREQUENT
<i>Poa pratensis</i>	Smooth Meadow-grass	FREQUENT
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Rumex conglomeratus</i>	Clustered Dock	FREQUENT



<b>BUDE MARSHES - REEDBED 11 WITH OPEN AREAS AND SCRUB - SS207059</b>		
<i>Agrostis stolonifera</i>	Fiorin	OCCASIONAL
<i>Alisma plantago-aquatica</i>	Water-plantain	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	RARE
<b>BUDE MARSHES - REEDBED 11 WITH OPEN AREAS AND SCRUB - SS207059</b>		
<i>Bolboschoenus maritimus</i>	Sea Club-rush	FREQUENT
<i>Carex hirta</i>	Hairy Sedge	OCCASIONAL
<i>Carex pendula</i>	Pendulous Sedge	RARE
<i>Epilobium hirsutum</i>	Great Willowherb	FREQUENT
<i>Equisetum arvense</i>	Field Horsetail	OCCASIONAL
<i>Eupatorium cannabinum</i>	Hemp-agrimony	OCCASIONAL
<i>Filipendula ulmaria</i>	Meadowsweet	OCCASIONAL
<i>Galium aparine</i>	Goosegrass	OCCASIONAL
<i>Iris pseudacorus</i>	Yellow Iris	OCCASIONAL
<i>Lathyrus pratensis</i>	Meadow Vetchling	OCCASIONAL
<i>Lemna minor</i>	Common Duckweed	RARE
<i>Lychnis flos-cuculi</i>	Ragged-Robin	OCCASIONAL
<i>Lycopus europaeus</i>	Gypsywort	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Mentha aquatica</i>	Water Mint	FREQUENT
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	FREQUENT
<i>Phalaris arundinacea</i>	Reed Canary-grass	OCCASIONAL
<i>Phragmites australis</i>	Common Reed	DOMINANT
<i>Rubus fruticosus</i> agg.	Blackberry	OCCASIONAL
<i>Rumex conglomeratus</i>	Clustered Dock	OCCASIONAL
<i>Salix alba</i>	White Willow	OCCASIONAL
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	OCCASIONAL
<i>Sparganium erectum</i>	Branched Bur-reed	RARE
<i>Stachys sylvatica</i>	Hedge Woundwort	RARE
<i>Symphytum x uplandicum</i>	Russian Comfrey	OCCASIONAL
<b>BUDE MARSHES - OPEN AREA AROUND POND 11a - SS20790599</b>		
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Alisma plantago-aquatica</i>	Water-plantain	RARE
<i>Arctium minus</i>	Lesser Burdock	OCCASIONAL
<i>Callitriche stagnalis</i>	Common Water-starwort	OCCASIONAL
<i>Cardamine pratensis</i>	Cuckooflower	OCCASIONAL
<i>Carex hirta</i>	Hairy Sedge	RARE
<i>Carex otrubae</i>	False Fox-sedge	OCCASIONAL
<i>Dactylis glomerata</i>	Cock's-foot	FREQUENT
<i>Equisetum arvense</i>	Field Horsetail	RARE
<i>Eupatorium cannabinum</i>	Hemp-agrimony	OCCASIONAL
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Iris pseudacorus</i>	Yellow Iris	OCCASIONAL
<i>Juncus bufonius</i>	Toad Rush	OCCASIONAL
<i>Juncus inflexus</i>	Hard Rush	OCCASIONAL
<i>Lemna minor</i>	Common Duckweed	RARE

<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	OCCASIONAL
<i>Phragmites australis</i>	Common Reed	OCCASIONAL
<i>Picris echioides</i>	Bristly Oxtongue	OCCASIONAL
<i>Plantago lanceolata</i>	Ribwort Plantain	FREQUENT
<i>Poa trivialis</i>	Rough Meadow-grass	OCCASIONAL
<i>Potentilla reptans</i>	Creeping Cinquefoil	OCCASIONAL
<b>BUDE MARSHES - OPEN AREA AROUND POND 11a - SS20790599</b>		
<i>Pulicaria dysenterica</i>	Common Fleabane	ABUNDANT
<i>Rubus fruticosus</i> agg.	Blackberry	OCCASIONAL
<i>Scrophularia auriculata</i>	Water Figwort	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	OCCASIONAL
<i>Symphytum x uplandicum</i>	Russian Comfrey	FREQUENT
<b>BUDE MARSH 12 - POND 12 - SS20790599</b>		
<i>Alisma plantago-aquatica</i>	Water-plantain	RARE
<b>PETHERICK'S MILL MARSH - EMBANKMENT 1a AND 1b - SS20990568 TO SS20990541</b>		
<i>Agrostis stolonifera</i>	Fiorin	RARE
<i>Alnus glutinosa</i>	Alder	RARE
<i>Angelica sylvestris</i>	Wild Angelica	OCCASIONAL
<i>Aquilegia vulgaris</i>	Columbine	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Brassica nigra</i>	Black Mustard	FREQUENT
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	FREQUENT
<i>Calystegia silvatica</i>	Large Bindweed	RARE
<i>Carex otrubae</i>	False Fox-sedge	RARE
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	Common Mouse-ear Chickweed	RARE
<i>Cirsium arvense</i>	Creeping Thistle	OCCASIONAL
<i>Cirsium vulgare</i>	Spear Thistle	RARE
<i>Conium maculatum</i>	Hemlock	RARE
<i>Convolvulus arvensis</i>	Field Bindweed	RARE
<i>Dactylis glomerata</i>	Cock's-foot	FREQUENT
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Epilobium obscurum</i>	Short-fruited Willowherb	RARE
<i>Eupatorium cannabinum</i>	Hemp-agrimony	RARE
<i>Festuca rubra</i> agg.	Red Fescue	RARE
<i>Filipendula ulmaria</i>	Meadowsweet	RARE
<i>Galium mollugo</i>	Great Hedge Bedstraw	RARE
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	RARE
<i>Geranium molle</i>	Dove's-foot Crane's-bill	RARE
<i>Hedera helix</i> subsp. <i>hibernica</i>	Atlantic Ivy	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL

<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Hypochaeris radicata</i>	Cat's-ear	RARE
<i>Iris foetidissima</i>	Gladdon	RARE
<i>Juncus effusus</i>	Soft-rush	RARE
<i>Lathyrus nissolia</i>	Grass Vetchling	RARE
<i>Lathyrus nissolia</i>	Grass Vetchling	RARE
<i>Lathyrus pratensis</i>	Meadow Vetchling	RARE
<i>Lavatera arborea</i>	Tree-mallow	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	OCCASIONAL
<i>Medicago lupulina</i>	Black Medick	OCCASIONAL
<b>PETHERICK'S MILL MARSH - EMBANKMENT 1a AND 1b - SS20990568 TO SS20990541</b>		
<i>Mentha spicata</i>	Spear Mint	RARE
<i>Phleum pratense</i>	Timothy	RARE
<i>Phragmites australis</i>	Common Reed	RARE
<i>Picris echioides</i>	Bristly Oxtongue	FREQUENT
<i>Plantago lanceolata</i>	Ribwort Plantain	OCCASIONAL
<i>Potentilla anserina</i>	Silverweed	RARE
<i>Potentilla reptans</i>	Creeping Cinquefoil	RARE
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Ranunculus acris</i>	Meadow Buttercup	RARE
<i>Ranunculus repens</i>	Creeping Buttercup	RARE
<i>Rubus fruticosus</i> agg.	Blackberry	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Rumex crispus</i>	Curled Dock	RARE
<i>Rumex sanguineus</i>	Wood Dock	RARE
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	RARE
<i>Salix viminalis</i>	Common Osier	RARE
<i>Salix x multinervis</i>	hybrid willow	RARE
<i>Scrophularia auriculata</i>	Water Figwort	RARE
<i>Senecio jacobaea</i>	Common Ragwort	RARE
<i>Sison amomum</i>	Stone Parsley	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Stachys sylvatica</i>	Hedge Woundwort	RARE
<i>Trifolium pratense</i>	Red Clover	RARE
<i>Trifolium repens</i>	White Clover	OCCASIONAL
<i>Tripleurospermum inodorum</i>	Scentless Mayweed	RARE
<i>Urtica dioica</i>	Common Nettle	RARE
<i>Vicia cracca</i>	Tufted Vetch	RARE
<b>PETHERICK'S MILL MARSH - DITCH 2 - SS20990568 TO SS20990543</b>		
<i>Alisma plantago-aquatica</i>	Water-plantain	OCCASIONAL
<i>Bolboschoenus maritimus</i>	Sea Club-rush	ABUNDANT
<i>Callitriche obtusangula</i>	Blunt-fruited Water-starwort	ABUNDANT
<i>Eleocharis palustris</i>	Common Spike-rush	OCCASIONAL
<i>Elodea nuttallii</i>	Nuttall's Waterweed	FREQUENT
<i>Glyceria fluitans</i>	Flote-grass	OCCASIONAL
<i>Myosotis laxa</i> subsp. <i>caespitosa</i>	Tufted Forget-me-not	RARE

<i>Phragmites australis</i>	Common Reed	LOCALLY ABUNDANT
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush	FREQUENT
<i>Sparganium erectum</i>	Branched Bur-reed	ABUNDANT
<i>Typha latifolia</i>	Great Reedmace	RARE
<i>Veronica catenata</i>	Pink Water-speedwell	OCCASIONAL
<i>Zannichellia palustris</i>	Horned Pondweed	OCCASIONAL
<b>PETHERICK'S MILL MARSH - DITCH MARGIN AND GRASS VERGE 3 AND 3a - SS20990568 TO SS20990543</b>		
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Angelica sylvestris</i>	Wild Angelica	OCCASIONAL
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	FREQUENT
<i>Brassica nigra</i>	Black Mustard	OCCASIONAL
<i>Calystegia silvatica</i>	Large Bindweed	OCCASIONAL
<i>Eleocharis palustris</i>	Common Spike-rush	OCCASIONAL
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Eupatorium cannabinum</i>	Hemp-agrimony	OCCASIONAL
<i>Festuca arundinacea</i>	Tall Fescue	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL
<i>Holcus lanatus</i>	Yorkshire-fog	OCCASIONAL
<i>Juncus effusus</i>	Soft-rush	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	FREQUENT
<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Mentha aquatica</i>	Water Mint	FREQUENT
<i>Persicaria hydropiper</i>	Water-pepper	RARE
<i>Phalaris arundinacea</i>	Reed Canary-grass	RARE
<i>Phragmites australis</i>	Common Reed	OCCASIONAL
<i>Picris echioides</i>	Bristly Oxtongue	OCCASIONAL
<i>Plantago major</i>	Greater Plantain	RARE
<i>Potentilla anserina</i>	Silverweed	RARE
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Ranunculus repens</i>	Creeping Buttercup	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Rumex crispus</i>	Curled Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Salix x multinervis</i>	hybrid willow	RARE
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush	RARE
<i>Sonchus asper</i>	Prickly Sow-thistle	RARE
<i>Stachys palustris</i>	Marsh Woundwort	OCCASIONAL
<i>Trifolium repens</i>	White Clover	FREQUENT
<i>Urtica dioica</i>	Common Nettle	OCCASIONAL
<b>PETHERICK'S MILL MARSH - EMBANKMENT AND VERGE 4 AND 4a -</b>		

