Basingstoke Canal Conservation Management Plan

Third edition 2018-2028

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Executive Summary

The Basingstoke Canal is a very special waterway of national importance for its unique water chemistry and the range of plants and invertebrates that this supports. It rightly has statutory protection for much of its length.

Unfortunately, twin pressures from recreational use since its restoration as a navigable waterway, and the continuing growth of trees surrounding the Canal have led to a decline in the condition and diversity of the waterway.

This plan sets out the conservation basis for actions to reverse the declining trend, and allows the managing local authorities to go about their business in the knowledge that the day to day managements are on a sound ecological basis.

Figure 1 - Deepcut Locks in summer, Surrey section of Canal
Photo credit – Paul N Drane

1. Introduction

1.1. The purpose of this plan

The Basingstoke Canal is of national importance for its wealth of wildlife. Most of the waterway has statutory protection as a Site of Special Scientific Interest, for which Conservation Objectives have been set and success in achieving these objectives is measured by Favourable Condition Tables [FCT].

The present FCT are based on the Common Standards Monitoring Guidance [CSMG] for canals, which amongst other matters use General Quality Assessment [GQA] standards for water quality. It is anticipated that the CSMG for canals will be updated during the life of this edition of the Plan; should this occur a formal review will be made to assess if adjustments to the Plan are required.

The Canal has other important functions, being especially highly valued as a linear public park, providing recreation and amenity in the countryside – indeed this is the statutory purpose for which the County Council owners hold the land. There is therefore a need to manage the SSSI in ways which both achieve its Conservation Objectives and maintain its recreational and amenity functions while maintaining its ability to function as a viable business entity.

The purpose of this Conservation Management Plan is to set out the conservation needs and then show how these can be met, while maintaining and, where possible, developing the Canal's other functions. The starting point is to take the Conservation Objectives [CO] and derive from them a list of practical management issues. This list is then turned into specific actions, for each of which success in contributing to conservation is measured against the relevant criteria in the FCT; implications for other functions of the canal are defined, and a timetable for implementation is proposed.

It should be noted at the outset that although "implications for other functions of the canal" may include compromises on some of those functions, in many cases the needs of conservation, recreation and amenity largely coincide. An important part manging the Canal is balancing of the needs of conservation and recreation, alongside the need to maintain and develop the financial viability of the Canal. Over the last 10 years of the previous plan some additional funding has been possible with financial grants from HLS to help work on tree thinning and removal as part of specific projects on the canal. However grant funding is becoming harder to find and with the current (at time of writing) looming of the exit from the European Union. This could have further negative effects. It should be noted that there are other very significant financial constraints on the Canal at this time already which were less significant over the last plan period.

This Plan replaces the Basingstoke Canal Site of Special Scientific Interest Management Plan (1992) and the Basingstoke Canal Conservation Management Plan (2008).

1.2. Governance

This plan is owned by the Basingstoke Canal Authority [BCA] (the local authority partnership who look after the Canal on a day to day basis), and the Canal's two owners Surrey and Hampshire County Councils (who are the statutory navigation authorities for the waterway). Before coming into operation the Plan will be presented to Natural England for their Assent - as an agreed scheme of management. This allows the BCA / owners to do a lot of day to day management without seeking individual assents for every activity, freeing BCA and Natural England officers' time to deal with the less mundane matters which need individual consideration; whilst at the same time providing a conservation based rationale for each action and management.

Periodic maintenance and revision of the plan will be undertaken by the BCA – with all revisions being submitted to Natural England for Assent.

Direction as to the content of the Plan, reviewing progress and any revisions will be given to the BCA by the Basingstoke Canal Conservation Steering Group [CSG] – a technical group made up of people with specialist knowledge in the field, or particular knowledge of the Basingstoke Canal. This group will be chaired by the owners' lead officer for the Canal.[1]

[1] Currently the owners appoint one joint lead officer, *Strategic Manager – Basingstoke Canal*, who will chair all meeting of the CSG. Should the owners in future appoint a separate lead officer each, the lead officer for Hampshire County Council will normally be in the chair, but may be deputised by the Surrey County Council officer as required or agreed between the two.

The CSG will meet at least twice per year and will consist of representatives from:

- Basingstoke Canal Authority
- Natural England
- Environment Agency
- Hampshire County Council
- Surrey County Council
- Basingstoke Canal Society
- Basingstoke Canal Angling Association[2]

At the discretion of the Chair further appropriate representatives who have a particular field of technical knowledge, or pertinent point of view about the Canal, may be invited to attend.

The Chair will periodically report the activity of the CSG to the formal steering body for the Canal – the Basingstoke Canal Joint Management Committee.

1.3. The Canal and its SSSI

For a description of the Canal, its history and current management structure, current usage and links to related websites, see http://www.basingstoke-canal.co.uk

The Basingstoke Canal SSSI has three components –

1. The navigation channel.

2. Off-channel areas, referred to in the Conservation Objectives as Off-channel Reserves and comprising a collection of water bodies such as flashes and ponds associated with and mostly connected to the main channel, together with their marshy surrounding areas.

3. Pondtail Heath. Pondtail Heath is the subject of a separate Conservation Management Plan and is not considered further in this document.

The off-channel areas, although considered (due to their adjoining nature) are largely not owned or managed by the canal.

Locations and ownerships are summarised in Appendix 1

Key stakeholders who have been consulted in the preparation of this Plan as part of the Conservation Steering Group (CSG) and Joint Advisory Group (JAG):-

- **owners**; Hampshire County Council and Surrey County Council, together managing the canal through the Basingstoke Canal Authority (BCA),
- **local riparian authorities**; Hart District Council, Rushmoor Borough Council, Guildford Borough Council, Surrey Heath Borough Council, Woking Borough Council, Runnymede Borough Council, Fleet Town Council
- **statutory regulators**; the Environment Agency, Natural England,
- **voluntary bodies**; Basingstoke Canal Society, and Basingstoke Canal Angling Association

[2] The BCAA represent those with angling interest in the Canal. Should the angling licensee change at any time, the current licensee will replace the BCAA.

1.4. The nature conservation value of the Canal

At the time of its most recent re-designation in 1995, the Canal SSSI had 87 species of native aquatic higher plant species (approximately half the UK total), five of which are nationally scarce and the canal may have been botanically the most species rich aquatic SSSI in England. Twenty four species of dragonfly were recorded on the canal, two of which are nationally rare. A range of other notable invertebrates have been found, both aquatic and in the marshy areas. Some of these also are scarce or rare. Exceptional richness is in part a result of the water quality in the canal, which gradually changes downstream from alkaline and high in calcium at the western end to mildly acid and much lower in calcium in the eastern part. This gradient favours different plant species in different lengths, hence the large overall species list. Also, unusually for a lowland water in present-day England, the water is mostly low in plant nutrients (nitrogen and phosphorus), which further favours a range of unusual species; although there are some initial studies which indicate that the eastern end of the Canal suffers from increased levels of phosphorous. The mix of open water, in-channel and bank side plants, marsh and wet woodland offers diverse habitats for the fauna.

A fuller account of the ecology of the canal and the division of the SSSI into units is in Appendix 3. The latest formal description of the SSSI, the 1995 Notification, is included as Appendix 4.

When the Basingstoke Canal SSSI was re-notified, the section in Working was dry at the time and was not included in the SSSI. This section has since been identified as a Site of Nature Conservation Importance.

During 2016 it became evident that the main channel SSSI units previously agreed by Natural England and proposed on an ecological basis in the 2008 iteration of this plan, dividing into Canal West and Canal East at Norris Bridge had not been used to update the official SSSI records. The official record used the county boundary at the River Blackwater to divide the units – Natural England do not now support the alteration of the units and this plan now reflects the official record dividing the main channel into two units at the county boundary.

1.5. The recreational and amenity value of the Canal

The Canal is greatly used as a recreational resource and was purchased under the National Parks and Access to the Countryside Act 1949 as land for public recreation. It forms a linear "country park" (although not formally designated as such) in which the towpath is much frequented by walkers and provides a traffic-free 'green corridor' in urban, suburban and rural areas. The Canal's easy public accessibility is particularly valuable because it runs through areas in which other accessible green spaces are limited and decreasing. Availability as a quiet and safe place to walk, cycle, picnic and exercise dogs is probably overwhelmingly the canal's greatest asset nowadays, in terms of numbers of people and hours spent along the waterway. It is this which Council Tax payers in the areas served by the riparian and county local government stakeholders are likely to see as the main benefit from continuing financial support for the canal.

Other recreational users include canoeists, kayakers and powered boaters and anglers. Although they are much smaller groups numerically, they are vital to the overall waterway scene, as well as gaining much enjoyment from their chosen activity and providing some income towards maintenance of the canal. National surveys have shown that public appreciation of canals as places at which to spend time is crucially dependent on those waterways being perceived as 'living', in the sense that they are well- maintained navigations on which moving boats are seen on a more or less regular basis. Based on pedestrian counter figures the canal towpath had 116,008 visitors in 2016

at the 4 counter locations. Planning Solutions in 2012 estimated that there were over 1.5million visits to the entire towpath in a 12 month period.

As well as being a place for active recreation, the Canal also provides a more general landscape amenity. Nearness to a canal raises the value of residential property a study for DEFRA by JBA Consulting concluded that property values adjoining an operating navigable waterway rose by up to 20%, and the presence of a 'green' water feature enhances public perception of the whole waterway corridor.

Figure 2 – typical recreational use

1.6. Recreational and amenity links with nature conservation

Some parts of the conservation value of the canal add considerable value to the recreational and amenity aspects.

Thus the 'green' component, mainly the attractive components of the vegetation such as reeds, water lilies and flowering marginal species, greatly enhance the environment for towpath users, while some of the fauna, notably dragonflies and waterway birds adds further interest. Although some of the rarer aquatic and bank side plants and invertebrates of high conservation importance are inconspicuous to non-specialist users, they are greatly valued by the minority of visitors with interest in natural history.

Overall if the SSSI is in good condition, it will contribute substantially to the Canal's appeal to the visiting public and to the waterway's amenity value to those who live alongside it. Likewise the strong amenity value of the canal ensures that it is continued to be managed in a way that is favourable for nature conservation. The two must work hand in hand for both to survive and flourish.

2. The Conservation Objectives

2.1. The ecological basis for conservation management

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2.2. The Conservation Objectives and their conversion into management requirements

The Conservation Objectives [COs] and accompanying Favourable Condition Tables (FCTs) are shown in full in Appendix 2

A few of the COs are passive in character, such as the requirement not to reduce the extent of the canal, for example by building on it, an unlikely eventuality for the foreseeable future. For such cases, no specific management action is included here and Appendix 1 provides sufficient reminder of this type of objective.

Most of the COs do require active management. The Canal is an artificial structure, subject to wear by use and structural decay. Unlike rivers, the navigation channel is not self-scouring over time. Instead it slowly silts up until dredging is needed to maintain water movement and depth.

The off-channel areas are subject to vegetation encroachment as well as siltation and if left unattended would gradually turn into reed swamps and ultimately into wet woodland by the process of natural succession. For these reasons, conservation management of this SSSI requires a combination of:

- **active management** of the channel to maintain water depth, bank integrity and good conditions for growth of aquatic vegetation;
- **vegetation and silt control** in the off-channel areas (where ownership makes this possible);

Towpath usage is less influential on the channel ecosystem. High visitor numbers are not, therefore, a major factor in conservation management of this SSSI. Locally areas associated with very high recreational use for angling or dog walking are associated with water's edge vegetation damage and eroded banks so that maintenance and strengthening are required. However most erosion comes from wind-created wave action and boat wash and the protected vegetation planting measures used to arrest this can be equally employed for local damage from the landward side.