<b>SS20980542 TO SS20890541</b>		
<i>Agrostis stolonifera</i>	Fiorin	ABUNDANT
<i>Brassica nigra</i>	Black Mustard	RARE
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	RARE
<i>Cirsium arvense</i>	Creeping Thistle	OCCASIONAL
<i>Crepis capillaris</i>	Smooth Hawk's-beard	RARE
<i>Dactylis glomerata</i>	Cock's-foot	FREQUENT
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Festuca rubra</i> agg.	Red Fescue	FREQUENT
<i>Holcus lanatus</i>	Yorkshire-fog	ABUNDANT
<i>Juncus effusus</i>	Soft-rush	OCCASIONAL
<b>PETHERICK'S MILL MARSH - EMBANKMENT AND VERGE 4 AND 4a - SS20980542 TO SS20890541</b>		
<i>Lolium perenne</i>	Perennial Rye-grass	ABUNDANT
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Phragmites australis</i>	Common Reed	LOCALLY ABUNDANT
<i>Picris echioides</i>	Bristly Oxtongue	OCCASIONAL
<i>Plantago lanceolata</i>	Ribwort Plantain	FREQUENT
<i>Pulicaria dysenterica</i>	Common Fleabane	RARE
<i>Ranunculus acris</i>	Meadow Buttercup	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	OCCASIONAL
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Trifolium dubium</i>	Lesser Trefoil	RARE
<i>Trifolium repens</i>	White Clover	FREQUENT
<i>Urtica dioica</i>	Common Nettle	OCCASIONAL
<b>PETHERICK'S MILL MARSH - GRASS VERGE 5 - SS20980568 TO SS20960543</b>		
<i>Agrostis stolonifera</i>	Fiorin	ABUNDANT
<i>Alnus glutinosa</i>	Alder	RARE
<i>Angelica sylvestris</i>	Wild Angelica	OCCASIONAL
<i>Arctium lappa</i>	Greater Burdock	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL
<i>Brassica nigra</i>	Black Mustard	RARE
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	FREQUENT
<i>Cirsium arvense</i>	Creeping Thistle	RARE
<i>Cirsium vulgare</i>	Spear Thistle	RARE
<i>Crataegus monogyna</i>	Hawthorn	RARE
<i>Dactylis glomerata</i>	Cock's-foot	OCCASIONAL
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Epilobium hirsutum</i>	Great Willowherb	OCCASIONAL
<i>Festuca rubra</i> agg.	Red Fescue	RARE
<i>Galium aparine</i>	Goosegrass	RARE
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	RARE
<i>Holcus lanatus</i>	Yorkshire-fog	OCCASIONAL
<i>Juncus effusus</i>	Soft-rush	RARE

<i>Juncus inflexus</i>	Hard Rush	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	FREQUENT
<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Mentha aquatica</i>	Water Mint	OCCASIONAL
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	RARE
<i>Persicaria hydropiper</i>	Water-pepper	RARE
<i>Phleum pratense</i>	Timothy	RARE
<i>Phragmites australis</i>	Common Reed	LOCALLY ABUNDANT
<i>Picris echioides</i>	Bristly Oxtongue	OCCASIONAL
<i>Potentilla anserina</i>	Silverweed	OCCASIONAL
<i>Pulicaria dysenterica</i>	Common Fleabane	OCCASIONAL
<b>PETHERICK'S MILL MARSH - GRASS VERGE 5 - SS20980568 TO SS20960543</b>		
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Rumex crispus</i>	Curled Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	OCCASIONAL
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	RARE
<i>Salix x multinervis</i>	hybrid willow	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Trifolium repens</i>	White Clover	FREQUENT
<i>Urtica dioica</i>	Common Nettle	FREQUENT
<b>PETHERICK'S MILL MARSH - DITCH 6 - SS20980568 TO SS20960543</b>		
<i>Agrostis stolonifera</i>	Fiorin	OCCASIONAL
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	ABUNDANT
<i>Festuca rubra</i> agg.	Red Fescue	RARE
<i>Lemna minor</i>	Common Duckweed	RARE
<i>Phragmites australis</i>	Common Reed	LOCALLY ABUNDANT
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush	OCCASIONAL
<i>Sparganium erectum</i>	Branched Bur-reed	OCCASIONAL
<i>Typha latifolia</i>	Great Reedmace	RARE
<i>Zannichellia palustris</i>	Horned Pondweed	OCCASIONAL
<b>PETHERICK'S MILL MARSH - DITCH 6a - SS20960543 TO SS20930542</b>		
<i>Juncus effusus</i>	Soft-rush	FREQUENT
<i>Phragmites australis</i>	Common Reed	DOMINANT
<i>Zannichellia palustris</i>	Horned Pondweed	OCCASIONAL
<b>PETHERICK'S MILL MARSH - DITCH 6b - SS20930542 TO SS20890543</b>		
<i>Agrostis stolonifera</i>	Fiorin	OCCASIONAL
<i>Bolboschoenus maritimus</i>	Sea Club-rush	FREQUENT
<i>Eleocharis palustris</i>	Common Spike-rush	FREQUENT
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Juncus articulatus</i>	Jointed Rush	OCCASIONAL
<i>Juncus effusus</i>	Soft-rush	OCCASIONAL
<i>Rumex conglomeratus</i>	Clustered Dock	RARE

<i>Ruppia maritima</i>	Beaked Tasselweed	FREQUENT
<i>Zannichellia palustris</i>	Horned Pondweed	OCCASIONAL
<b>PETHERICK'S MILL MARSH - EMBANKMENT 7 - SS20920571 TO SS20880542</b>		
<i>Achillea millefolium</i>	Yarrow	FREQUENT
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Brassica nigra</i>	Black Mustard	OCCASIONAL
<i>Buddleja davidii</i>	Butterfly-bush	RARE
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	Common Mouse-ear Chickweed	RARE
<i>Cirsium arvense</i>	Creeping Thistle	FREQUENT
<i>Cirsium vulgare</i>	Spear Thistle	RARE
<i>Crocoshmia x crocosmiiflora</i>	Montbretia	RARE
<i>Dactylis glomerata</i>	Cock's-foot	ABUNDANT
<b>PETHERICK'S MILL MARSH - EMBANKMENT 7 - SS20920571 TO SS20880542</b>		
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Epilobium montanum</i>	Broad-leaved Willowherb	RARE
<i>Festuca arundinacea</i>	Tall Fescue	RARE
<i>Filipendula ulmaria</i>	Meadowsweet	RARE
<i>Galium mollugo</i>	Great Hedge Bedstraw	RARE
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL
<i>Holcus lanatus</i>	Yorkshire-fog	ABUNDANT
<i>Hypericum perforatum</i>	Perforate St John's-wort	RARE
<i>Hypochaeris radicata</i>	Cat's-ear	RARE
<i>Impatiens glandulifera</i>	Himalayan Balsam	RARE
<i>Juncus effusus</i>	Soft-rush	RARE
<i>Lotus pedunculatus</i>	Large Bird's-foot-trefoil	FREQUENT
<i>Oenanthe crocata</i>	Hemlock Water- dropwort	OCCASIONAL
<i>Phyllitis scolopendrium</i>	Hart's-tongue Fern	RARE
<i>Picris echioides</i>	Bristly Oxtongue	OCCASIONAL
<i>Plantago lanceolata</i>	Ribwort Plantain	OCCASIONAL
<i>Plantago major</i>	Greater Plantain	RARE
<i>Prunella vulgaris</i>	Selfheal	RARE
<i>Prunus spinosa</i>	Blackthorn	RARE
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Quercus</i> sp.	Oak	RARE
<i>Rubus fruticosus</i> agg.	Blackberry	FREQUENT
<i>Rumex acetosa</i>	Common Sorrel	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Rumex crispus</i>	Curled Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	OCCASIONAL
<i>Salix cinerea</i> subsp. <i>oleifolia</i>	Grey Willow	RARE
<i>Senecio jacobaea</i>	Common Ragwort	RARE
<i>Sonchus asper</i>	Prickly Sow-thistle	RARE

<i>Stellaria graminea</i>	Lesser Stitchwort	RARE
<i>Taraxacum officinale</i> agg.	Common Dandelion	RARE
<i>Trifolium dubium</i>	Lesser Trefoil	RARE
<i>Trifolium repens</i>	White Clover	FREQUENT
<i>Urtica dioica</i>	Common Nettle	FREQUENT
<i>Vicia cracca</i>	Tufted Vetch	RARE
<b>PETHERICK'S MILL MARSH - RIVERBANK 8a - SS20930576 TO SS20880560</b>		
<i>Alliaria petiolata</i>	Garlic Mustard	RARE
<i>Anagallis arvensis</i> subsp. <i>arvensis</i>	Scarlet Pimpernel	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Atriplex prostrata</i>	Hastate Orache	OCCASIONAL
<i>Beta vulgaris</i> subsp. <i>maritima</i>	Sea Beet	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL
<i>Brassica nigra</i>	Black Mustard	OCCASIONAL
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	RARE
<i>Cardamine flexuosa</i>	Wavy Bitter-cress	RARE
<i>Chenopodium polyspermum</i>	Many-seeded Goosefoot	RARE
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<b>PETHERICK'S MILL MARSH - RIVERBANK 8a - SS20930576 TO SS20880560</b>		
<i>Festuca arundinacea</i>	Tall Fescue	RARE
<i>Festuca rubra</i> agg.	Red Fescue	FREQUENT
<i>Galeopsis tetrahit</i>	Common Hemp-nettle	RARE
<i>Galium aparine</i>	Goosegrass	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	FREQUENT
<i>Impatiens glandulifera</i>	Himalayan Balsam	OCCASIONAL
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Oenanthe crocata</i>	Hemlock Water- dropwort	OCCASIONAL
<i>Persicaria hydropiper</i>	Water-pepper	RARE
<i>Persicaria maculosa</i>	Willow Weed	RARE
<i>Phragmites australis</i>	Common Reed	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Tripleurospermum maritimum</i>	Sea Mayweed	RARE
<i>Vicia cracca</i>	Tufted Vetch	RARE
<i>Vicia sativa</i> subsp. <i>segetalis</i>	Common Vetch	RARE
<i>Vicia tetrasperma</i>	Smooth Tare	RARE
<b>PETHERICK'S MILL MARSH - RIVERBANK 8b - SS20870551 TO SS20880560</b>		
<i>Arrhenatherum elatius</i>	False Oat-grass	FREQUENT
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	FREQUENT
<i>Cirsium arvense</i>	Creeping Thistle	RARE
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Galium aparine</i>	Goosegrass	RARE
<i>Holcus lanatus</i>	Yorkshire-fog	OCCASIONAL
<i>Impatiens glandulifera</i>	Himalayan Balsam	FREQUENT
<i>Mentha aquatica</i>	Water Mint	RARE
<i>Oenanthe crocata</i>	Hemlock Water- dropwort	RARE



<i>Phragmites australis</i>	Common Reed	ABUNDANT
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Urtica dioica</i>	Common Nettle	OCCASIONAL
<b>PETHERICK'S MILL MARSH - RIVERBANK 8c AND 8d - SS20870551 TO SS20890538</b>		
<i>Anthriscus sylvestris</i>	Cow Parsley	OCCASIONAL
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	FREQUENT
<i>Cirsium arvense</i>	Creeping Thistle	OCCASIONAL
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Festuca rubra</i> agg.	Red Fescue	OCCASIONAL
<i>Galium aparine</i>	Goosegrass	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL
<i>Impatiens glandulifera</i>	Himalayan Balsam	OCCASIONAL
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	RARE
<i>Phalaris arundinacea</i>	Reed Canary-grass	RARE
<i>Phragmites australis</i>	Common Reed	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Sonchus oleraceus</i>	Milk-thistle	OCCASIONAL
<i>Urtica dioica</i>	Common Nettle	FREQUENT
<b>PETHERICK'S MILL MARSH - MARSH 9a - SS20890544 TO SS20890559</b>		
<i>Agrostis stolonifera</i>	Fiorin	DOMINANT
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	RARE
<i>Deschampsia cespitosa</i>	Tufted Hair-grass	RARE
<i>Eleocharis palustris</i>	Common Spike-rush	OCCASIONAL
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Glyceria fluitans</i>	Flote-grass	OCCASIONAL
<i>Iris pseudacorus</i>	Yellow Iris	RARE
<i>Juncus effusus</i>	Soft-rush	OCCASIONAL
<i>Juncus inflexus</i>	Hard Rush	RARE
<i>Juncus x diffusus</i>	hybrid rush	RARE
<i>Oenanthe crocata</i>	Hemlock Water-dropwort	OCCASIONAL
<i>Ranunculus repens</i>	Creeping Buttercup	OCCASIONAL
<i>Rumex conglomeratus</i>	Clustered Dock	OCCASIONAL
<i>Rumex obtusifolius</i>	Broad-leaved Dock	OCCASIONAL
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<b>PETHERICK'S MILL MARSH - MARSH 9b - SS20910558 TO SS20920571</b>		
<i>Agrostis stolonifera</i>	Fiorin	DOMINANT
<i>Alopecurus geniculatus</i>	Marsh Foxtail	RARE
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL

<i>Glyceria fluitans</i>	Flote-grass	OCCASIONAL
<i>Lolium perenne</i>	Perennial Rye-grass	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Potentilla anserina</i>	Silverweed	OCCASIONAL
<i>Pulicaria dysenterica</i>	Common Fleabane	RARE
<i>Ranunculus repens</i>	Creeping Buttercup	OCCASIONAL
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Senecio erucifolius</i>	Hoary Ragwort	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Sonchus asper</i>	Prickly Sow-thistle	RARE
<i>Sonchus oleraceus</i>	Milk-thistle	RARE
<b>PETHERICK'S MILL MARSH - MARSH 9c - SS20910564</b>		
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Phragmites australis</i>	Common Reed	DOMINANT
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<b>PETHERICK'S MILL MARSH - MARSH 9d - SS20930569</b>		
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL
<i>Phragmites australis</i>	Common Reed	DOMINANT
<b>PETHERICK'S MILL MARSH - EMBANKMENT 10a AND 10b - SS20920571 TO SS20940575</b>		
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT
<i>Brassica nigra</i>	Black Mustard	ABUNDANT
<i>Cirsium arvense</i>	Creeping Thistle	FREQUENT
<b>PETHERICK'S MILL MARSH - EMBANKMENT 10a AND 10b - SS20920571 TO SS20940575</b>		
<i>Dactylis glomerata</i>	Cock's-foot	ABUNDANT
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Heracleum sphondylium</i>	Cow Parsnip	OCCASIONAL
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Picris echioides</i>	Bristly Oxtongue	RARE
<i>Rumex acetosa</i>	Common Sorrel	OCCASIONAL
<i>Taraxacum officinale</i> agg.	Common Dandelion	RARE
<i>Urtica dioica</i>	Common Nettle	ABUNDANT
<b>PETHERICK'S MILL MARSH - DITCH 11 - SS20950575 TO SS20980569</b>		
<i>Alisma plantago-aquatica</i>	Water-plantain	RARE
<i>Callitriche obtusangula</i>	Blunt-fruited Water-starwort	FREQUENT
<i>Phragmites australis</i>	Common Reed	DOMINANT
<i>Veronica catenata</i>	Pink Water-speedwell	OCCASIONAL
<i>Zannichellia palustris</i>	Horned Pondweed	RARE
<b>PETHERICK'S MILL MARSH - EMBANKMENT 12 - SS20990569 TO SS20960575</b>		
<i>Arctium lappa</i>	Greater Burdock	RARE
<i>Arrhenatherum elatius</i>	False Oat-grass	ABUNDANT

<i>Brassica nigra</i>	Black Mustard	OCCASIONAL
<i>Calystegia silvatica</i>	Large Bindweed	OCCASIONAL
<i>Carex hirta</i>	Hairy Sedge	FREQUENT
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	Common Mouse-ear Chickweed	RARE
<i>Cirsium arvense</i>	Creeping Thistle	FREQUENT
<i>Conium maculatum</i>	Hemlock	RARE
<i>Elytrigia repens</i>	Common-couch	ABUNDANT
<i>Eupatorium cannabinum</i>	Hemp-agrimony	RARE
<i>Festuca rubra</i> agg.	Red Fescue	FREQUENT
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Juncus inflexus</i>	Hard Rush	RARE
<i>Medicago lupulina</i>	Black Medick	OCCASIONAL
<i>Picris echioides</i>	Bristly Oxtongue	FREQUENT
<i>Potentilla reptans</i>	Creeping Cinquefoil	FREQUENT
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Ranunculus repens</i>	Creeping Buttercup	OCCASIONAL
<i>Rubus fruticosus</i> agg.	Blackberry	OCCASIONAL
<i>Rumex conglomeratus</i>	Clustered Dock	OCCASIONAL
<i>Rumex crispus</i>	Curled Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	OCCASIONAL
<i>Salix viminalis</i>	Common Osier	RARE
<i>Senecio erucifolius</i>	Hoary Ragwort	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	OCCASIONAL
<i>Trifolium repens</i>	White Clover	OCCASIONAL
<i>Vicia sativa</i> subsp. <i>segetalis</i>	Common Vetch	RARE

**PETHERICK'S MILL MARSH - VERGE 13 AND 13a - SS20950575 TO SS20970569**

<i>Agrostis stolonifera</i>	Fiorin	ABUNDANT
<i>Brassica nigra</i>	Black Mustard	RARE
<i>Elytrigia repens</i>	Common-couch	FREQUENT
<i>Equisetum arvense</i>	Field Horsetail	RARE
<i>Festuca arundinacea</i>	Tall Fescue	RARE
<i>Festuca rubra</i> agg.	Red Fescue	OCCASIONAL
<i>Geranium dissectum</i>	Cut-leaved Crane's-bill	RARE
<i>Heracleum sphondylium</i>	Cow Parsnip	FREQUENT
<i>Holcus lanatus</i>	Yorkshire-fog	FREQUENT
<i>Hordeum murinum</i>	Wall Barley	RARE
<i>Lolium perenne</i>	Perennial Rye-grass	FREQUENT
<i>Medicago lupulina</i>	Black Medick	RARE
<i>Mentha aquatica</i>	Water Mint	OCCASIONAL
<i>Persicaria hydropiper</i>	Water-pepper	RARE
<i>Phragmites australis</i>	Common Reed	RARE
<i>Picris echioides</i>	Bristly Oxtongue	RARE
<i>Plantago major</i>	Greater Plantain	RARE
<i>Poa annua</i>	Annual Meadow-grass	RARE
<i>Polygonum aviculare</i>	Knotgrass	OCCASIONAL

<i>Potentilla anserina</i>	Silverweed	FREQUENT
<i>Potentilla reptans</i>	Creeping Cinquefoil	OCCASIONAL
<i>Pulicaria dysenterica</i>	Common Fleabane	FREQUENT
<i>Ranunculus acris</i>	Meadow Buttercup	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	OCCASIONAL
<i>Senecio erucifolius</i>	Hoary Ragwort	RARE
<i>Trifolium repens</i>	White Clover	FREQUENT
<i>Viburnum opulus</i>	Guelder-rose	RARE
<i>Vicia sativa</i> subsp. <i>segetalis</i>	Common Vetch	RARE
<b>PETHERICK'S MILL MARSH - DITCH 14 - SS20930571 TO SS20940573 TO SS20970568</b>		
<i>Bolboschoenus maritimus</i>	Sea Club-rush	FREQUENT
<i>Calystegia sepium</i> subsp. <i>sepium</i>	Common Bindweed	OCCASIONAL
<i>Phragmites australis</i>	Common Reed	DOMINANT
<b>PETHERICK'S MILL MARSH - MARSH 15 - SS20940573 TO SS20950551</b>		
<i>Agrostis stolonifera</i>	Fiorin	ABUNDANT
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL
<i>Carex otrubae</i>	False Fox-sedge	RARE
<i>Eleocharis palustris</i>	Common Spike-rush	RARE
<i>Elytrigia repens</i> var. <i>aristata</i>	Awned Common Couch Grass	RARE
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Juncus effusus</i>	Soft-rush	RARE
<i>Juncus gerardii</i>	Saltmarsh Rush	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Phragmites australis</i>	Common Reed	RARE
<i>Picris echioides</i>	Bristly Oxtongue	OCCASIONAL
<i>Potentilla anserina</i>	Silverweed	OCCASIONAL
<b>PETHERICK'S MILL MARSH - MARSH 15 - SS20940573 TO SS20950551</b>		
<i>Pulicaria dysenterica</i>	Common Fleabane	OCCASIONAL
<i>Ranunculus repens</i>	Creeping Buttercup	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	RARE
<i>Sonchus asper</i>	Prickly Sow-thistle	RARE
<i>Trifolium repens</i>	White Clover	RARE
<b>PETHERICK'S MILL MARSH - MARSH 16 - SS20940573 TO SS20890543</b>		
<i>Agrostis stolonifera</i>	Fiorin	FREQUENT
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	DOMINANT
<i>Potentilla anserina</i>	Silverweed	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush	OCCASIONAL
<b>PETHERICK'S MILL MARSH - MARSH 17 - SS209054</b>		
<i>Agrostis stolonifera</i>	Fiorin	ABUNDANT
<i>Alopecurus geniculatus</i>	Marsh Foxtail	OCCASIONAL