2.3. Achieving the Conservation Objectives

The box below sets out the condition of the Basingstoke Canal SSSI in the formal terms of the Conservation Objectives and Favourable Condition Tables in Appendix 2

The condition of the SSSI at the start of this Plan is mostly –

unfavourable declining.

The aim of the Plan is to define ways to reverse this decline, first achieving

unfavourable recovering condition then progressing towards ***favourable condition***

In their 2016 report the Hampshire Biodiversity Information Centre (HBIC) [Survey of Wetland Flora of the Basingstoke Canal *Ralphs & Callegari* 2016 p46] conclude:

> "It does appear that there is no single overriding factor causing the reduction of species in the Basingstoke Canal."

They go on to detail potential factors which may be contributing to the unfavourable condition. These include:

- Tree growth depositing leaf litter in the Canal bed, causing rooting difficulty for submerged aquatics.
- Lack of light reaching the canal surface – caused by tree growth, bankside vegetation and aspect
- Resuspension of silt from the canal bed caused by quantity and different types of siltation and continued use by powered boats.

In a marked change from previous iterations of this plan they also comment:

> "However, it does seem that the reduction of the diversity of aquatic species is principally light related, but currently measurements of direct shade are not explaining the whole problem."

It seems that there is no one overriding factor, and anyone of these could be the major cause, or more likely a combination of all of them.

Figure 3 - autumn leaf fall

Water quality monitoring by the EA has reduced during the period of this plan (due to funding cuts), however, results have not shown any deleterious changes in the key features of water quality.

Water supply is a potentially critical factor in that when it is inadequate, the level falls in the channel, creating stress upon the aquatic ecosystem. However, some short term dewatering have been shown to be potentially beneficial to water ecosystems, encouraging rapid regrowth:

> "Dewatering may encourage regeneration from buried seed" [Plant Records for Surrey Sections 22 & 23 of the Basingstoke Canal *Groom G* 2016].

This factor may be exacerbated in the future by changing climate and continuing modifications to natural drainage patterns as the catchment is developed. It could also be positively affected by proposals from South East Water to stop pumping from the aquafer which is the Canal's main water source, apart from rainfall.

There has been no re-stocking of fish within the last 5 years. Fish rescues during 2015 and 2016, associated with planned de-waterings, have shown fish stocks to be generally quite high, with the exception of carp which appear to be substantially down in number. Intensive control of non-native crayfish over the last 2 years could also have had a beneficial effect for fish populations. It is not thought that fish stocking is a major contributory factor to the decline of the SSSI condition, especially with the reduction in bottom feeding species such as carp.

Influences which are potentially important, but have been managed to be complimentary with conservation for many years, are navigation, invasive weed removal, dredging and bank protection works. These do, of course require continued assessment and regulation for conservation purposes.

A recent depth survey (Autumn 2016) has shown the areas that some areas of the Canal have started to shallow and require dredging; a dredging management plan will be drawn up to implement this. A limited programme of dredging for the Canal has been funded in the Hampshire portion of the Canal. This will be accompanied by an assessment of water clarity and turbidity before and after the works.

Although most of the components needed for effective conservation are susceptible to management, it must be recognized that the two believed to be most important, namely **tree shading** and **invasive non-native species**, pose considerable difficulties. At the start of the period covered by this Plan, bank side tree cover continues to be both extensive and in many places dense. It will continue to be a massive undertaking to reduce this cover to the required much lower level. The planning, cost, effort and public relations needs are considerable and it is unlikely that the necessary tree management could be completed within this second ten year duration of the Plan; as only a limited number of planned reductions were achievable during the first 10 years. The main constraints found were the Town & Country Planning system and local objections to felling of trees, particularly in the Sheerwater, and St John's areas of Woking,

For this reason, the target set for the period covered by this Plan is to achieve half the necessary reduction in tree shading. To have any possibility of achieving this substantial input and support from other local authorities, Natural England and the Environment Agency will be required.

The other component believed to be critical, namely control of non-native species of flora and fauna, is also difficult. Although effective management methods are available for some of the species, for others no feasible control system is currently available. It is possible that advances in management methods in the years ahead will improve the situation. During the first 10 year plan much work has been carried out in the management of invasive species. The key areas of success have been:

- **Japanese Knotweed** - annual herbicide injection has seen the number of stands reducing
- **Himalayan Balsam** - is regularly pulled to reduce spread by seeding
- **Floating Pennywort** – has been a particular success through physical control both with a weed cutter boat and by hand removal by teams of volunteers, this has resulted in a major reduction in the instance of Floating Pennywort. A trial of chemical spraying below Lock 1 (outside the SSSI) was also carried out with results show good dieback after spraying but regrowth is still rapid the following year. Results from the trial being similar to that of physical removal however longer term spraying may have a more significant effect.

- **North American Signal Crayfish** – a reduction in this invertebrate is also desirable to reduce disturbance of the canal banks and bed, with intensive trapping by a commercial trapper from 2013 onwards. Over 50 individual licences were revoked in 2013 with a single commercial trapper now covering the whole Canal; this has given better control over the intensity, control and record keeping – this method has shown to be very successful with approximately 7 tonnes of crayfish removed in 2017

Figure 4 - example catch of signal crayfish

However this work is on-going and will need to be continued for the foreseeable future to maintain and continue to gradually reduce invasive species, with the aim of;

- checking periodically that currently satisfactory ones remain in that state;
- continuing to improve those components which are currently unsatisfactory and for which management techniques are available, with annual targets and tracking of progress in achieving those targets;
- assessing the progress of conservation research in the years ahead in developing any new techniques for managing components currently difficult to control and implementing those techniques where feasible;

Thus a clear management track is possible at the start of the second ten year period, but periodic reviews thereafter may lead to alterations in targets as practical progress and advances in knowledge and experience develop.

In the following section (Section 3) the overall management requirement is broken down into actions, each of which corresponds to one or more CO. For each, a short note on its ecological basis is followed by the necessary action, targets for its progress and a timetable for their completion. Where the ecological aspect warrants fuller coverage, this is provided as technical appendices at the end of the Plan. The monitoring topics are designed to yield data which will be used by Natural England for future statutory Condition Assessments, based on the Favourable Condition Tables (FCTs).

In a final section (Section 4) procedures are set out for assessing annual progress towards specific targets and for periodic review of the Plan.

3. Conservation Management Actions

All Conservation Management Actions [CMA] will be undertaken by the Basingstoke Canal Authority and/or the County Council owners unless stated otherwise.

Each CMA should be referenced to the relevant COs in Appendix 2

3.1. Water level management

Ecological basis

A water level at around design depth is desirable for both navigation and conservation. It provides the greatest water cross-section for boat movements, thereby maximising ease of navigation and minimising disturbance to the channel bed and its plants and animals during each boat passage.

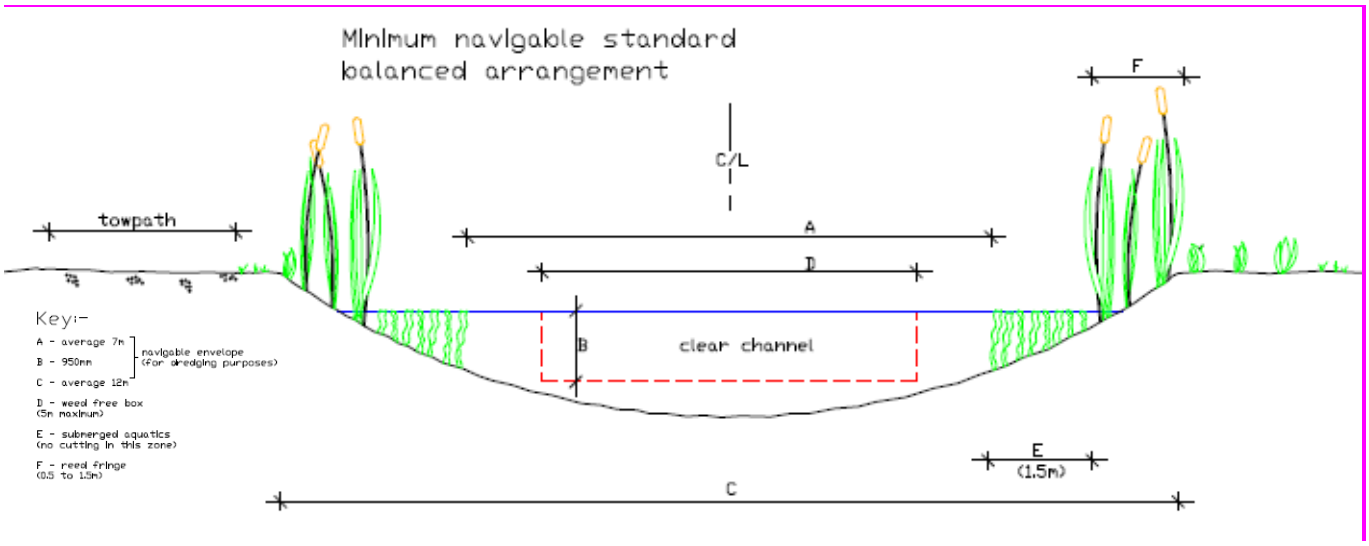


Figure 5 - minimum navigable standard

Lowered levels bring problems; apart from making boat movements more difficult and disruptive, associated exposure of the channel bed can lead to drying out and cracking of the lining, so that the canal leaks when re-filled. Also, during times of drawdown mammals and signal crayfish may construct burrows which become conduits for serious leakage on re-watering.

The majority of emergent aquatic plants have only limited tolerance of drying out, while most submersed and floating-leaved species have even less. On short pounds between locks, where water level variations are inevitable, the marginal vegetation shows some selection in favour of species tolerant of temporary exposure.

Engineering considerations

Historically the canal has been undersupplied with water, especially between Ash Embankment and Brookwood – with the first recorded instance occurring in summer 1804. In long dry periods in summer, levels have sometimes fallen so much that navigation has had to be suspended, and the short channel areas between locks becoming partly drained. Since 2013 new “managed navigation” methods have been brought in to manage water for the use of the lock flights more efficiently. This has led to much shorter periods of lock closures and thus undesired dewaterings – a few days or weeks, rather than months which were common 1991-2009. The back pumping schemes at Woodham and St John’s also are used successfully to maintain levels from Hermitage down to Lock 1. The pump at Frimley is used to help top up the Mytchett pound but is not enough to have a major impact on levels.

Where channel engineering work becomes necessary, scheduled dewatering is often needed, normally in winter when risks of damage by drying out of the lining and by burrowing animals are least.

Because the Canal, unlike a river, is perched in places above adjacent land, breaches are a significant risk with the potential for loss of life, land and property. Emergency dewatering in response to an actual or potential breach must therefore have priority over wildlife conservation interests. A procedure has been drawn up for this that was agreed by the Conservation Steering Group see Appendix 9 – Dewatering Protocol & Fish Rescue Procedure

Target

To maintain water level within 0.2 m below design height on plain channel and within 0.4 m on short pounds between locks.

Actions and timetables

The BCA will achieve these actions through the Basingstoke Canal Strategy, and Operational Plan & Policies. These can be accessed on line via the BCA web site at http://www.basingstoke-canal.co.uk or at the BCA offices.

WL.1 Operational ranges

Water supply will be managed to keep levels within the range 0 – 0.2 m below design level on plain canal and 0 – 0.4 m on short pounds in lock flights.

Continuous.

WL.2 Recording of levels

Water levels will be measured and recorded by BCA staff daily at the following sites:

- Hampshire Pound - Farnborough Road Weir
- Mytchett Pound - Ash Vale Weir

A telemetry scheme has been installed and is partly up and running (2017) which enables remote monitoring of water levels via PC and smart phone at the following locations:

- Colt Hill
- Farnborough Rd Weir
- Ash Vale Weir
- Lock 28 Deepcut (TBC)
- Lock 14 Brookwood (TBC)
- Lock 12 St Johns/Hermitage
- Lock 6 Woking
- Lock 2 Houseboats

This system is still in development and will likely vary over time, however, it will enable long term water level monitoring at a strategic level, as well as aiding field level control by waterside staff.

Continuous.

WL.3 Scheduled dewaterings

NE & EA should be notified of all dewatering. This is notification rather than application for approval as long as works follow the Dewatering Protocol (agreed at Conservation Steering Group Meeting April 2015) as laid out in Appendix 9.

These will be designed to affect the shortest possible length of canal for the shortest possible time and will normally be in winter.

As circumstances require.

WL.4 Emergency dewaterings

These dewaterings will be reported to Natural England and the Environment Agency as soon as possible and advice sought from them on any conservation mitigations and fish rescue needs. Dewatering Protocol (Appendix 9) will be followed where possible.

As circumstances require.

WL.5 Conservation of existing water supplies by back-pumping

Where additional back-pumping is proposed, the assessment of its suitability will include consideration of effects upon the chemical water quality gradient in the canal and the possibility of upstream transfer of non-native species. Proposals will be submitted to the Environment Agency and to Natural England for advice and assent.

As circumstances permit.

WL.6 Development of additional water supplies

Opportunities will be sought to obtain additional sources of water for the Canal. Where a new source is proposed, the assessment of its suitability will include consideration of its chemical quality in relation to the need to maintain the west- to-east alkaline to acidic gradient and the low nutrient status of the canal (WQ.1 and WQ.2 below). Proposals will be submitted to the Environment Agency and to Natural England for advice and assent.

As circumstances permit.

WL.7 Reporting

Water level records, both routine (WL.2) and from dewaterings (WL3 and WL4) will be compiled at the end of each year and failures to comply with WL.1 will be analysed. Proposals to reduce such non-compliances in the future will be developed where possible. Proposals for conserving and increasing water supplies (WL.5 and WL.6) will be reported for review.

Report to CSG for review.

WL.8 Managed Navigation

In the absence of a fully sustainable water supply the BCA will ration the use of the longer lock flights for navigation to ensure that water levels are maintained in the longer pounds of the Canal throughout dry periods, and to try as best as possible to maintain all lengths of channel “in water”. This will consist of the rationing the use of locks for navigation into short periods to enable water conservation measures such as “caulking” lock gates and paddle gear to be deployed in the most efficient way.

Continuous.

3.2. Water quality management

Ecological basis

The alkaline, calcareous chalk springs at the western end of the canal and the acidic sources off sands and gravels in the east create a gradient of water chemistry down the canal, which is crucial to the established pattern of distribution of some species along the canal. For wildlife conservation, water management should be directed to maintaining and enhancing this west to east alkaline to acidic gradient.

Maintaining the historically only moderately nutrient rich (mesotrophic) character of the canal, unusual in a lowland waterway, depends upon controlling side drainages along the whole length of the channel, minimising use of those with high dissolved phosphorus loads. High concentrations of nitrate are entering the canal at the western end from the major spring sources partly due to an historic build-up of nitrates in the aquifers.

Nothing can be done by the BCA to prevent this, the nitrate decreases downstream, more rapidly in summer than in winter, suggesting uptake by channel vegetation is a major cause of this decrease. As the quantity of vegetation has declined at the western end of the canal, this nitrate removal seems also to have diminished, allowing the nutrient to spread eastwards.

Transparency seems to have decreased over many years, perhaps sufficiently to retard submersed aquatic plant growth. Causes probably include inputs of fine particles in side drainages from eroding catchment soils and from roads, organic debris from the very heavy leaf input each autumn and boat passages stirring up the channel bed, especially where the channel is shallow due to insufficient dredging.

The water emerging from the springs near Greywell is calcium-supersaturated. It is therefore unstable when it comes into contact with the atmosphere and precipitates calcium carbonate as a milky greyish white turbidity at the western end of the canal and this is an uncontrollable natural phenomenon, sometimes apparent in the North Warnborough – Broad Oak – Winchfield length.

Pollution has not been a major problem over the years. Minor contaminations from properties near the canal and from road drainages have been controlled effectively. However there is concern over a potential source of pollution in the Woking pound, the result being periodic blooms of duckweed and related floating plants. A study to test water (as part of a BSc dissertation) through this stretch has been conducted in summer of 2017 to ascertain if there are any pollution sources potentially from garden cesspits. It is known that some properties in this area are not connected to the mains sewerage network.

There have also been unconfirmed suggestions that agricultural run-off causes issues for the Canal in the more rural areas upstream of Fleet. The BCA will engage with the EA in the development and implementation of River Basin Management Plans, and any specific projects to influence good agricultural practices in the Canal's catchment.

Engineering considerations

The Canal was designed to use the Hampshire Pound as its reservoir, particularly in summer periods water is transferred from the Hampshire to the Mytchett Pounds via the sluices at Ash Lock, without this the Canal cannot operate and the Mytchett Pound, and Deepcut Locks will dry up in dry weather periods. The boundary between alkalinity and acidity changes around Eelmoor (botanical survey sections H25-27 / chainage 30-31km). Water quality analysis has shown that there is no evidence that passing water down the Canal as intended has had any effect on the acid/alkaline gradient.

Target

To maintain the alkalinity [3]gradient decreasing from >200 mg/l in the Greywell - Colt Hill length to <125 mg/l in the Hermitage Road Bridge - Scotland Bridge length and to maintain annual mean phosphorus ≤35 µg/l.

Actions and timetables

WQ.1 Maintain the alkaline to acidic gradient

BCA will manage water supplies where possible, as far as is consistent with achieving the levels in WL.1, and WL.8

Continuous.

WQ.2 Maintain mesotrophy

Surveillance of existing water supplies will be maintained, so that any increase in phosphorus is detected. Signs, such as outbreaks of duckweed, filamentous algae and plankton blooms, will be noted by the BCA and made the reason for initiating chemical analyses in collaboration with the Environment Agency. [Routine water quality monitoring (WQ.7) will also support this surveillance.

Continuous.

WQ.3 Detecting pollution

The Environment Agency will be informed immediately, by telephone to the EA Emergency Hotline: 0800 80 70 60, of suspected pollutions, whether detected by fish kills, water discoloration, outbreaks of duckweed or filamentous algae, smells or otherwise and the BCA will collaborate with the Agency in providing samples, site knowledge and actions where requested.

As circumstances require.

WQ.4 Management of pollution incidents

The BCA will work with, and take direction from, EA officers to minimise the effect of pollution by isolating and containing, or flushing to dilute pollutants as best suited to the circumstances.

However, in high water conditions the need to ensure continued public safety from overtopping or embankment failure due to surcharging will over-ride the need to isolate any section from a pollution perspective. Also the environmental effect of a catastrophic failure will far out-weigh the initial pollution incident.

The BCA will maintain a stock of stop planks and their grooves, stop gates and contracts for rapid deployment of inflatable dams/booms, so that an affected length can be quickly isolated pending control measures. Where side weirs do not have sufficient capacity to dispose of flow from upstream of any stop-planked length, pumps may need to be deployed to over-pump if necessary.

As circumstances require

WQ.5 Assess water qualities of potential new supplies

The BCA, in collaboration with the Environment Agency, will assess proposed new supplies for expected quality and any pollution risks.

[3] Alkalinity as mg/l CaCO3 at pH4.5. **Phosphorus as µ g soluble reactive P/l.

As a general principle, no new sources of treated effluents and surface drainages from canal side properties will be accepted, although the Environment Agency and the relevant owner will assess each discharge consent application on a case by case basis and may make exceptions. If a land owner can prove a right of easement, a consent may be allowed as long as it is not an increase in volume, and can be demonstrated to be an improvement in water quality. Improvement in quality may be demonstrated through the adherenece to the principles of a Sustainable Urban Drainage Systems (SUDS), which may amongst other matters require attenuation before discharge into the Canal. Quality of water must be monitored and reported back to BCA annually as an on-going process and will be a requisite of the consent. Accepted new sources will be monitored at least four times for actual quality in the first year of their use, using the protocol in WQ.6. This will be the responsibility of the applicant not the BCA or EA. Applicants will be advised to use low phosphate detergents to minimize increases in phosphates.

Drainage from fields (including playing fields and sports pitches, agricultural land, horticultural or equine establishments) will not be accepted, as these nearly always discharge only in wet periods when least needed and are turbid and at risk of carrying accidental pollutions such as agrochemicals. Road bridge drainages are sources of local pollution by gritting salt in winter and by oil, silt and spills from road accidents. They must have adequate traps in place, maintained by the highway authority and/or by the local authority or landowner. As a general rule no new road drainages will be accepted for similar reasons to agricultural drainage.

As circumstances require. Report any developments at CSG.

WQ.6 Water quality monitoring

At the following points, water quality will be analysed at least four times a year **by the EA** (monitoring frequency last confirmed at CSG in 2015 by the EA).

> *Site 1 - Colt Hill, Odiham* - monitored monthly by EA. Existing Environment Agency site, retain for long-term trend detection, near enough to Greywell to represent source, but with some buffering out of the variable local fluctuations that sometimes occur close to sources.
>
> *Site 2 Eelmoor* – Monitored monthly by EA Existing Environment Agency site, retain for long-term trend detection.
>
> *Site 3 Ash Embankment* - Monitored 4 times/year by EA
>
> *Site 4 Deepcut* - Monitored 4 times/year by EA Pre-1995. Environment Agency site; some past data for trend detection.
>
> *Site 5 Brookwood Lock Flight* - Monitored 4 times/year by EA
>
> *Site 6 Scotland Bridge* - Monitored 4 times/year by EA. Pre-1995 Environment Agency site; some past data for trend detection.

The minimum analytical programme will be as follows;

> *In the field*
>
> Water temperature, dissolved oxygen, pH, and transparency.

In the laboratory

Alkalinity (mg CaCO3/l at pH4.5), conductance, suspended solids, chlorophyll, total dissolved nitrogen and soluble reactive phosphorus. The BCA will collect field data and water samples and the Environment Agency to carry out laboratory analyses.

Monitoring in April, June, August and October each year. Report results to CSG annually.