<i>Arrhenatherum elatius</i>	False Oat-grass	RARE
<i>Atriplex prostrata</i>	Hastate Orache	OCCASIONAL
<i>Bolboschoenus maritimus</i>	Sea Club-rush	RARE
<i>Cirsium arvense</i>	Creeping Thistle	RARE
<i>Epilobium hirsutum</i>	Great Willowherb	RARE
<i>Glyceria fluitans</i>	Flote-grass	FREQUENT
<i>Juncus effusus</i>	Soft-rush	LOCALLY ABUNDANT
<i>Juncus gerardii</i>	Saltmarsh Rush	RARE
<i>Juncus inflexus</i>	Hard Rush	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	OCCASIONAL
<i>Oenanthe crocata</i>	Hemlock Water- dropwort	OCCASIONAL
<i>Plantago major</i>	Greater Plantain	OCCASIONAL
<i>Pulicaria dysenterica</i>	Common Fleabane	RARE
<i>Ranunculus repens</i>	Creeping Buttercup	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Rumex obtusifolius</i>	Broad-leaved Dock	RARE
<i>Sonchus arvensis</i>	Perennial Sow-thistle	OCCASIONAL
<i>Trifolium repens</i>	White Clover	OCCASIONAL
<i>Tripleurospermum maritimum</i>	Sea Mayweed	RARE
<b>PETHERICK'S MILL MARSH - POND 18 - SS20930548 TO SS20880544</b>		
<i>Agrostis stolonifera</i>	Fiorin	RARE
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL
<i>Eleocharis palustris</i>	Common Spike-rush	OCCASIONAL
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Ruppia maritima</i>	Beaked Tasselweed	ABUNDANT
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush	OCCASIONAL
<b>PETHERICK'S MILL MARSH - POND 19 - SS20930548 TO SS20930568</b>		
<i>Atriplex prostrata</i>	Hastate Orache	RARE
<i>Bolboschoenus maritimus</i>	Sea Club-rush	OCCASIONAL
<i>Juncus inflexus</i>	Hard Rush	RARE
<i>Lythrum salicaria</i>	Purple-loosestrife	RARE
<i>Rumex conglomeratus</i>	Clustered Dock	RARE
<i>Ruppia maritima</i>	Beaked Tasselweed	FREQUENT
<i>Schoenoplectus tabernaemontani</i>	Glaucous Bulrush	OCCASIONAL

## 6. Recommendations on monitoring and evaluation

### 6.1 Species monitoring

*Though no Nationally Rare or threatened species were recorded during the survey it would be worthwhile monitoring the populations of the six Cornwall Scarce*

*species found in the survey area – Trifid Bur-marigold Bidens tripartita, Grass Vetchling Lathyrus nissolia, Bee Orchid Ophrys apifera, Beaked Tasselweed Ruppia maritima, Pink Water-speedwell Veronica catenata and Horned Pondweed Zannichellia palustris.*

*Of these species the current management regime appears to be favourable for Grass Vetchling Lathyrus nissolia, Beaked Tasselweed Ruppia maritima, Pink Water-speedwell Veronica catenata and Horned Pondweed Zannichellia palustris and if the current regime continues these species should continue to have healthy populations in the survey area. Monitoring of these species should be a yearly note of which compartments they occur in and a note on population size.*

*Bee Orchid Ophrys apifera appeared in the survey area only in the last few years so the management must have been conducive to a population becoming established in grassland that has developed in Bude Marsh 10. The current regime of occasional cutting of the grassland appears to be favourable to the species but numbers of flowering spikes should be counted each year. These are recognisably 'orchids' so can be counted when flowering in June. However orchid numbers are notorious for fluctuating from year to year, so declines in numbers of flowering spikes may not be a negative result from management.*

*Trifid Bur-marigold Bidens tripartita appears to be a newly recorded species to the survey area but it is likely that it has been in the site but probably over-looked or not recorded. It is growing in Bude Marsh 6a, which is an area of once opened up ponds and ditches within the reedbed. This species needs areas of open mud to colonise, so if the management recommendation of re-opening up of Bude Marsh 6a is carried out it is possible that more plants may appear. Only one plant was counted in 2007 so it should be easy to monitor if the population increases.*

It would also be worthwhile monitoring the population sizes of the Cornwall Local species Greater Burdock *Arctium lappa*, White Willow *Salix alba* and Wood Club-rush *Scirpus sylvaticus*, though if current management regimes continue the populations of them are not expected to change significantly. A yearly note of where they are found would be sufficient.

It is recommended that the populations of the invasive non-native species be monitored though only Himalayan Balsam *Impatiens glandulifera* appears to be increasing at present.

## **6.2 Habitat monitoring**

Before any monitoring of the habitat is suggested, the purpose of monitoring needs to be clear as it uses a lot of manpower and can be costly. If it is to monitor changes in the present vegetation, with the desire to maintain these vegetation types, monitoring is essential. The survey area is a complex area of pathways, scrubby embankment,

swamp, inundation grassland and ponds, which has survived, developed and modification by man's influence, by the construction of the canal, railway and the flood defence embankments. It is likely that further modification will occur in the long-term, so it would be worthwhile establishing what needs monitoring.

It would be worth monitoring the vegetation within Petherick's Mill Marsh, as it is slightly different in character to Bude Marsh and looks more susceptible to change than Bude Marsh.

The low embankments along the west and east banks of the lower reaches of the River Neet have a marked influence on both the two sites in the survey area. Bude Marsh to the west of the river Neet also has the Bude Canal to the west, with a higher water level. With the freshwater in the canal kept artificially high, this freshwater seeps into Bude Marsh and the vegetation is typical of freshwater conditions. The water level is also controlled in the northern part of Bude Marsh (Bude Marsh 8). Petherick's Mill Marsh on the east side of the River Neet is also bordered by a low river embankment. With three openings to the river, the brackish vegetation and conditions of the Petherick's Mill Marsh suggests that it is inundated with at least slightly saline water at times of flood or high tide. Ditch 6, 6a and 6b within the marsh are brackish, with Beaked Tasselweed *Ruppia maritima* and Sea Club-rush *Bolboschoenus maritimus* characteristic species present. Ditch 2 and 11 receive water from another source (not from the river unless at times of flood) and blocked by the slightly elevated path the species present here are characteristic of freshwater conditions.

The level of brackishness in Petherick's Mill Marsh will be influenced by the amount of water entering from the River Neet, so monitoring the vegetation in the Marsh in yearly or five yearly intervals should show if the vegetation is changing. A Phase two survey of vegetation communities, using the National Vegetation Classification methodology would identify this. From field notes from the surveyor from previous visits in 2002 and 2003 it appears that the small stands of Common Reed *Phragmites australis* are becoming larger, especially along the ditches, within the marsh and monitoring should show whether it is increasing. For vascular plants of open vegetation communities too much *Phragmites* is not desired.

## **7. Management suggestions**

The following are general suggestions towards management of the survey area

- ◆ The public uses the survey area for cycling, dog-walking or walking, but this is confined to the pathways that encircle and cross the survey areas. These path sides are necessarily managed more intensively than the main areas of swamp or inundation grassland to make access more easy. The periodic cutting or mowing along the path sides ensures that the verge vegetation is kept low and the species found reflect this management regime. This regime should continue.
- ◆ Some past cutting of reeds is evident, especially in Bude Marsh 6. Continuing some cutting of reeds creating open areas within the reedbeds and ditches would be beneficial to those species that require open areas, such as Celery-leaved Buttercup *Ranunculus sceleratus*, Trifid Bur-marigold *Bidens tripartita* and if mud is exposed quite a diverse flora would develop, even if only temporarily. A

bulldozer or digger would be worth considering clearing some reeds and areas previously opened up (Bude Marsh 6a and 11a) would be the areas to target first.

- ◆ The inundation vegetation in Petherick's Mill Marsh is now mostly closed so a few small shallow scrapes created in parts of 9a, 9b, 15, 16 and 17 would give species of open habitats areas to colonise.
- ◆ The scrub areas with trees (Bude Marsh 1, 2, 5a, 5b) along the embankments are useful as they form a barrier between the heavily used pathways and the marshes. However some parts could be cleared if more viewing points looking into the marshes are required for birders. Some scrub is encroaching into Bude Marsh 11 so it is recommended that numbers of small shrubs are taken out if an open marsh is desired.
- ◆ The grassy areas Bude Marsh 10 and 10a have a high diversity of vascular plants species (including Bee Orchid *Ophrys apifera*) and on the survey visit (August 10<sup>th</sup>) these areas were alive with invertebrates. Current management appears favourable so should continue.
- ◆ Consider some removal or reduction of invasive non-native species. Of these Himalayan Balsam *Impatiens glandulifera* seems to be the species that is increasing but its effect on other species is not recorded so careful thought should be given before removal is considered.

## 8. Acknowledgements

Coralie Barrow of North Cornwall District Council provided maps.

## 9. References

BOTANICAL CORNWALL GROUP. (2006). *Rare Plant Register – provisional list of species*. [http://floracam.co.uk/bcg/rare\\_plant\\_listing.php](http://floracam.co.uk/bcg/rare_plant_listing.php)

CHEFFINGS, C.M. & FARRELL, L. (eds.), DINES, T.D., JONES, R.A., LEACH, S.J., McKEAN, D.R., PEARMAN, D.A., PRESTON, C.D., RUMSEY, F.J., TAYLOR, I. (2005). *The Vascular Plant Red Data List for Great Britain*. Species status 7: 1-116. Peterborough, JNCC.

ERICA for WINDOWS botanical database

JNCC. (1990). *Handbook for Phase 1 habitat survey*. Joint Nature Conservation Committee

JNCC. (2007). UK List of Priority Species and Habitats. *Joint Nature Conservation Committee*

<http://www.ukbap.org.uk/library/BRIG/SHRW/SpeciesandHabitatReviewReport2007andAnnexes1-3.pdf>

<http://www.ukbap.org.uk/library/BRIG/SHRW/SpeciesandHabitatReviewReport2007Annexes4-6.pdf>