3.3. Tree Management

Figure 6 - tree lined nature of many portions of the Canal

Ecological basis

A diversity of waterside trees is beneficial to channel wildlife in a number of ways:

- local shading provides cool areas for fauna in hot, sunny weather; also a niche for shade-tolerant bankside plants excluded from open areas by competition from species which are more vigorous, but require full sunlight; trees are important habitats for the adult stages of some insects with aquatic larvae, including some species of dragonflies;
- groups of trees provide roosts, sources of insect prey and flight paths for bats. These valuable features are, however, sufficiently provided by quite small numbers of trees.

However, if denser tree cover develops, then undesirable features become predominant:

- continuous deep shade prevents reed growth, so bank protection is lost.
- submersed and floating-leaved rooted vegetation is also lost due to insufficient light; this results in almost total loss of the vegetation features for which the SSSI is designated;
- autumnal leaf fall to the water smothers the canal bed with slowly decaying litter, leading to de-oxygenation of the sediment and depressed dissolved oxygen concentrations in the water, which together are deleterious to the whole range of flora and fauna in the channel;
- residues left after leaf decay accumulate quite quickly as black, soft sediment which then requires dredging to maintain navigable depth in the canal.

For these reasons, isolated trees and small clumps benefit wildlife conservation, but long, dense, continuous tree shading is deleterious. On the canal itself, about 10% tree-shading of the channel is required to achieve the above benefits, whilst minimising the deleterious effects also noted above. In addition to this, isolated specimen trees, especially mature ones and clumps of trees should be retained, as these are beneficial as local habitat diversity.

An ecologically valuable feature of lightly managed tree-covered areas is the presence of dead wood, which offers habitat to a diversity of invertebrates. Standing deadwood should be retained where

not dangerous, as this is particularly ecologically valuable. Appendix 5 gives further information on the influence of trees in the ecology of the waterway.

Historical aspects

Along the Basingstoke Canal, long lengths have, over the years, become heavily wooded, which were once open. This encroachment has been a consequence of the commercial decline and subsequent neglect of the canal corridor. Old photographs show that when this and other canals were working freight routes, trees were generally much sparser and indeed were discouraged by many operating companies[4]. Although tree control was a part of the restoration of the canal from the 1970s onwards, on balance continued growth has exceeded removal over the subsequent decades. Therefore to restore the waterway to its historic, mainly open, state from its present heavily tree-lined state will require major clearance.

This process will be assisted by the age distribution of the tree population, as many individuals are approaching the ends of their lives and so would in any case have to be removed in the next few years as dead, diseased or dangerous hazards to the public. Appendix 5 includes an historic photographic comparison and estimates of increasing shading derived from successive aerial photographic surveys.

The off-channel areas mostly have a very extensive tree cover, despite this having been cleared back from the water's edge on a number of occasions by the Wildlife Trusts, MoD and the BCA for conservation of the aquatic vegetation. Periodic clearances will need to be continued to retain the value of these sites, but the overall level of cover will remain markedly higher than on the main navigation channel and will include areas of wet woodland of conservation importance.

Although it is desirable to reduce tree shading and it remains in the CMP for this plan period. It must be noted that currently no funding exists to carry out extensive tree thinnng works although these works will be considered if or when funding becomes available. Attempts to carry out tree thinning have been thwarted over the previous 10 year plan in some areas by refusal of tree planning consent due to objections from neighbours, and national policy favours the retention of trees. This was particularly the case in Sheerwater, Woking. However a successful project was carried out in the Greywell cutting in 2015 with a 1km of trees removed/thinned and in Rushmoor Flash in 2014.

A full canal tree hazard survey was carried out in 2014 by Parsons Brinckerhoff which took over 6 weeks to complete. It concluded that:

> "The authority owns or has responsibility for many hundreds of thousands of trees along the canal route. The recording of only 516 trees requiring remedial action is an indication of the relatively good health and structure of the trees and the high quality of on-going management on site".

The 516 trees identified were programmed for works over the following 3 winters and a resurvey is now planned as soon as possible (originally programmed for winter 2017).

A new tree policy has been adopted by HCC's Countryside Service (CSTREES) this includes the management of the Canal; this policy is primarily aimed at continuing public safety. Its approach is that of a hierarchical inspection regime based on perceived risk – with high risk areas to be inspected

[4] There is some historic evidence to show that some areas of the Basingstoke Canal were heavily wooded even in the nineteenth century, and documentary evidence showing the Basingstoke Canal Navigation Co. planted stands of oak as a crop during the Napoleonic era.

annually, medium risk areas every 3 years, and low risk areas every 6 years. Intelligence on tree and shrub growth will also be gathered during regular asset inspections – especially Length Inspections (LI) which are conducted at 6 monthly intervals.

Target

Along the navigation route, reduce tree shading towards[5] about 10 % of the channel length, leaving shading by single and small groups of trees at intervals elsewhere. This target includes shade reduction which will occur by management of trees which are found to pose a health and safety hazard, and such trees will be the first priority for management.

In the off-channel areas, periodically clear back trees to allow sufficient light to the water to support aquatic plant growth and prevent successionary processes.

Tree management will include crown lifting, lopping and pruning, as well as felling. The management applied in particular locations will depend upon the condition of the trees, their distance from the channel, aspect and the considerations in TR.2 below.

Actions and timetables

TR.1 Continuous assessment of tree stocks

Continue to map trees which pose a safety threat to canal users, neighbours or to the canal structure (e.g. on embankments) in accordance with the hierarchical inspection regime required by the HCC "CSTrees" tree management policy.

Continuous

TR.2 Select lengths for management then implement management programme.

Using the results of continuous tree management surveys select areas of the Canal channel which would be most suitable for a larger programme of tree management. Criteria will include the following:

- Public safety – using the results from TR.1 trees which pose a safety risk to be managed or removed
- Engineering reasons to remove trees, e.g. on embankment or on lower sides of cutting; roots potentially damaging structures such as locks or bridges.
- Landscape or other local reason for retaining trees, e.g. to screen canal from buildings or major road, group of especially fine specimen individuals, isolated mature trees and Tree Preservation Orders.
- Landscape or local reason for reducing or removing trees, e.g. to open up a view.
- Improvements for navigation
- Special or local conservation issues which either favours or disfavours tree management. E.g. - removal of trees along Greywell Cutting to let in light for water plants while maintaining a tree avenue for foraging bats.
- Aspect - canopy reduction in a north facing aspect may not have a meaningful effect on allowing light to water column.

[5] The aim within this ten year Plan is to achieve about half the necessary reduction in shading. However this will only be possible with significant support from the public and cooperation of outside bodies such as local authorities with a planning role, the Forestry Commission, EA and Natural England.

- Land ownership - areas where there is sufficient of the wooded land on Canal property to make a meaningful difference will be preferred.
- The proportion of non-native species of trees; there will be a presumption in favour of reducing non-natives (especially sycamore which causes heavy shading) more than native species.
- Location downstream of a nearby off-channel reserve to facilitate colonisation by aquatic vegetation after shade reduction, as off- channel areas may be a source of propagules.
- Whether a 0.5 km section can be managed without encountering difficulties of ownership or other limitations.
- Lengths of 0.5km or more will be preferred due to leaf drift.

The total management programme proposed over the ten year currency of this Plan should be sufficient to achieve about half the total reduction needed to bring shading down from its present level to around 10%.

Whilst a planned systematic approach would be most efficient in reducing tree shade, in practice over the previous iteration of the Plan financial and local political pressures have coloured the selection of which larger areas of tree management were achievable; these pressures are likely to continue. Due to ongoing financial pressures, opportunities for further funding from external funding bodies are also likely to be highly influential on the prioritisation, or re-prioritisation, of areas selected.

At the Conservation Steering Group annually, propose prioritised areas for tree shade management, with reasons for the choice, numbers of trees and type of management proposed, showing how these link to complimentary works proposed or undertaken under DR1 and BP 1-3.

The CSG will also review progress towards the shade reduction target, by reviewing evidence of the works undertaken to date; including trees managed solely for safety purposes under the HCC "CSTrees" Policy requirements.

Implementation of selected areas for extensive tree management will take place September-March to avoid bird nesting season and disturbance to bats.

TR.3 Maintain control over tree regeneration.

Continue the existing policy of stopping growth of new saplings. Carryout an approx. 5 year rotation of clearance on the towpath side of the Canal. This work is largely carried out by the volunteer workforce.

Continuous.

TR.4 Disposal of wood.

Due to inaccessibility with machinery in many sections of the Canal large sections of cut timber will be left on site to form habitat for fungi and invertebrates. Where landownership allows habitat piles of brash will be left on the non-towpath side to form habitat piles. In appropriate areas where public and engineering safety permit, some stumps or monoliths should also be left to provide habitat for fungi, invertebrates, birds and bats.

Continuous.

TR.5 Bat considerations

Individual trees will be assessed for bat potential before all works are carried out. Planned works will be amended, where safety considerations permit, to retain bat habitat (eg; retaining a monolith as opposed to felling).

When larger areas of tree felling is planned, there will be a presumption in favour of retaining a bat foraging corridor.

Canal rangers will receive training on the identification of bat roosting potential and the procedures necessary if bats are found in trees prior to implementation of any tree management works.

As required.

3.4. Navigation

Ecological basis

Boats exert direct effects on the channel ecosystem by the impact of moving hulls and the chopping action of propellers. They also create indirect effects via the water flows which they generate, namely return flows past the moving hull, waves and the propeller jet.

These cumulatively disturb the canal bed, leading to turbidity in the water and hence a reduction in transparency and thus underwater light for submersed plants. Appendix 6 provides more detail on hydraulic aspects.

Emergent vegetation, i.e. reed fringe, is fairly robust, being firmly rooted and adapted to tolerating waves and other water movements within the range expected when the boats keep inside the BCA speed limit of 6.4 km/h (4 mph). Submersed vegetation ('pondweeds') and floating leaved-rooted plants (e.g. water lilies) are much more susceptible to damage by boat traffic, partly because they are further into the channel than the reed fringes and partly because they are more delicate in structure. Analyses indicate that there is limited scope for sustainable populations of these plants in the central navigation track, hydraulic forces there being too great. Good habitat does, however, remain on the batters (the slopes up on each side of the canal bed from the central track to the water's edges). Here the disturbance by passing craft is only moderate and this is beneficial to many species in that it curbs the dominance of the few most strongly growing species and periodically opens up new patches of habitat to weaker colonisers. The latter group includes some of the aquatic species of greatest conservation importance in the SSSI.

Achieving this favourable state of moderate disturbance, in which the needs of both conservation and navigation are best balanced, depends upon management of certain basic features.

These are as follows.

- *The size of the channel.* Even quite small increases in width and especially in depth confer great improvements in potential plant habitat. For example dredging from 1.0 m to 1.5 m almost halves the boat-induced water velocities and hence the stresses they cause to channel vegetation.
- *The firmness of the canal bed.* A firm rooting medium allows plants to endure the pull generated by boat-induced water flows. In soft silt, plants are easily uprooted and lost.
- The boat traffic density. This determines the total intensity of disturbance. The limit here of 1300 movements per year at any one site is derived from national research, taking into account the size of the SSSI channel (see Appendix 6).