## **Appendix E**

### **Survey of bridges**

## **Survey for Otter / American mink presence in Bude Marsh catchment**

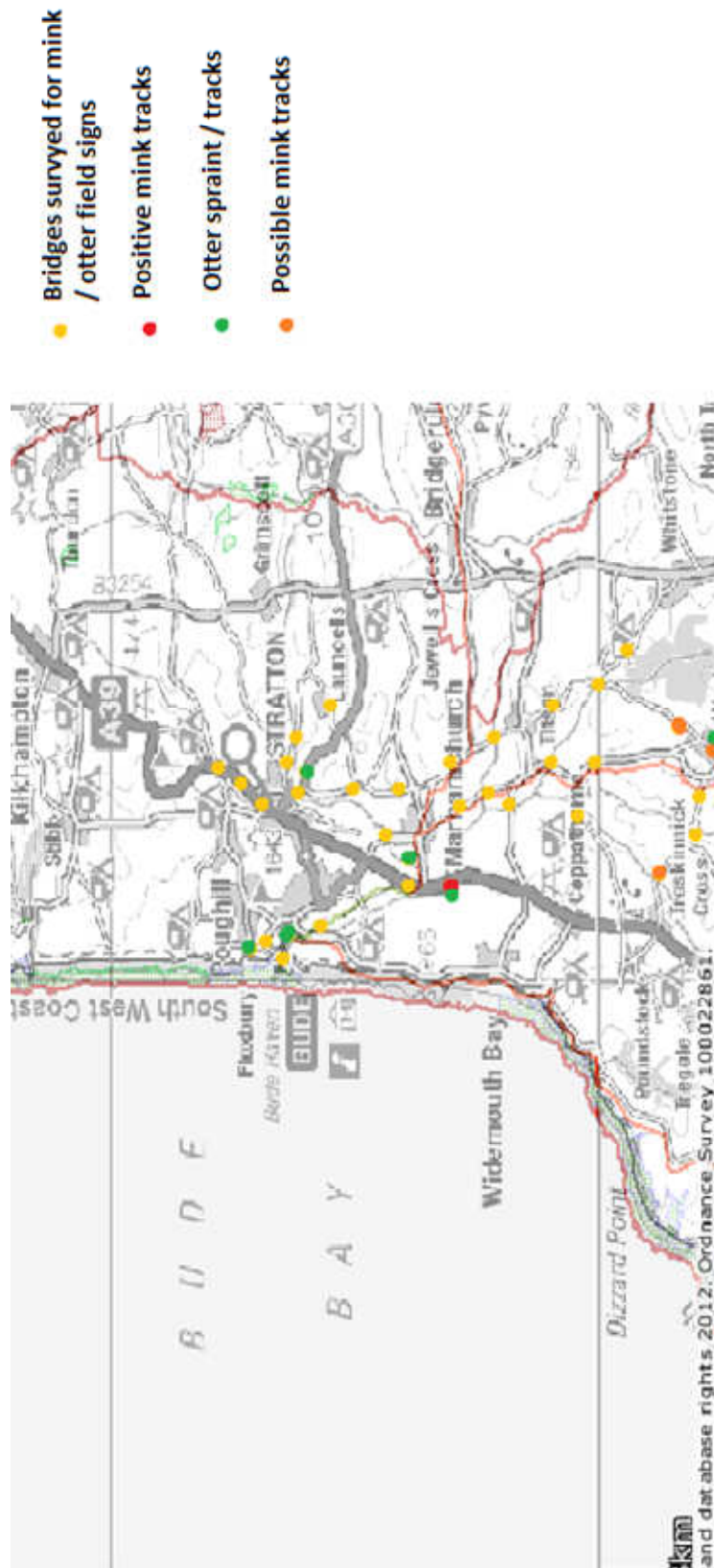
### **Introduction:**

A survey was conducted of the tributaries within the catchment that runs in to Bude Marshes for the presence of American Mink (*Neovison vison*) and European otter (*Lutra lutra*). The survey was carried out on Tuesday 24<sup>th</sup> July by Rebecca Northey and completed on Friday 27<sup>th</sup> July by Derek Gow and Rebecca Northey. The survey concentrated on all locations where the water course passed under accessible road bridges. The surveyors specifically looked under platforms and ledges situated under / within bridges and along the fine silt of the immediate river bank on either side for mink tracks. It is additionally characteristic for mink to use these locations as sprinting areas.

### **Survey:**

In preparation for the survey all areas where road bridges and water crossed were marked on a map – see figure 1 below. The survey then began on a warm dry day from the most northern part of the catchment, working south. This followed 4 dry and warm days which allowed for water levels to stabilise / drop and any fresh field signs to be created and remain in situ. Prior to this heavy rains and fluctuating water levels will have been likely to have washed any field signs away.

Figure 1  
 Map showing locations of bridges surveyed and presence of otter and mink field signs



### Findings:

On the Atlantic Highway A39, there were two road bridges at Bush. On this occasion no signs of mink /otter were seen although the first bridge was inaccessible on foot. The southern bridge did not have a ledge running under the bridge and no field signs were visible in the silts. A local who was spoken with on the day reported that a Mink Farm had previously been located at Bush. Having worked at the farm as a young man he recalled how mink were kept for their pelts until the very last day of legal culling and once mink farming was made illegal all the juvenile mink that had not been culled for their pelts were released into the local environment. From this information the assumed date that juvenile mink would have been released would have been 2000. Bush is just north-west of Stratton and the tributary at Bush leads directly into the river Strat which links with Bude Marshes. No mink field signs were found at the bridges that were surveyed along Bush, Stamford Hill or Stratton. In Stratton there were two road bridges. The northern bridge was accessed and underneath was surveyed thoroughly. Three areas of otter spraint was found along the shillet bank underneath the bridge and footprints were seen – shown below. The second bridge in Stratton was not accessed underneath.



*Otter spraint under bridge in Stratton (above) and otter footprints (below)*



To the west of the catchment at Maer there were 4 ditches with either a bridge or piped culverts. These were all explored as practicable. At the entrance to the two tunnels situated together on Maer Down Road otter spraint and footprints were seen. Along the ditches here a mallard (*Anas platyrhynchos*) duck was seen on the water with approximately 10 ducklings. These ditches are in very close proximity to Maer Lake which lies to the north east. Maer Lake is where the last potential records of water voles were recorded in July / August 1995.



*Otter spraint in tunnel at Maer Down Road*

In the centre of Bude town there are two main bridges which cross the water, one crossing where the water goes out to sea and the other crossing the water as it flows adjacent to the canal into Bude Marsh. Under the road bridge where the canal flows out to the sea was potential otter spraint - seen with binoculars - although many Canadian geese (*Branta Canadensis*) were also present in this area.

No ledge or field signs were found under the road bridge that crosses through Bude town over the water that runs parallel to the canal. Further south is a large foot bridge crossing over the water. Underneath was a large silt build up where two areas of otter spraint and footprints – photos below - were found as well as abundant brown rat (*Rattus norvegicus*) prints.



*Otter spraint (left) otter footprint (right) under bridge at Bude Marshes*

Upstream from this footbridge the Bude canal and the river meet at the Weir. Just above the weir is a large pond which is part of the wildlife centre at the Weir Café/bistro. The owner of the Weir Cafe/Bistro could not recall seeing a mink for the last 15 years but recalled seeing them prior to this on a regular basis from the bridge on the edge of his property. The river passes next to the pond on the other side of a footpath/car park and follows along the main road. Approximately 100 metres upstream just west of Marhamchurch and north of Helscott under the main road bridge were probable mink tracks. These were identified by Derek Gow on the silts of the shelf beneath the bridge. 90 % of the shelf was underwater but on the 10% of

the shelf not submerged the mink tracks were visible. No photo evidence was obtainable at this site, Otter spraint was also found on the rocks above the bridge.



*Equivocal tracks at Week St Mary. Potentially grey squirrel on the left (*Sciurus carolinensis*) and mink on the right.*

At the Week St Mary ford were possible mink tracks. These were no readily distinguishable due to the muddle of rat and otter prints on the bank – photos above. There were also possible mink tracks identified on the small stream at Steele Hill. At Newmill near to Treskinnick Cross there were potential mink tracks on the banking beneath the mill. The owner of the land here was clear that she had not seen mink in the area for 15 years. Otters and cubs have been seen in the area as were a mallard duck and her ducklings on the day. A second member of the public at Marhamchurch recalled the mink hounds working the river but had not personally mink for the last 15 to 20 years. Near to Marhamchurch at Bangors is a fisheries called ‘Hele Barton’. The owner was contacted and had not seen mink for the past 15 – 20 years although he did see the occasional otter.

Just south of the weir the River Strat joins the main river at Helebridge. Helebridge has two arches, the second one which the river does not flow underneath but instead has been incorporated into a large angling lake for Bude Canal Angling Association. The arch of Helebridge with the angling lake had two areas of otter spraint and footprints – photos below. Under the main road bridge next to Helebridge was a small inaccessible bank which could not be surveyed.



*Otter spraint (left) and location of otter spraint under Helebridge at Angling Lake (right)*

All other bridges that were searched did not reveal any mink tracks or spraint. The survey was limited due to many of the river banks underneath the bridges being inaccessible from the road. In these locations binoculars were used to survey for field signs from above the bridge. Ledges underneath the bridges would not have been surveyed if access was unobtainable therefore mink could be present in areas that have not been identified.

### **Conclusion**

The survey found that otter spraint and footprints were frequently identified in the catchment that flows into Bude Marshes. This coupled with local anecdotes of otter sightings suggests that otter presence is widespread in this area. Otter locations in this survey identified presence in Stratton, Helebridge, Maer, Bude Marshes and Week St Mary.

North American mink are known to have been farmed locally at Bush. Anecdotal evidence suggests that mink were farmed until 2000 when legislation made mink farming illegal. Local landowners who own fisheries and lakes have not seen mink for the past 15-20 years. From this survey mink tracks were identified near to Helebridge and potential tracks were located near to Treskinnick Cross and Week St Mary.

**Appendix F**  
**Case studies of previous water vole reintroductions**



## **Case Studies - Reintroductions**

### **Trossachs water vole reintroduction trial – Aberfoyle**

The Trossachs water vole project is a partnership between the Forestry Commission, the Royal Zoological Society of Scotland and the Derek Gow Consultancy Ltd. Partial funding for the project was made available from Scottish Natural Heritage. In 2006 a series of development projects on the outskirts of Glasgow had to remove water voles from their footprints. As there was no adjacent capacity to re-home the water voles in their surrounding environment a receptor site for a large scale reintroduction trial was sought. The 16 mile long valley of the Duchray river above Aberfoyle had undergone a significant process of habitat improvement as a result of the Forest Water Framework Directive. What had formerly been a densely planted commercial conifer forest had been transformed by the complete removal of tree cover to a depth of over 20 meters from the waters edge to allow semi emergent vegetation to re-establish. This process was coupled with an extensive programme of lakes, pool and meander creation. Although water voles had been previously recorded in 'Shady Glen' on the side of Loch Lomond and their old burrow systems were still visible in the peat banks of the Duchray there were no contemporary field signs of their presence. A programme of mink eradication was devised and delivered by the Forestry Commission's field staff and in 2008 the first 350 water voles were reintroduced.

The captured voles were captive bred for three years to provide a substantial numerical and genetic base stock for release. Approximately a third of the released population was black with a high variability in colour types amongst the other individuals involved. Releases were undertaken in May 2008, August 2008, May 2009 and August 2009. After this time the remaining individuals were transferred to the Highland Wildlife Park for overwintering and release in 2010. All of the water voles were micro-chipped and recapture surveys identified wild bred progeny by the end of 2008. The valley of the Duchray is steep sided with only a single inflow and outflow. It is believed that the water vole population has now expanded to colonise all the suitable habitat types within the valley. The reintroduced water vole population has now entered a monitoring and natural expansion phase. This water vole project has been highly successful due to the consistent and hard work of the Forestry Commission staff who have dedicated people and resources for mink control, habitat recreation, survey and research to the water vole project. Water voles are now found throughout the release sites and beyond.

### **Wildfowl and Wetlands Trust – Arundel**

In September 1999 34 water voles were released into the grounds of the Wildfowl and Wetlands Trusts reserve at Arundel. This was the first ever attempt to reintroduce the species using captive bred individuals into a landscape where it was believed to be extinct. Subsequent surveys revealed a few animals in a recapture programme in 2002 and sporadic sightings of single individuals were recorded in 2004. No field signs of this species were found on site during a series of surveys in 2005 and it was presumed that this population had either become extinct or was so numerically low as to be considered unviable in the medium term.

A remarkable aspect of this early attempt was that it succeeded in establishing a small population which survived. The release timing was very late for effective breeding in the year of release as it was believed that water voles commonly cease breeding in mid to late September. Although the project was supported by a further smaller release in the spring of 2002 the numbers involved were small and were drawn almost entirely from a relatively small pool of genetic founders. Genetic interchange is now known to be a critical feature in the successful survival of water vole meta-populations. As soon as isolation occurs even substantial populations are highly vulnerable to a reduction in fecundity. This factor coupled with an absence of immigrating offspring can result in eventual extinction.

A significant flood event in 2001 further compromised the prospects of this population and as a result the concept of attempting to introduce a numerically significant, genetically diverse population at an appropriate seasonal timing was felt to be worth while. On the 16<sup>th</sup> of August 2005, 82 male and 89 female water voles (*Arvicola terrestris*) bred from 7 mixed founder bloodlines at the breeding facility of the Derek Gow Consultancy Ltd near Lifton in Devon were released into the grounds of the Wildfowl and Wetlands Trust's Arundel Centre.

A significant number were released into the newly created 'Wetlands Discovery Area' where they rapidly became used to visitors on boats and proved to be a highly visible and popular feature of the experience. The population was resurveyed from the 7<sup>th</sup> – 11<sup>th</sup> of November using live catch traps in order to assess individual weight gain, breeding status and juvenile abundance. A further follow up survey was undertaken in March 2006. Field signs by this time were well distributed throughout the site and the capture of a 75g juvenile confirmed that there had been breeding. Water voles are now well established throughout the grounds of the site. Free living populations have formed from migrants outwith the fence and at least one of these is now believed to be self sustaining.

## **Dartford Parks**

The development of the Dartford park site in East London by Prologis necessitated the clearance of water voles from a footprint of over 264 acres. A mitigation strategy was designed to accord with the likely requirements of the 2006 Water vole Handbook and in handbook. In 2004 130 captured animals were taken into the captive holding facility of the DGC at Upcott Grange in Devon. Provision had been made in the site development plan for the future establishment of new water bodies and the retention of already existing water vole habitat. There was no capacity to allow the water voles to remain on site while active construction works were undertaken. The mitigation strategy therefore focused on trapping out the onsite population completely to establish a captive breeding programme which would have the capacity to restore a significant population of genetically variable water voles to the Dartford park site once habitat restoration was complete.

Although habitat restoration was originally programmed for 2007, delays to the construction schedule coupled with the slow regeneration of vegetation delayed this process until 2009. In 2009 150 captive bred voles were released into the riparian

edge habitats of Dartford Park. The sites chosen for release were all selected for friable soils and good vegetation cover. This was followed by further population reinforcement in 2010 with a further 71 voles which were late litter juveniles from 2009. A field sign survey in the Autumn of 2010 confirmed that a water voles population was well established throughout the suitable habitats present on site in Dartford Park.

### **Langorse Lake**

Llangorse Lake is the second largest water body in the Brecon Beacons National Park. It has a circumference of 5 miles, a total area of 327 acres and is one mile long. It is relatively low lying at 154 m above sea level and fringed with 10.2 hectares of extensive reed beds, with species rich grassland and woodland dominated by Alder and Willow. Llangorse Lake was created by glacial movements during the last Ice age. In 2009 the Environment Agency proposed the reintroduction of water voles into the lakes surrounding environment. This project had to encompass the water courses which flowed into the lake on surrounding land. It required the support of local farmers and landowners in order to create new habitat through the creation of pool and ditch networks which were fenced to exclude livestock.

A comprehensive programme of mink control had removed the presence of this species from the lake and its feeder streams by early 2009 allowing the first water vole release to proceed in May 2009.

This was followed with further releases in August 2009, May 2010 and again in August 2010. Colonies of water voles were released on the lake itself and into nearby farmland. The project attracted significant media interest and was assisted by local volunteers of the Brecon Wildlife Trust who assisted the release team with every release. In May 2010 a survey of the primary release sites was carried out by trained volunteers and staff from the DGC. Water vole signs were found throughout the survey area.

### **Rutland Water**

The 800 acres of Rutland Water is a relatively recently created wildlife habitat. The site is owned by Anglian water and managed by the Leicestershire and Rutland Wildlife Trust which has a permanent presence based on site. While the reservoir provides a strategic water supply the Nature Reserve is one of the most important wildfowl sanctuaries in Great Britain. It is a site of scientific interest, is designated as an ESPA and is recognised as a globally important wetland RAMSAR site. The reserve contains approximately 100 acres of good quality potential water vole habitat. There are approximately 37 acres of reed beds, 3000 meters of secondary ditch system and 1800 meters of stream or other bank side habitat. Within the wider catchment there is approximately 140 km of further potential habitat.

Museum specimens, historic sightings and field sign records testify that water voles were formerly a common species in Rutland. The Vincent Wildlife Trusts 1989-90 National Water Vole Survey recorded the species presence on 72.4% of surveyed sites in the Anglian region. By 1996-98 this percentage had declined to 29.8% and they

were “patchy...nowhere abundant” on the Gwash. Population estimates based on these regional percentages hypothesised an initial figure of 1,400,735 in 1989 declining to 179,352 by 1998. In the 13 year period between this last national survey and 2011 the Wildlife Trust has continued to monitor a significant decline in the water vole population. They are currently a very rare species in Leicestershire and Rutland.

Although sporadic sightings of water voles have been recorded at Rutland Water in the last few years it would seem likely that the species is now either extinct or present in such low numbers as to be no longer viable. A strategic programme of North American mink control has been in place on site for a number of years using the mink monitoring raft developed by the Game and Wildlife Conservation Trust. The rafts are monitored weekly and no field signs of North American mink have been identified since 2008. A sighting of a single individual was reported in 2009. There are healthy breeding populations of moorhen and little grebe which are both good indicators of a mink free environment. Many other species of wetland birds breed in profusion on the 600 acre site. While it is therefore not likely that a breeding population of mink are present irregular immigrants are probable. The mink rafting programme will be extended in 2011 to cover the entire catchment of Rutland Water.

The current project at Rutland Water aims to reintroduce water voles for at least 2 seasons in order to re-establish a substantive, genetically diverse, meta-population of considerable size and scope. The reintroduction of approximately 400 individual water voles into pre-selected sites commenced in the summer of 2011. This process will continue with reinforcements in the spring and summer of 2012.

### **River Colne - Essex**

The River Colne has recently undergone an extensive Water Vole Recovery Project lead by the Essex Wildlife Trust – Water for Wildlife – initiating in 2007 to present. The project has included large scale mink removal to allow natural re-colonisation, habitat creation and water vole translocations to ensure recovery of the water vole to Essex. The Derek Gow Consultancy has worked with Essex Wildlife Trust on a number of water vole translocation to areas along the River Colne.

A series of potential water vole receptor habitat sites were identified by the Essex Wildlife Trust on the River Colne which is approx 45km as a whole tracked from the headwaters near Stambourne to the estuary mouth at Brightlingsea. The main freshwater channel is from Great Yeldham to Colchester (approx 30km) then the river becomes tidal from Colchester to the estuary mouth. Water voles were formerly present on the river but last recorded in 2004. Historically, the River Colne had a widespread occupancy of water voles, which significantly declined in recent years due to the presence of North American mink. The Essex Wildlife Trust have carried out extensive mink monitoring and trapping prior to water vole translocations.

Along the River Colne water vole translocation have taken place in response to large scale mitigation projects across Essex. The River Colne has been a receptor site for water voles trapped from the London Gateway, M25 ditches and Crossness. 229 water voles were released from London Gateway in June 2010, followed by another 250 in spring 2011. In summer 2011 100 water voles were released from the M25 road widening project, followed by a further 100 in spring 2012. In total a mixture of approximately 700 captive bred and wild caught water voles were released on to the

River Colne between 2010 and 2012. Extensive monitoring by Essex Wildlife Trust employees and volunteers of the re-established population through regular field sign surveys and initial radio-tracking of released populations suggests that it is now well established and expanding.

### **Barn Elms**

Barn Elms is a 105 acre wetland created around the site of a former Victorian reservoir 4 miles from the centre of London. The habitat mosaic of large wet meadows, pools and reed beds was believed to be ideal for water voles. No mink were present on the site and access for this predator was believed to be very difficult due to extensive surrounding conurbations. In the summer of 2001 and spring 2002 a combined total of 200 water voles had been reintroduced to the wetlands centre and subsequent surveys and trapping found that the initial animals had bred and that the population had spread rapidly. By the beginning of 2005 it was apparent that the water vole population had suffered a significant restriction of range and were only inhabiting one main part of the reserve so further animals were released to supplement the population. On the 11<sup>th</sup> June 2006 35 supplementary water voles were released at Barn Elms. This population has now established and flourished to between 3-400 individuals and can be viewed daily on a series of 10 water vole platforms put in and around their habitat. 3 of the platforms are used as feeding stations by the water voles and water voles can be seen feeding here daily by the public visiting the wetlands centre.

### **Netheridge Nature Reserve – Gloucester City Council**

On the 17<sup>th</sup> of August 2005 10 water voles (8 males and 2 females) were released as a component part of a reintroduction project in the Netheridge Nature Reserve on the outskirts of Gloucester (SO 811157). Repeated surveys by site staff have identified that this population is spreading rapidly from the main pool core release area into a substantial network of surrounding ditches. A survey in July 2007 following an extensive period of complete flooding captured 13 individual animals. At the time of writing this population is still extant and extensive.

### **Wild CRU – Upper Thames**

On the 11<sup>th</sup> of April 2005 40 water voles were provided to the Wildlife Conservation and Research Unit of Oxford University as a component population for their trial reintroduction work on the Upper Thames. All the individual animals involved in this project were subcutaneously transpondered and captured on a monthly basis to assess their weight gain, breeding status and survival. Although a full project report has yet to be published the survival of released individuals in good habitat by the end of the summer was as high as 85%. Most of the animals stayed within 500 meters of their release point but a few individuals moved considerable distances. Breeding was highly successful and significant numbers of juveniles were recorded in summer trapping sessions. At the time of writing some of the reintroduced populations from this project are extant and extensive.

## **Monnow**

Water vole reintroduction on the Dore began in the summer of 2006 following a substantive programme of mink rafting by the Game and Wildlife Conservation Trust. 10 unrelated founder populations of water voles were obtained with the consent of the Environment Agency from a number of English and Welsh locations to facilitate this project. This base population was developed to ensure a high degree of genetic variance. Over 300 juveniles were released on the upper Dore in August 2006. Further voles were released in May 2007, followed by another summer release on the lower river in 2007. There was a final Monnow release in spring 2008. Surveys of the initial release sites have identified significant over-winter survival and further field sign surveys will establish the extent and rapidity of range gain. There is now an extensive population of water voles inhabiting the Monnow catchment.