- *The speed of the boat.* Hydraulic forces rise steeply with boat speed and infringements of the speed limit are very damaging.
- *Boat manoeuvring.* When boats start, reverse, or turn using the propeller, locally high and damaging hydraulic forces are created and substantial turbidity may be generated. Concentrating these movements in designated mooring and turning areas at deeply-dredged locations attractive to boaters largely eliminates this problem. Although this feature is included here as a wildlife conservation measure, it will also enhance the canal as a cruising waterway, by offering good mooring facilities to boaters.
- *The availability of underwater light.* Within the traffic density limits specified in this Plan, the boat-induced turbidity is not sufficient to prevent underwater growth on the batters. However, if light is already reduced by tree shade, the further increment from boats may become critical.

Target

A powered boat traffic not exceeding 1300 movements per year and at speeds not exceeding 6.4 km/h, in a channel with a firm bed and attractively located and well-designed stopping and turning places for craft.

Actions and timetables

NV.1 A powered boat traffic not exceeding 1300 movements per year

Boat traffic will be monitored and collated for report annually via recording of all boat licences, and movement records through the locked sections of the Canal

The use of electronic boat counting equipment proposed in the previous version of the plan has been removed as two systems trialled proved unable to give accurate results in the field. Better intelligence is now obtained due to tighter controls on licensing and the "managed navigation" system referred to in WL.8.

Continuously monitor boat movements. If the limit is reached, propose means to curb further increase[6].

NV.2 Revision of the maximum traffic limit in NV.1

If the SSSI returns to Unfavourable Recovering or Favourable Condition, the Conservation Steering Group may recommend to Natural England a specified increase in the traffic limit above 1300 movements per year, with appropriate ecological monitoring of the consequences of such action.

The BCA to bring forward evidence to the Conservation Steering Group to determine if the SSSI condition allows an increase in boat traffic

NV.3 A speed limit of 4mph (6.4 km/h)[7]

BCA will provide literature on the damaging effects of speeding to user groups and to individuals being issued with licences. This will be included in the Boaters Information pack, and will include information on how to assess speeds as most vessels are not equipped with speedometers.

[6] Past records show that historically this limit has occasionally been approached in the Hampshire length but that traffic has always been far below it on the Surrey length.

[7] Temporary lower limits of 4 km/h ("dead slow") on newly dredged lengths and after installation of extensive soft bank protection are specified in DR.3 and BP.6 respectively.

Continuous

NV.4 Concentrate and promote boat manoeuvring and mooring in purpose designed locations

Periodically assess existing and potential stopping, turning and mooring places for width, water depth, hard walls and nearby facilities for boaters (e.g. car parks, shops, pubs). Locating facilities in attractive places for boaters will help reduce ad hoc mooring which has the potential to damage bankside flora. Propose any developments which will make these sites more attractive to users.

Develop proposals and present to CSG for consideration, and react to new opportunities arising from required engineering works as detailed in BP7 below.

NV.5 Boat rallies and waterway festivals

These will normally be held between Brookwood and Woking, avoiding the mid-May to September period of greatest plant growth and ensuring traffic generated will not be sufficient to cause the general 1300 movements/year limit to be exceeded on SSSI lengths.

The BCA will organise turning and mooring arrangements which minimise damage to channel vegetation[8].

Events proposed outside the above locations and times will be subject to approval by Natural England, on prior notice of at least one month. If any adverse effects are noted as a result of boat rallies or festivals which are held before May 15th or after September, then all future events will also be subject to Natural England assent.

As circumstances require. Report events to Conservation Steering Group.

3.5. Fisheries and angling

Ecological basis

A fishery of roach, perch, pike, gudgeon, tench, bream, eels and crucian carp (*Carassius carassius*), with an overall stock density within the carrying capacity of the ecosystem (about 200 kg/ha[9]), is a natural component of lowland, slowly flowing U.K. waterways. Its effects are, therefore, harmonious with conservation objectives. The fishery will also provide good sport for anglers, offering a diversity of target species and fish sizes.

Difficulties for conservation only arise in the following circumstances.

- Non-native species are introduced. Apart from the general objection to non- natives, some of the species are physically very destructive. In particular Common carp, which were probably introduced into the UK during the mediaeval period for food, stir up the channel bed while grubbing in it for their food, damaging and uprooting aquatic vegetation and making the water cloudy with suspended sediment. Larger individuals are also voracious consumers of dragonfly larvae and other invertebrates. (Amongst native species, bream and tench are also bottom-feeders, but at natural population densities are not as disruptive as carp.)
- Artificially high stocking is attempted, beyond the natural carrying capacity of the waterbody. Although over time fish densities will fall back to natural levels, in the interim

[8] Avoidance of damage by mooring and turning is the main issue. Traffic generation has been, on experience to date, a lesser consideration, the largest number of boats attending a festival in recent years being about 75 (i.e. creating about 150 passages).
[9] Fisheries Technical Advisory Group (2005).

high densities can damage other parts of the ecosystem. For example predation on invertebrates may be excessive.

- Angling pressures damage the ecosystem. Very heavy ground baiting can create local water quality problems of de-oxygenation and nutrient release, as well are artificially increased populations in some species. Cutting back vegetation to allow angling, trampling during setting up and the proliferation of locations where anglers sit can cause local bank damage and set up erosion.

Historically there was a limited problem with carp in the SSSI, but fish surveys since 2000 indicate so few carp that damage from this source has become insignificant. There is no past evidence of excessive stocking or ground baiting. Local bank damage has been largely kept under control by ad hoc repairs.

In common with other waterway SSSIs, a Closed Season from 15th March to 15th June inclusive has been maintained for wildlife conservation purposes. The period covered is a vital one for vegetation growth and repair along the banks and water margins.

It also includes a large part of the breeding season of many waterside birds, permitting nesting and rearing of young without the disturbance and interruptions caused by the presence of anglers, who, unlike other waterway users, often remain at one location for many hours at a time.

Target

To allow the canal fishery to maintain itself as a natural mix of native species with an overall stock density of about 200 kg/ha.

Actions and timetables

These are mostly passive. Fish surveys are labour intensive and expensive, so it is impractical to use these to obtain frequent checks on the state of the fishery. Surveys are done mostly in response to specific issues, such as a report of poor angling, a fish kill or suspicion of colonisation by non-native species or as part of other routine works such as dewatering. Instead routine management is confined to maintaining suitable conditions for achieving the above target state for conservation, while providing good recreational angling.

Angling rights are licensed on an exclusive basis by Hampshire and Surrey County Councils as owners of the Canal, the current licensee being the Basingstoke Canal Angling Association. The licence sets out the conditions under which the Angling Association may exercise its rights.

FA.1 Stocking

No fish stocking will be considered unless there has been a proven fall in stock density significantly below carrying capacity, e.g. after a major fish kill and a new fish survey has been carried out to ensure that the above target has not already been reached or exceeded.

Fish stocking must be first authorised by the Environment Agency and Natural England on a case by case basis.

Report any issues to Conservation steering Group for review

FA.2 Non-native fish species

No Common carp or other non-native species will be introduced. Any reports of other non-native fish species, whether made to the BCA or to the Angling Association, will be passed to the

Environment Agency and to Natural England for assessment as to the need for appropriate action, if any.

Continuous.

FA.3 Fish surveys

The Environment Agency will conduct surveys as it considers appropriate, whether in response to particular requests from the BCA, the Angling Association or the advice of its own officers. Wherever possible, advantage will be taken of such surveys to assess the stock densities in the SSSI against the target density, leading to a decision on whether fish stocking or removal is needed. Survey results and possible actions thereon will be assessed in liaison with Natural England, the BCA and the Angling Association.(BCAA)

As circumstances require. Report to CSG.

FA.4 Closed Season

A Closed Season for coarse angling will be maintained from 15th March to 15th June inclusive. It will be bailiffed by the Angling Association, which will seasonally erect, maintain and remove temporary 'No fishing' signs.

Every year, mid-March to mid-June.

FA.5 Fishing competitions

The locations of fishing competitions will be agreed between the Angling Association and the BCA. On these lengths, marked pegs will be cut and kept free of marginal growth. Access for competitions will be limited to these pegs and vegetation clearance elsewhere will not be permitted.

Review each April to decide actions for the year ahead.

FA.6 Provision for disabled anglers

For disabled anglers, fishing platforms incorporating geotextile or coir roll protection of the bank will be constructed and maintained by the Angling Association at locations and in numbers agreed with the BCA in advance.

BCA to review each April to decide actions for the year ahead.

FA.7 Repair of damaged banks

Where banks and marginal vegetation are damaged by anglers, the BCA / County Councils will carry out the necessary repair work as part of prioritised Softbank repairs, including re-instatement of the reed fringes to the specification in 3.7 below. Temporary signage will be placed on site by the BCA, requesting anglers to avoid fishing these lengths until the reeds have re-established and a complete vegetation cover has been achieved on the bank. This should not take more than one summer, with the Closed Season for angling in any case covering the most important period for vegetation establishment.

Continuous.

FA.8 Ground baiting

Routine monitoring by BCA rangers and Angling Association bailiffs will include looking for danger signs, such as patches of ground bait rotting in the water or obvious discoloration (especially grey or

black) in the water or on the canal bed. In such cases the BCA will arrange with the Angling Association for a reduction or dispersal of ground baiting.

Report any issues to BCA immediately.

3.6. Dredging

Ecological basis

As the channel silts up and becomes shallower and its bed becomes softer, habitat quality for aquatic wildlife declines. The combination of shallowness with a soft and easily disturbed bed results in each boat movement stirring up silt, destabilising bottom-living plant and animal communities and filling the water with suspended solids which curtail light penetration and hence depress submersed plant development.

Although periodic dredging (every c. 25 years with spot dredging in-between as required) is essential, it is nevertheless an ecologically highly disruptive event. Plants and their associated fauna are uprooted and removed, along with their substratum. Water quality temporarily deteriorates as large amounts of suspended solids and nutrients enter the water and there is often a reduction in dissolved oxygen and release of ammonia, hydrogen sulphide and other toxic components when oxygen-deficient sediments are disturbed. These disruptions are much reduced by dredging in winter, when temperatures are low and plants and animals are inactive.

Recovery of plant species after dredging varies. Emergent fringes usually re- establish during the next growing season after dredging. Submersed and floating- leaved species take longer, but at the moderate boat traffic on this canal, most can be expected to re-colonise within a few years. Recovery is assisted by limiting the numbers and speeds of boat in the growing season after dredging.

The small amount of information available suggests that recovery of the fauna parallels that of the vegetation.

Fuller detail on the ecological effects and management of dredging is in Appendix 7

Target

To minimise the adverse effects and maximize the positive effects of dredging on the channel ecosystem.

Actions and timetables

DR.1 Planning a dredging operation

For detail, see Appendix 7 Pre-dredging preparations.

Planning of each operation will begin about one year ahead of its implementation. Any necessary mitigations for wildlife will be identified and plans approved by Natural England in time for plant mitigations to be carried out in the summer prior to the operation.

Initiate in response to a bathometric survey which indicates that channel dimensions through siltation or erosion has reduced the channel size below the minimum specified Operational Plan & Policies. Any systematic programme of dredging will be proposed to the CSG – preferably 12 months in advance - with a proposed timetable for preparatory planning and works, including sediment testing, translocations and mitigation planting.

As circumstances require – report to CSG in advance of planned works

DR.2 Dredging procedure

For detail, see Appendix 7 Dredging procedure.

Dredging will be carried out in late autumn and winter and will be to the design profile of the channel, except that where reed fringes are present, they will be left undisturbed as far as possible to a width of about 1 m on each side. Any excess reeds will be used to repair inadequate fringes elsewhere on the canal[10]. Where economically feasible, sequence dredging will be used, clearing a series of

0.5-1.0 km lengths in one year, alternating with similar lengths not cleared until the second or third year. Otherwise linear dredging will be used, working upstream.

As required between October and early March.

DR.3 Post-dredging management

For detail, see Appendix 7 - Management of the recovery phase.

In the summer following dredging, intervention on plant recolonisation of the channel will be avoided, except in extreme circumstances of total blockage to navigation. For the year after dredging, all boat rallies and regular trip-boat workings (as far as practical) will be scheduled away from the length and a 3.2 km/h (2 mph) "dead slow" speed limit will be applied to all traffic, with explanation of its reason.

As required in the year after dredging.

DR.4 Spot dredging

For detail, see Appendix 7 - Spot dredging.

When carried out in winter and at sites without aquatic plants of special conservation importance, spot dredging does not require permission from Natural England.

As required between October and early March.

DR.5 Reporting of dredging

Records will be kept of all lengths dredged and the results from any subsequent botanical surveys of these lengths will be used to measure rates of species recovery and hence develop better understanding of any long-term ecological effects of the operation.

Report to CSG, accumulating data year-on-year

3.7. Bank protection

Ecological basis

The emergent plants within marginal zones on each side of a canal are very important part of the waterway ecosystem. In themselves they have the potential to be species-rich in both plants and invertebrate fauna and they can provide key habitat for fish spawning, fry rearing, bird nesting and refuge and for mammal burrows. Unlike in lakes and large rivers, where the marginal zones can be wide, along inland waterways they are highly compressed, rarely exceeding 2 m in width. Despite

[10] Reeds from below Lock 7 will not be relocated to any other portion of the Canal above Lock 7 to prevent the spread of the non-native invasive Floating Pennywort (*Hyrdocytyle ranuculoides*)

being narrow, they do constitute a major part of the overall ecosystem on account of the high edge to open water ratio of canals.

The margins are also important as access routes between land and water, for amphibians, birds and mammals and as migratory routes for a number of species.

Because of their narrowness, structural complexity and the fragility of some of their components, maintenance of the zones on a working waterway requires considerable care. The two main stresses are –

- *wave-induced erosion from boat wash*, which can undermine rooting systems and break the stems of reeds;
- *tree shading*, which depresses growth of the plants and hence their ability to recover from damage: dense tree shade altogether prevents establishment and survival of marginal vegetation.

Minor localized damage may also come from mooring of boats and from trampling by anglers and by dogs. In rural areas, the offside margin may be subject to cattle trampling and grazing.

Engineering responses to damage

Bank erosion has serious consequences for canals. On raised sections of channel it can lead to a breach. On the towpath side, it can create a hazard for users of the path. It also results in shallowing of the navigation track as eroded bank material falls into the channel and increase the need for dredging.

Historically the Basingstoke Canal was constructed with soft vegetation protection of its margins, this being sufficient for the non-motorised traffic of the time. Tree growth at water's edge was discouraged to allow for effective operation.

With the introduction of motorised craft, boat wash has become a much greater influence on banks, especially since restoration for recreational use, as traffic nowadays is far higher than it was when the canal carried only freight boats. Also, tree shading has reduced the ability of reed fringes to survive wave action.

The traditional engineering response to bank erosion was to use steel sheeting. Engineering techniques have subsequently advanced, with "soft" vegetative margins now being the preferred approach in all cases, and steel or concrete walls being reserved for instances where they are most required from a technical perspective. Soft vegetative protection has been retained in many lengths of the Canal, in some cases with a variety of root re-enforcement techniques, some of which have been more successful than others. Nevertheless, considerable lengths of bank, especially those too tree-shaded to support reeds, have been reduced to bare earth and hence are inevitably subject to some degree of erosion.

Appendix 8 gives further information on both bank erosion and on techniques for combating it.

Target

Wherever engineering requirements permit, to maintain vegetative bank protection as a zone of diverse vegetation which provides habitat for a wide range of fauna.

Actions and timetables

BP.1 Bank erosion creating hazard to towpath users: unshaded locations

Areas of erosion which create a hazard to towpath users will be repaired on a priority basis with three levels of priority based on safety. Funding available at the time will then dictate when works are completed. This will use "soft" re-enforced vegetative bank protection, where engineering considerations permit.

Details of the approved methods and planting specifications are contained in Appendix 8; see also BP7 for areas where "hard" engineering is a requirement.

Continuous

BP.2 Bank erosion creating hazard to towpath users: shaded locations

Soft bank repairs will prioritised as per BP1 where engineering considerations permit, to allow establishment of a reed fringe at a later stage, when shading has been reduced. These areas should be prioritised for tree management.

Details of the approved methods and planting specifications are contained in Appendix 8; see also BP7 for areas where "hard" engineering is a requirement.

Continuous

BP.3 Eroded banks in all other locations

Eroded banks in all other locations will be prioritised according to likelihood of an uncontrolled spill of water, with those areas of erosion on raised embankment receiving the highest priority. Regardless of location "soft" engineering methods which may promote recolonization of vegetative growth will be used in preference to "hard" engineered methods, unless there is a sound engineering reason not to.

Longer lengths of "soft" bank repairs which are heavily shaded should be prioritised for tree shade reduction.

Details of the approved methods and planting specifications are contained in Appendix 8; see also BP7 for areas where "hard" engineering is a requirement.

Continuous

BP.6 Post-installation procedures

On longer lengths of Canal where new soft vegetative protection is installed, a speed limit of 3.2 km/h (2 mph) will be applied to boat traffic for a year after construction. Anglers will also be instructed to avoid these areas, and to prevent all damage. The BCA will provide the necessary notifications (for example in boating information pack and notification to the Angling club), or by site notices.

As required.

BP.7 Engineered banks

Where engineering considerations preclude use of soft bank techniques to solve seepage, or otherwise form part of an existing engineered structure, submerged planting shelves will normally be incorporated into the design on the channel side of the piles / wall to allow for marginal plants to re-establish after the work. The only exceptions to this will be where such a shelf would interfere

with navigation (such as at bridge, lock, or other engineered narrowing), or where such a hard edge could be used as visitor mooring where the site has been identified as a "navigation hotspot" under NV.4.

As required

3.8. Vegetation control in the channel

Ecological basis

The channel vegetation comprises two components;

- *Reeds and other associated emergent species* which are generally shallow water plants forming fringes along the edges of the channel. These are attractive in appearance and provide habitat for fauna, as well as being of conservation interest in themselves.
- *Floating-leaved rooted*[11]* *and submersed species*, which extend out into deeper water.

Left alone, the reed fringes will gradually shallow the channel as each year's leaves and stems only partly decay, building up an organic sediment layer on the canal bed, on which the next year's growth extends a little further out until the whole width of the waterway is covered and no open water remains. This process makes the canal un-navigable. It also suppresses floating-leaved and submersed vegetation by removing their open water habitat. Reeds are, however, both a vital part of the ecosystem and important for bank protection, whilst the floating-leaved and submersed vegetation includes many of the most important conservation species and again are also important for fauna.

Management is therefore essential to maintain the required combination of conservation, bank protection and unimpeded navigation. To a large extent, the moderate boat traffic in the canal SSSI will achieve this balance and intervention will only be needed when;

- either the early summer growth of floating-leaved and submersed vegetation is so dense in the navigation track that it obstructs boat movement;
- or the reeds spread so far out into the channel that they displace the floating- leaved and submersed vegetation and, in extreme cases, block the central navigation track.

An ideal balance is a reed fringe width in the range 0.5-1.5 m. Reed control is needed once this is exceeded and a practical trigger for intervention is 2 m, cutting back to 0.5-1.0 m.

Floating-leaved and submersed vegetation should only be cut if absolutely necessary, as doing so can destabilize its species composition and favour fast- growing components which worsen channel blockage. A little impedance to early season boating should be tolerated where possible, as the passage of craft will soon open up the central track.

Cut vegetation should be removed from the channel to avoid risks of re-growth and of de-oxygenation if parts of it were to decay in the water.

The use of herbicides against native plant species should always be avoided, in view of their non-specific action and risk of creating sudden mass decay and de- oxygenation in the water. Should herbicides prove necessary, advice must be sought from the Environment Agency and assent to their use obtained from Natural England.

[11] Free-floating vegetation, notably duckweeds (Lemna spp.) and filamentous green algae, may sometimes form dense mats on the water surface.

Dense free floating mats of floating plant species (eg: Duckweed - *Lemna spp.*) occasionally occur – they are undesirable in that they retard growth of the conservationally important submersed species beneath them and can be a considerable obstruction to boats, both directly and by clogging engine cooling systems. They can also partly block weirs and small culverts threatening water control. These growths are largely uncontrollable by any direct means. Clearance by weed cutting boats or manual raking is laborious, incomplete and usually followed by rapid regrowth. Blooms of duckweed appear to be very sporadic and restricted to the eastern half of the Canal, and although generally a consequence of excessive plant nutrient inputs, so far field data does not support this. A water quality project was carried out by an undergraduate student during summer 2017 – the project concluded that there did appear to be a water quality issue in the eastern most parts of the Canal from possible septic tank leachate; and recommended that this should be investigated further as a source of pollution. Phosphorus levels were high in 2 sampling localities near properties which were known not to have mains sewerage connections, and as septic tanks are highly concentrated in phosphorous (due to the large concentration of domestic waste), it followed that the results we an indication of possible leaching.

Measures to manage water quality (WQ.2, WQ.4, WQ.5) should reduce the incidence of blooms. They are also relatively intolerant of boat traffic and of dispersal by water flow. Depending on local conditions, they may be concentrated or dispersal by wind action.

Targets

To manage reed fringes of 0.5-1.5 m width to provide bank protection without obstructing either navigation or growth of submersed and floating- leaved plants.

To restrict cutting of submersed and floating-leaved vegetation to the navigation track only and there to the minimum needed to permit boat movement.

Actions and timetables

VC.1 Reed control

When reed fringes exceed 2 m in width, reduce them to 1.5-2.0 m, taking care not to detach the bank edge part of the vegetation. Control is best done by taking out whole plants, including rooting systems, rather than just cutting back at the bases of stems, as regrowth from the latter is usually rapid in the next year. Arisings should be removed from the Canal channel unless it is to be reused to bolster reed fringe elsewhere.

Ideally this will be done outside of the bird nesting season (generally March to August inclusive). If this period cannot be avoided, check carefully for birds' nests in both the vegetation to be removed and in adjacent parts intended to remain uncut. If nests are present, delay the start of the work until young have fledged. If water voles present, follow the national water vole guidance (Strachan & Moorhouse 2006).

As required in autumn

VC.2 Vegetation cutting in the navigation track

Intervene only if there is major obstruction to navigation. Cut only in the central 5m and there a little above the canal bed. Aim not to uproot plants. Remove cut material to land disposal. Never cut the submersed and floating-leaved vegetation on the batters.

As required in early summer.

VC.3 Free-floating mats of vegetation

Direct control of duckweed and filamentous algae should only be required if there are very dense blooms – this will be by mechanical or manual raking.

Where lock or weir operation is interfered with by wind-blown banks of vegetation, manual raking may be needed. Alternatively, if sufficient water is available, induced flows can be used to disperse the mats downstream. When blockages of weir crests and culverts interfere with water management, manual raking should be used to clear the vegetation.