## **Devon County Council – River Axe**

A water vole reintroduction programme was established with East Devon District Council as part of their county Water Vole Recovery project. This took place on the lower end of the River Axe. 202 water voles were released in 2009 at Seaton Marshes - and directly onto the tributaries of the river Axe. Each of the 8 release sites included a pond. Surveys completed in February 2010 found water vole field signs at 4 of the 8 release site which included the main release area at Seaton Marshes. A final follow up water vole release commenced in August 2010 and surveys conducted by East Devon District Council have identified the continued presence of water voles populations.

## **Appendix G**

### **Water vole health screening protocol**

## **Water Vole (*Arvicola amphibius*) Release Project: Disease Screening Protocol**

Water voles (*Arvicola amphibius*), the largest of the British voles, have suffered a significant decline in numbers and distribution over the last few decades. They are now legally protected under Schedule 5, section 9(4) A & B of the Wildlife and Countryside Act (Revised (1998)). Attempts are under way to release captive-bred and wild caught voles back into various British riparian habitats. Before any release can be made, measures must be taken to safeguard the health and welfare of the individual voles and also to prevent the introduction of pathogens to the resident water vole populations. Measures should also be taken to combat the threats to the voles at the release sites, primarily those posed by habitat loss and mink. In addition, the range of infectious agents and parasites carried by any resident voles at the release sites should be identified in case these might cause disease in the naïve released population.

Examination of the minimal literature available on the health problems of and diseases carried by water voles has suggested the following screening plan.

- Veterinary checks of all voles to assess fitness before release (in most cases this would be a brief examination, but a more detailed examination would be required for a proportion of the population)
- Veterinary checks of any sick voles and post-mortems of any dead voles
- Regular weighing and monitoring of body condition, plus examination for ectoparasites of all water voles
- Faecal sampling: basic screening for parasites and also culture.
- Blood sampling: serology to screen for specific diseases e.g. *Francisella tularensis*.

The following screening plan allows testing for those diseases which, in the literature at least, are most likely to pose a threat to the water vole populations.

### **Screening Plan:**

**Faeces**- these may be collected from the latrines in each pen (each pen containing no more than one breeding pair of voles) or cage.

Tests: Screening for **helminths** (e.g. cestodes such as *Hymenolepis nana* / *diminuta*)

**Protozoa** (e.g. *Cryptosporidium parvum*, *Giardia* spp.)

Culture for *Campylobacter* spp *Salmonella* spp. *Yersinia pseudotuberculosis* / *enterocolitica* / *pestis* - *Shigella* spp.

**Bloods**- blood sampling is carried out prior to release. The procedure needs to be carried out under general anaesthetic. 2.5% of the voles to be released are sampled.

Tests: Serology for *Francisella tularensis* *Leptospira* spp.

Blood smears to screen for *Babesia microti*

**External parasites** – regular examination and testing (by culture of hair plucks) if required for ringworm (*Microsporum persicolor* or *Trichophyton mentagraphytes*) and ticks. (The latter are known to carry *Babesia microti* and *Borrelia burgdorferi*, both of unknown significance in this species).

**Post mortems** – 2.5% of the voles to be released are euthanased and post mortemed to check for any abnormalities/ signs of disease.



## **Appendix H**

**Wildlife and Conservation Research Unit of Oxford University (WildCRU)  
Health and Welfare in Reintroductions: A progress report**

# Wildlife Conservation Research Unit (WildCRU)

University of Oxford

## Progress Report

November 2008

### Health and welfare in reintroductions: Lessons from small mammals

Merryl Gelling



## Disease risks in reintroductions

Inadequate disease risk assessment has been cited as a reason for the failure of many wildlife reintroduction programmes. The act of reintroducing a species to a new area brings with it the potential for pathogens to simultaneously be spread to novel environments, with resultant serious implications for the prevalence of enzootic diseases. Conversely, the introduction of naïve, captive-bred individuals to the wild may result in their exposure to parasites and pathogens to which they have no immunity. The impact of disease may be sufficient to negate the potential benefits of a reintroduction programme, and could result in an overall negative impact on wildlife conservation in the local environs should alien pathogens be introduced to extant or sympatric populations of other species at the release site.

The release of infected animals could also pose a risk to the welfare of established wildlife. Animals released into the wild must establish new territories. The resultant contact between released and territory-holding individuals will facilitate the transmission of parasites and disease; with the introduction of new hosts for extant parasites potentially influencing existing host-parasite relationships with extant species in the area. Animals routinely come into contact with conspecifics during: dispersal, competition for mates, territorial encounters etc., all of which may increase opportunities for pathogen transmission. Even where captive-bred animals are relatively free of parasites and disease, when released into vacant habitat they may become exposed to infections from sympatric populations of other species, and they may lack the necessary immunity to combat otherwise benign infections. Conversely, parasites within a captive-bred population may require control to prevent the occurrence of possible deleterious effects augmented by captivity. An important consideration within any reintroduction programme is that a single species is not being reintroduced, instead, a 'biological package' is reintroduced, including the host animal, and its spectre of passenger organisms, which could include viruses, bacteria, fungi, and a range of additional parasites and pathogens.

## Water voles

The water vole, *Arvicola terrestris* (Linnaeus 1758), is a semi-aquatic rodent belonging to the sub-family Arvicolinae, order Rodentia. Water voles were historically common throughout rivers, streams, canals, ditches, dykes, lakes and ponds in lowland UK habitats, as well as in Scottish upland regions. Within the UK, water voles are found living in bank-side burrows in the riparian zone next to slow-flowing freshwater rivers. Individuals hold territories within a colony strung along a water course. Breeding females maintain territories which may be shared with female offspring (natal philopatry); with male ranges overlapping several female territories, and often those of other males. In the wild individuals live on average for 18 months, often surviving for only one winter, during which there is on average a 70% decline in local populations, but this short life expectancy is outweighed by their prodigious breeding capacity.

### *Reasons for decline*

Today, water voles are Britain's most endangered mammal, with numbers estimated to have fallen by up to 95% since the 1960s, making it the UK's fastest-declining mammal. The reasons behind this decline are two-fold. Firstly, severe habitat fragmentation and loss was instigated by agricultural intensification in the 1940s, resulting in large-scale agricultural land management, including canalisation of rivers and drainage modernisation. The second primary factor behind water vole decline is due to the introduction of American mink (*Mustela vison*)

as escapees and purposeful releases from fur farms in the 1950s. These semi-aquatic mustelids subsequently spread throughout the riverine systems in the UK, with disastrous consequences for many of the remaining water vole populations. Despite water voles having a role in the food chain as a food source for many native predators, including grey heron (*Ardea cinerea*) and red fox (*Vulpes vulpes*), the added localised pressure of an invasive species, which proved to be more agile on both land and in water than water voles, and with the added ability of being able to fit into water vole burrows, resulted in a rapid extirpation of many local populations.

## Project Outline

In 1996 a public survey found that taxpayers were willing to pay a further £7.44 in taxes during that year in order to pay for the water vole's biodiversity action plan, despite the fact that the majority of the population may never see a water vole themselves. Reintroducing species, particularly such charismatic species as the water vole, benefits all members of society. Conversely, a failed reintroduction is a waste of both time and money, which may have been better spent elsewhere, and furthermore damages the credibility of the whole concept of reintroductions. The impacts of health and welfare on reintroduction success are increasingly being cited as an area requiring further research. Thus defining methods to aid reintroduction success, using water voles as a model species, will reduce the number of failed projects on a global scale, in addition to benefiting water vole populations, both wild and reintroduced, at a national level.

## Parasites and pathogens in extant populations of wild water voles

Wild water voles were live-trapped at eight sites throughout England and Wales from a variety of different habitats within which they were found to naturally occur, including upland moorland, lowland rivers, and reedbeds located within a protected area. All sites were live-trapped using Sherman XLK 8 x 9 x 30 cm folding aluminium with galvanized steel doors, baited with carrot and apple, and placed at 15m intervals along the water body.

Once captured, water voles were taken to a central sampling point (less than 500m from the trapping site in all cases), where they were anaesthetised using a portable anaesthesia system with an inhalation mixture of oxygen and isoflourane (2%) delivered at a rate of 2 l/min<sup>-1</sup>. Biometric data were taken from anaesthetised animals, including weight (nearest gram), length (nearest 0.5cm), sex and breeding condition, and each individual water vole was given a fur clip mark to ensure it wasn't re-sampled on subsequent trapping days. Biological samples were obtained from each individual for pathogen screening; tracheal aspirates using gavage tubes, urine by external manual palpation of the bladder wherever possible, and fresh faeces via enema. Blood samples were taken via venapuncture of the lateral tail vein. Any obvious ectoparasites were collected with an arbitrary scoring system being developed for ectoparasite load. Once the animals had fully recovered after the procedure they were released at their point of capture.

Fresh faecal samples were sent to be screened for *Campylobacter*, *Salmonella* and *Escherichia coli*. Serum samples were screened for *Toxoplasma gondii*, *AB Puumala* and *Leptospira*. Presence of the coccidian protozoan pathogens *Cryptosporidia* and *Giardia* in faeces were tested for, and faecal samples were analysed for gut parasite eggs using salt floatation.

## Results to date

In total 120 wild individuals have been screened for this work; 78 in 2004 and 42 in 2006. Power analysis suggests that screening 120 animals for a disease present within populations at 5% prevalence gives a probability of failing to detect that disease of 0.002. In practice, it was impossible to obtain all required samples from every individual without compromising animal welfare, thus in total 113 blood samples were taken, 81 urine samples, 101 fresh faecal samples, and 107 faecal samples from the trap or holding box. Laboratory work on these samples is still ongoing.

Fifty-one of the animals sampled (42.5%) were male and 69 (57.5%) female. Weights ranged from 61g – 292g (mean = 163.1g), with head-body lengths ranging from 12 – 22cm (mean = 18cm). Rectal temperature was obtained from 116 animals in total, with a mean temperature of 35.5°C (minimum 32.1°C, maximum 39.2°C).

## Changes in health and welfare of reintroduced captive-bred water voles

Whether or not the source of individuals destined for a reintroduction is wild-caught (translocated from elsewhere) or captive-bred, individual health is likely to be a key factor in determining the ultimate success of the scheme. Such initiatives often fail, due to a low success rate for the survival of either the reintroduced cohort, or their progeny, and there has been little attempt to explain the causes of this failure. The accidental introduction of a novel pathogen or parasite into a new area may have severe impacts upon extant individuals; either of the same host species in a different location where reintroduction is being used as a tool to bolster an existing population, or to sympatric populations of other species.