As required.

VC.4 Recording of vegetation control

A record will be kept of each year's vegetation control (locations, type of vegetation, methods used and time spent).

Report to CSG, noting any year-on-year trends which may indicate the need for further actions

3.9. Bankside vegetation control

Ecological basis

Bankside vegetation is mostly outside the SSSI boundaries, except in the off- channel areas (3.10 below). Specifications for its management therefore strictly falls outside this Plan, except where they could influence the designated area. Three obvious influences would be disposal of cut material, drift of herbicide sprays from the banks into the channel and allowing dense terrestrial vegetation such as bramble or saplings shade the water.

When terrestrial vegetation is cut, for example in the mowing of towpath verges, the cut material should not be dumped in the channel or allowed to fall or be blown by wind into it. There is no shortage of natural, aquatically-generated organic matter in the channel and this is unavoidably supplemented by wind-blown tree-leaf litter at certain times of year. In the relatively still water conditions of a canal, the risk of dissolved oxygen depletion is always present. Oxygen depletion occurs when organic decay is taking place and is liable to intensify to stressful extents in still water where resupply by downward transfer from the atmosphere is slow. It is therefore important not to add to this potential stress on the aquatic flora and fauna by increasing organic inputs, especially in summer when high temperatures, fast decay processes and reduced oxygen solubility combine together to maximise risks.

During the early 2010s with the BCA employing fewer site staff, winter cutting regimes were reduced; which has led to the dominance of scrub vegetation such as bramble, nettle and sapling trees on the banks in some areas – this was noted in the 2012 and 2016 vegetation surveys as starting to dominate marginal plant growth. In recent years effective volunteer engagement and additional equipment have made some progress towards an effective annual winter cut of dense scrub growth on the banks down to water's edge.

Wherever possible, manual / mechanical control of vegetation should be the preferred option, but where use of herbicides is essential, these should be formulations which are painted or weed wiped rather than sprayed on the vegetation or cut stumps. Advice must be sought from the Environment Agency.

Target

To avoid deleterious effects of bankside vegetation control on the channel ecosystem.

Actions and timetables

BV.1 Cut vegetation disposal

Cut bankside vegetation will be removed to places where it will decay without risk of it entering the channel.

Ideally cutting will be done outside of the bird nesting season (generally March to August inclusive).

If this period cannot be avoided (eg: to ensure continued use of the towpath) check carefully for birds' nests in both the vegetation to be removed and in adjacent parts intended to remain uncut. If nests are present, delay the start of the work until young have fledged. If water voles present, follow the national water vole guidance (Strachan & Moorhouse 2006).

As required

BV.2 Use of herbicides

Herbicides can be used within 20m of the channel edge by staff suitably qualified in pesticide application including use next to water. Control of non-native species is pre-agreed on a 10 year basis for the duration of this plan as agreed with EA and NE. No further permissions need to be sought. This includes stem injection of Japanese Knotweed and painting of cut Rhododendron stumps. It will also include isolated spraying of regrowth of bamboo and Japanese Knotweed (especially after stem injection techniques have already had a pronounced effect).

Spraying of Floating Pennywort may also be considered; but manual or mechanical control will always be preferred. Where necessary herbicide may be used under this agreement, but only if other methods are not being successful in at least containing growth at its current level.

As required at the appropriate time of year depending on growth cycles.

BV.3 Recording of vegetation control

A record will be kept of each year's vegetation control (locations, type of vegetation, methods used and time spent).

Report with VC.4 noting any year-on-year trends which may indicate the need for further actions

BV.5 Annual winter cutting programme

A winter bank cutting programme will be carried out to ensure dense terrestrial vegetation such as bramble does not start to dominate, or allow trees saplings to become established on the banks. This will be done by manual or mechanical means and will be carried out between the months of October and February.

Annually as required

3.10. Management of non-native species

Ecological basis

The spread of non-native flora and fauna is a major environmental issue throughout the world. Whilst the majority of species introduced to sites outside their natural distribution range cause no problems, a minority spread aggressively, reducing diversity by displacing native flora and fauna. As

well as damaging natural ecosystems, often quite severely, the invasions can create major economic costs, as for example when Australian swamp weed (*Crassula helmsii*) or Floating pennywort (*Hydrocotyle ranunculoides*) block waterways and major clearance operations are required. Amongst invasive non-native fauna, Signal crayfish (*Pacifastacus leniusculus*) damage fisheries, aquatic invertebrate populations and channel banks as well as aquatic vegetation.

The scope for controlling non-native species varies. For some, the only feasible control is prompt eradication on first appearance, as once established, their populations outstrip current management technology. This is especially so in SSSIs, where use of heavy doses of herbicides or anti-faunal poisons would cause major collateral damage to the conservation interest. For other species, continuous control effort can keep populations down to levels at which their damage is slight, though it is often impossible to achieve complete eradication. Non-natives currently causing problems in the canal SSSI are as follows.

- *Australian swamp weed (Crassula helmsii).* Colonises channel and lower banks, also off-line waters. Rarely blocks navigation, but can interfere with operation of culverts, weirs and lock gates. Tangles boat propellers and block weed traps. Uncontrollable other than by local manual clearance. Vegetative fragments are easily spread on maintenance machinery. Displaces native channel and water's edge vegetation, though few native species are wholly lost.
- *Floating Pennywort (Hydrocotyle ranunculoides).* There are large amounts of this in the River Wey, from which the canal populations have probably originated and are periodically renewed by fragments carried by boat hulls, or through thoughtless individuals. Early manual clearance prevented establishment of overwhelming quantities in the canal and continuing effort has so far maintained control over the pennywort, which is easily capable of blocking the navigation and displacing most native aquatic plant species. The EA have started a spraying programme on the River Wey and have sprayed the non-SSSI area of the Canal below Lock 1 for the last 3 years. However, although it reduces the growth after spraying it does not prevent regrowth the following year. The population on the Canal has so far been controlled to remain below (east) of Lock 7. Although there was an isolated outbreak in the Fleet area in 2016 which has been locally controlled by manual means and apparently eradicated; there is some evidence to suggest this may have originated from a local resident clearing a garden pond into the Canal.
- *Least duckweed (Lemna minuta).* Outgrows native duckweeds, but, like them, requires a rich source of plant nutrients in the water for it to become a problem. Both its spread and its growth uncontrollable by current methods (other than nutrient limitation). Clogs boat weed traps and engine cooling systems. Largely present in the Woking pound.
- *Water fern (Azolla filiculoides).* Forms dense floating mats. Characteristically erratic in its occurrences. May be hardly detectable for years then suddenly abundant. Both its spread and its growth uncontrollable by current methods.
- *North American Signal crayfish (Pacifastacus leniusculus).* Damage is difficult to quantify, but probably significant to aquatic vegetation and aquatic invertebrate populations and to banks by burrowing and to fisheries by eating eggs and fry. A commercial trapping agreement is in place with all specimens removed from the Canal, to ensure that removal of adults only do not simply boost numbers of juveniles (the species is demonstrated to self-predate). Recording of numbers caught and catch effort will give some indication of any trends in the adult population. Further studies are in progress and until any new guidance becomes available, continuation of the present high intensity trapping policy seems sensible.

- *American mink (Mustela vison).* Conservation damage is caused by predation on Water voles (*Arvicola terrestris*) and other fauna, including fish and breeding birds. Trapping is practiced and is certainly worth continuing, as there is evidence from elsewhere that persistent effort is greatly reducing mink populations and consequently the damage they cause. On the canal, recording of numbers caught and catch effort will give some indication of any trends in the population. There is evidence that where Otter is returning to waterways, they are reducing the numbers of Mink.
- *Japanese knotweed (Fallopia japonica) and Indian ('Himalayan') Balsam (Impatiens glandulifera)*. These species may form tall, dense masses along the water's edge and thus interfere with reed fringe development. Neither is easy to control once established, so prompt eradication is essential as soon as new colonisations start. Large existing populations should be subjected to annual control, with the aim of eradication over a period of years. The eradication of Himalayan Balsam in particular is difficult as it can spread very effectively from surrounding waterways. A new biological has been introduced in the past couple of years which may be effective in reducing the impact of this species.
- *Bamboo.* Bamboos are evergreen perennial flowering plants in the subfamily Bambusoideae of the grass family Poaceae. Bamboos include some of the fastest-growing plants in the world, due to a unique rhizome-dependent system. This incredibly hardy plant spreads quickly from neighbouring properties, breaking through the towpath and quickly providing screening and thus shading of the waters edge and narrowing of the towpath. Bamboo should be targeted for manual removal followed by herbicide spraying annually until it has been killed.

Various other non-native species have been recorded, but have not so far caused problems. Examples amongst the aquatic plants are: Parrot's feather (*Myriophyllum aquaticum*) which is causing serious infestations elsewhere in Britain and should be removed, and Fanwort (*Cabomba caroliniana*) which is noted as spreading to additional sections of the Canal in HBIC's 2016 study.

Target

To minimize damage to the SSSI by non-native species.

Actions and timetables

NN.1 Control of Floating pennywort (Hydrocotyle ranunculoides).

Maintain management by rigorous manual removal[12] as soon as plants are seen. Dispose of cleared material on land. This control should be extended to the non- SSSI Woking length, to safeguard navigation and to prevent build-up of populations there which could spread into the SSSI. Manual removal by weedcutter/lifter, by volunteers with boats and from the towpath.

The programme should include initial manual clearance early the season to control early growth before bird nesting season - particularly moorhens which nest early. A second programme of manual control should be undertaken as soon as possible after nesting season to remove summer regrowth and continue through rest of summer / early autumn.

[12] New control methods, including spraying remaining plants with glyphosate-based herbicides in conjunction with Topfilm adjuvant, are being trialled below lock 1 (outside the SSSI section) in conjunction with the EA's programme on the River Wey. Initial results have been disappointing with the following year's regrowth showing no signs of being reduced. Should herbicide treatments improve control of Pennywort further trials should be considered. EA and NE approvals would be required for use inside the SSSI.

Programme annually in February-March and August-October. Prioritise removal of any spread above (west) of Lock 7.

NN.2 Control of Australian swampweed (Crassula helmsii), Least duckweed (Lemna minuta) and Water fern (Azolla filiculoides).

Blockages and severe concentrations will be cleared manually/mechanically from weirs, culverts and locks and nearby areas of channel, where these interfere with operation of the Canal (water levels, public safety, public health, navigation) No other control will be attempted until effective methods become available (NN.6).

As required at any time of year.

NN.3 Control of Parrot's feather (Myriophyllum aquaticum).

Rigorous manual removal will be undertaken, aiming to eradicate this species before it starts to cause problems.

Identify sites and remove plants.

NN.4 Control of Japanese knotweed (Fallopia japonica) and Indian balsam (Impatiens glandulifera) on canal banks

New infestations will be eradicated as quickly as possible. Established populations will be controlled annually by chemical injection by appropriately trained staff members with the aim of reducing them ultimately to eradicate them on the Canal. Investigate the use of the new biological control techniques for Himalayan Balsam.

Programme in July and August annually

NN.5 Control of Signal crayfish (Pacifastacus leniusculus).

Commercial trapping will continue under licences issued by the BCA & EA, pending further guidance. Trappers will be asked to record numbers caught and numbers of traps and frequency of emptying. They should also remove and dispose of all crayfish caught and not return any including juveniles to the canal.