Even endemic parasites and pathogens, which do not exhibit clinical symptoms may have significant negative effects on reproduction and survival, thereby reducing the probability of population establishment and ultimately leading to reintroduction failure. In addition, established wildlife may be at risk from the release of infected animals and captive-reared animals that are relatively free of – and have no immunity to – certain pathogens may be exposed to infections from sympatric populations of other species. The rate of interaction between individuals post-reintroduction is likely to increase as reintroduced animals establish new territories. The resultant social contact may therefore facilitate the transmission of pathogens and parasites.

I investigated the accumulation of parasites and pathogens in water voles reintroduced under experimental conditions to six sites throughout the Upper Thames region in Oxfordshire, UK over three years: 2005, 2006 and 2007. I looked at changes over time of pathogens and parasites known to be of significance, both in individuals within the released cohort, and in subsequent juveniles born on site. I focused upon the changes in pathogen load of four specific pathogens: *Cryptosporidia*, *Giardia* and *Leptospira*, as well as ectoparasites, gut parasites, and a number of measures of welfare, including body condition indices and use of the Nitroblue Tetrazolium (NBT) test. Poor condition of an animal is likely to render it more susceptible to infection, and conversely, an infected animal is likely to be in poorer condition, thus utilisation of a measure of welfare is a useful measure for overall condition of animals in a situation where it might be easy to miss a specific pathogen.

## *Cryptosporidia* and *Giardia*

*Cryptosporidia* and *Giardia* are water-borne pathogens of significance within the developed world for a number of reasons. They are indigenous infections with a low infective dose; the densities of environmental contamination with infective cysts / oocysts are sufficient to pollute the aquatic environment; the cysts / oocysts are small enough to penetrate water treatment processes and are also insensitive to commonly-used water treatment systems. Both *Cryptosporidia* and *Giardia* have previously been found to infect water voles. Contamination of water bodies into which the voles are reintroduced may arise from a variety of sources, including human, domestic or wildlife, with ingestion of cysts or oocysts occurring along with ingestion of riparian vegetation.

## *Leptospira*

It has long been assumed that water voles have the potential to be infectious for *Leptospira spp.* However, the only published record of Leptospirosis having been positively identified from a water vole in the UK was in 1964. Previously we have used a direct PCR method to diagnose *Leptospira spp.* in urine samples from wild water voles, with no positive results. However, sympatric species of rodents, including brown rats (*Rattus norvegicus*), are known to be infectious for *Leptospira spp.*, and therefore may act as a reservoir of disease for water voles.

## **Results to date**

Five species of flea were identified from the reintroduced water voles: *Ctenophthalmus nobilis*, *Ctenophthalmus nobilis vulgaris*, *Megabothris walkeri*, *Hystrichopsylla talpae talpae* and *Palaeopsylla soricis soricis*. Laboratory screening work for the presence or absence of pathogens and parasites, and reading of blood slides for NBT work is ongoing.

## **The incidence of *Leptospira* species in wild and reintroduced water voles**

Water voles are currently the subject of several translocation and reintroduction programmes, resulting in increased levels of contact between water voles and humans, and thereby potentially increasing the risk posed to humans of contraction of zoonotic Leptospires from water voles, which results in Weil's disease in humans.

Wild rodents, including species found in the UK, are known to be reservoirs for Leptospires. It is therefore likely that the same species are also potential hosts for *Leptospira* species (*spp.*) in the UK. Wild rats are frequently implicated as a primary source for zoonotic infection with Weil's disease in humans, with 'at risk' groups including those who regularly use rivers or other waterways in some capacity. The fact that water voles and rats are known to coexist in many areas may imply that direct competition between the two species is more complex, with the transmission of disease such as *Leptospirosis spp.* also playing a role in depressing populations of the less competitive water vole.

A number of different diagnostic tests have been used to investigate the incidence of *Leptospira spp.*, but much work in wildlife predates advances in diagnostic technology. I aimed to investigate the prevalence of *Leptospira spp.* in fragmented, extant populations of wild water voles sourced from locations throughout the UK from a number of different habitat types, including upland streams, a dry ditch and lowland rivers. If sympatric species of other rodents present within the habitat represent a constant reservoir for *Leptospira spp.*, then it is possible that even a low pathogenicity rate within water voles may contribute to a negative

impact on the likelihood of survival for the remnant population, e.g., due to depressed fecundity, that may result in that population being more prone to extinction.

The second part of this investigation investigates the prevalence of *Leptospira spp.* in captive-bred water voles destined for release, and followed the same individuals and their offspring for up to five months post-release. The aim is to investigate the risk posed by Leptospirosis in captive-bred populations, and examine how that risk might change for epidemiologically naïve animals post-release as they are exposed to naturally occurring environmental pathogens.

Eighteen serovars were included in the microagglutination (MAT) screen: *icterohaemorrhagiae*; *javanica*; *calledoni*; *canicola*; *ptrogenes*; *ballum*; *autumnalis*; *australis*; *grippotyphosa*; *hebdomadis*; *sejroe*; *saxkeobing*; *hardjo*; *mini*; *brativiae*; *tarrasovi*; *pomona*; and *cynopteri*, and results should be available shortly.

Depending on the outcome, these results are likely to have important implications for practitioners handling water voles. Water voles are now fully protected within the UK under the Wildlife and Countryside Act 1981 (as amended), and as such are increasingly the subject of translocation projects in development sites. In addition, numerous reintroduction projects are being implemented throughout the country in a bid to return water voles to their historic range, often requiring captive breeding to produce a sufficient cohort of individuals to repopulate a given area. In either scenario, it is necessary to handle water voles, either during live-capture, or during routine husbandry practice whilst they are in captivity.

## Further Studies

### ***Impact of trapping and handling on Leukocyte Coping Capacity in bank voles (*Clethrionomys glareolus*) and wood mice (*Apodemus sylvaticus*)***

Small mammals are routinely live-trapped and subsequently handled for a range of ecological and behavioural studies. Despite the techniques commonly employed being potentially stressful for the individual animals involved, it has hitherto been difficult to quantify the physiological impact. I investigated the first instance of using the Leukocyte Coping Capacity Technique (LCC) in bank voles (*Clethrionomys glareolus*) and wood mice (*Apodemus sylvaticus*) to look at the physiological impact of routine trapping and handling techniques.

Twenty µl of blood were obtained from 40 animals, of which 25 were handled following standard protocols and 15 were not. We found that even a short period of acute stress is sufficient to trigger an immune response, which was measurable using the LCC technique. These results further validate the use of the LCC technique for measuring the physiological impact on wild mammals of standard trapping and handling treatments.

Handling brought about a marked reduction in LCC (see Figure 1). The mean LCC, measured in relative light units (RLU), of handled animals (lower line) was significantly lower than that of animals that had not been handled, indicating that handled animals have increased levels of immunosuppression, and therefore may be less likely to mount an immune challenge in response to a bacteriological challenge. Bars represent one standard error of the mean.

A paper describing this work and the results obtained has been accepted for publication in the journal *Animal Welfare*.

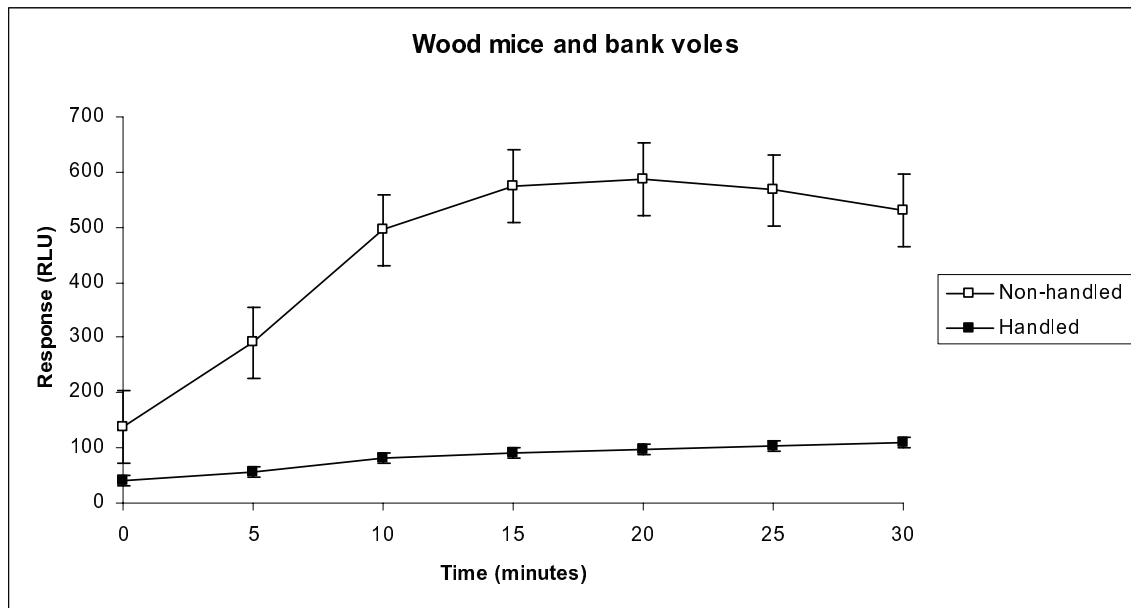


Figure 1. Handling brought about a marked reduction in LCC. The mean LCC, measured in relative light units (RLU), of handled animals (lower line) was significantly lower than that of animals that had not been handled.

### *Captive housing for reintroduction: does short-term social stress impact on welfare?*

Animals which are captive bred for reintroduction are likely to be housed under conditions which are not representative of their preferred social structure for at least part of the reintroduction process. Specifically, this is most likely to occur during the final stages of the release programme, during transportation to the release site. The degree of social stress experienced by individuals during this time may negatively impact upon their immunocompetence.

We examined two measure of stress – body weight and Leukocyte Coping Capacity (LCC) – to investigate the effects of housing density upon captive-bred water voles destined for release as part of a reintroduction programme. The water voles were housed in laboratory cages containing sibling groups. The LCC of water voles was positively correlated with the area of cage available per water vole, suggesting that individuals with less space experienced a larger degree of immunosuppression than did individuals with larger areas. Total leukocyte count decreased over the study, possibly attributable to immuno-redistribution of leukocytes, as they move away from peripheral blood circulation towards tissues where they might be better positioned to combat a potential challenge. During the course of the study mean body weights increased, in contrast to expectations from a previous study. This was attributed to the individuals sampled being sub-adults and thus growing in length and weight during the course of the investigation. The reintroduction process will inevitably cause some stress to the release cohort. However, in the case of water voles, we conclude that reintroductions could be improved by decreasing housing density during transportation and / or within captive colony housing practices. The techniques employed in this work are appropriate for identifying those individuals which are suitable for translocation or reintroduction.

Another paper summarising this work has recently been resubmitted for publication in the journal *Animal Conservation*.





The Wildlife Conservation Research Unit (WildCRU)  
Department of Zoology, University of Oxford  
Tubney House, Abingdon Road, Tubney, Oxfordshire OX13 5QL, U.K.  
Tel: +44 (0)1865 393122/100; Email: [diana.roberts@zoo.ox.ac.uk](mailto:diana.roberts@zoo.ox.ac.uk)  
Web: [www.wildcru.org](http://www.wildcru.org)