Continuous. Report trappers' records at end of each season.

NN.6 Control of American mink (Mustela vison).

Continue and where possible intensify trapping. Trapping and disposal must be carried out using humane national guidelines. Trappers will be asked to record numbers caught and numbers of traps and frequency of emptying.

Continuous. Report records to CSG.

NN.7 Response to reports of new non-native species.

Reports of new non-native species will be confirmed where possible and advice sought from Natural England and the Environment Agency on appropriate actions. For plants, the BCA will additionally advise the Centre for Aquatic Plant Management at the Centre for Ecology and Hydrology, Wallingford, requesting a risk assessment and advice on control.

Continuous. Report any new records and actions to CSG.

NN.8 Advances in control methods.

Scope for improving control of non-native species as a result of new research findings will be assessed each year.

NN.9 Education of user groups

The BCA will develop and issue guidance for users of the waterway (i.e. boaters, canoeists, and anglers) on the importance of good biosecurity (eg: "Check, Clean, Dry") to prevent the spread of invasive species.

Continuous

NN.10 – control of native and non-native species of that may be considered a pest within and adjoining the SSSI

Where a dense concentration of species which may be considered a pest (eg; wasps, rats or rabbits) pose a threat to human health or danger to Canal infrastructure lethal controls may be applied, if other less severe options are not considered feasible. Controls will need to be able to be targeted to the specific pest species - all carcasses must be removed from site promptly.

As *required*

3.11. Management of Greywell Cutting & promoting bat habitat

Ecological basis

The management of the cutting requires balancing of the potentially conflicting conservation requirements of the populations of the unusual Stream Water- crowfoot (*Ranunculus penicillatus ssp. pseudofluitans var. vertumnus*) in the channel, which has a high light requirement against the need for tree cover along the banks to provide a protected and shaded route for bats approaching and leaving their roost in the Greywell Tunnel SSSI. The needs of the bats may be satisfied by retaining trees set back from the channel banks and perhaps lopping their lower branches where these significantly shade the water. It may be noted that the *Ranunculus* and bat features have co-existed very satisfactorily in the past, so clearly the potential conflict can be resolved. There is a long history of monitoring of bats on the Basingstoke Canal and a useful dataset has been established.

If some trees are retained for habitat purposes, (e.g. for some dragonflies and other invertebrates and fish), it will be preferable to keep these on the north side of the canal. Trees on the north bank will be more likely to have sunny areas over the water for species such as dragonflies, it will provide more open conditions on the south side, admitting more light to the channel than any tree on the north side.

A large scale tree thinning project took place in winter 2015/6 by BCA to thin approximately 1Km of trees from the cutting (part funded by an HLS grant).

Target

To provide a tree-lined corridor to the tunnel mouth, while retaining sufficient light to the channel to support good growth of the Water buttercup.

Actions and timetables

GC.1 Assess present tree cover

Assess tree regrowth in this area no less than every-other year.

Every-other year.

GC.2 Implement tree management plan for the cutting

Carry out sapling cutting to prevent regrowth establishing as necessary.

As required – outside bird nesting season

Figure 7 - Natters bats in Greywell Tunnel
Photo credit Paul Hope – ECS Ltd

GC.3 Bat Surveys

The Greywell Tunnel is classified as a confined space within the meaning of the Confined Space Regulations. Entry into the tunnel is restricted to trained personnel equipped with breathing apparatus and other safety equipment – the cost of this controlled entry means that BCA can no longer afford the regular monitoring of the bat population which formerly occurred three times per year. Currently tunnel safety inspections are conducted every-other year, which will now be combined with a single bat survey.

Hampshire County Council and the BCA will continue to facilitate access by suitably trained members of the Hampshire Bat Group, or Natural England officers / contractors to conduct additional surveys at their own cost.

Every-other year; and/or facilitate access to bat surveyors with suitable training and safety equipment at other times in consultation with NE

GC.4 Bat Box Monitoring

Continue yearly monitoring of existing bat boxes along the Canal in collaboration with local county bat groups and consider the potential to set up additional bat box monitoring sites (particularly along the Surrey stretch of the canal).

Annually

GC.5 Training

Canal rangers should receive training on the identification of bat roosting potential in trees prior to implementation of any tree management works.

As required

3.12. Management of off-channel areas

Ecological basis

The SSSI includes a large number of wetland areas adjacent to the main navigation channel. These are listed in Appendix 1 and aerial photographs of them are in a CD which forms part of Annex 2 to the Conservation Objectives.

The areas range from substantial open water (Dogmersfield Lake), through the flashes (a combination of open water, marsh, wet woodland and heath) to small canal side marshes. Most, but not all, are hydraulically connected to the canal. They are important in themselves in that they provide habitat for some species not found in the main channel and they also function as refuge areas for channel species whose populations are currently stressed by shading and other factors. Whilst the Canal itself is in its present unfavourable condition, the latter function of the off-channel areas is especially important.

Areas of shallow water, marsh and associated woodland naturally undergo quite rapid change, as the water space becomes filled in with dead leaves and other plant debris and a succession of species exploit the changing habitats. Left alone, such areas move from maximum species diversity, when the whole range of aquatic and marsh habitats is present, through decreasing diversity as reeds then wet woodland encroach. If the process runs to its conclusion, then only woodland remains at the end. The succession can be reversed by conservation management to clear back the woody species and dredge out the silted water bodies. When this has been done, there is usually an initial phase when pioneer, fast-growing plant species predominate as the succession restarts.

Target

Work with the land owners to encourage their management the off-line areas as a group to ensure that there is a range of succession stages present at all times.

Actions and timetables

OC.1 Work with managers of the off-line areas to encourage them to consider appropriate conservation management of these areas.

Offer advice where necessary and collaborate over any plans for management to ensure no damage to the SSSI and any work is to enhance the SSSI.

Continuous

3.13. Minor engineering operations

Engineering considerations

The Canal is a man-made environment, including many engineered structures such as locks, sluices, bridges, brick or steel channel edgings and adjoining mettled or partly mettled tracks and paths. Many of these features will be within, over/under or immediately adjoining the SSSI.

These features require occasional maintenance and repair in order to maintain function and allow the Canal to continue to operate in a safe manner. Small scale repairs may be considered “minor

engineering operations" – examples of these might include the replacement of sluice paddles or winding gear, bridge decking or parapets repairs over the channel, the repairing of brickwork in masonry structures which retain or pass under / over the Canal, or repairs to towpath surfaces adjoining the SSSI.

Ecological basis

Minor engineering works on structures adjoining the canal channel, if not planned or controlled properly, could lead to issues of water quality and harm to the environment. This might be through paints, oils or cement being spilled into the water. Non-stable substances could leach chemicals into the canal, leading to poisoning of fauna, deoxygenation of water or otherwise altering water quality.

Equally if water containing structures are not adequately maintained desirable water levels may be lost. It is therefore in the overall ecological interest of the Canal SSSI that especially those features which retain or control water are kept operable and in good condition at all times, without inundating NE with requests for assent.

This section links particularly to the Conservation Actions contained in *3.1 Water level management* and *3.7 Bank protection* above, whilst not strictly Conservation Actions themselves such small scale works are not considered elsewhere in this Plan but are required to meet the COs and for other CAs to be effective.

Action and timetables

ME1 Materials and design

The chemical make-up and stability of materials should be considered in advance of planned works. Materials which are intrinsically safe and stable in the aquatic environment should normally be selected over other products, where engineering considerations allow. Works involving paints, resins, cement or concrete where this will normally be in contact with the water must be undertaken whilst the canal channel is drained (see WL3 and Appendix 9) and be allowed to thoroughly dry so there is no risk of leachate once refilled. Materials which could partly wash off into the water body should be avoided, or surfaces designed in such a way that drainage is away from the canal channel.

As required

ME2 Methods of working

All works adjoining or over the water will be planned to include a risk and method statement which includes environmental management. This will always include methods of separating and isolating any potential spills of materials or substances (eg: temporary bunds or sheeting), and have a secondary means of containment (eg spill kits) available at all times. All such operations must also have a bio-security plan to prevent the spread of invasive non-native species (eg; clean/dry/inspect all plant and equipment before deployment to site).

Designs or methods which cannot conform to these requirements will require individual consent/assent from Natural England.

As required

4. Monitoring and progress of the Plan

4.1. Collection of field data

NE's Common Standards Monitoring methods, appropriately adapted to the requirements of this Plan, will continue to be used, as they have been in recent years.

Botanical surveys

The County Boundary (R. Blackwater) is the boundary between western and eastern parts.

- 2018 – No monitoring
- 2019 – No monitoring
- 2020 – Full channel survey
- 2021 – No monitoring
- 2022 – No monitoring
- 2023 – No monitoring
- 2024 – Full channel survey
- 2025 – No monitoring
- 2026 – No monitoring
- 2027 – No monitoring
- 2028 – Full channel survey

Dragonfly surveys

No formal arrangement. The BCA will liaise with the Wildlife Trusts, Ministry of Defence contacts and local naturalists expert on dragonflies, collecting and collating survey results as they become available and presenting them to the CM Steering Group. If Natural England requires more than is yielded by these processes for its periodic condition assessment of the SSSI, it will commission the necessary survey.

Figure 8 - Banded Demoiselle (Calopteryx splenden)

Other data

The collection and assessment of other data components is covered in Section 3 above.

Water level	WL.2 WL.7
Water quality	WQ.2 WQ.6
Tree management	TR.1
Navigation	NV.1
Fisheries and angling	FA.3
Dredging	DR.5
Vegetation control	VC.4
Bankside vegetation	BV.3

Non-native species	NN.5, NN.6
Greywell Cutting	GC.1

4.2. Annual assessment

The Conservation Steering Group will assess completion rates towards targets against their individual timetables and recommend any adjustments for the year ahead – this will usually be at the March / April CSG meeting.

4.3. Periodic review

Every three years this Plan will be reviewed and adjusted in relation to experience, changed priorities and advances in conservation research. All amendments will require assent from Natural England.

5. Summary of Conservation Management Actions

The actions in Sections 3 and 4 above are here compiled into summary tables, to provide a management checklist, against which implementation of the Plan can be assessed. Detail is given from the start to 2019, at which point the first Periodic Review (4.3) will set the programme for the next phase.

Actions are divided into those which are either continuous, or at regular intervals of less than one year, those which will be in response to particular circumstances which may arise, topics expected to be covered by CSG review and those timed for completion in the period to 2023.

5.1. Continuous or frequent interval CMAs

Table 1 CMAs with continuous or frequent interval

Water supply	Maintain levels within operational range	Continuous	WL.1
	Record levels	Continuous	WL.2
	Managed navigation	Continuous	WL8
Water quality	Maintain alkaline to acidic gradient	Continuous	WQ.1
	Maintain mesotrophy	Continuous	WQ.2
	Monitoring	April, June, August, October	WQ.6
Tree management	Inspection of tree stock	Continuous - In accordance with HCC tree policy	TR1
	Control regeneration	Continuous	TR.3
	Dispose of wood	Continuous	TR.4
Navigation	Monitor boat movements	Continuous	NV1
	Boat speed limit	Continuous	NV3
Fisheries & angling	Surveillance for non-native species	Continuous	FA.2
	Maintain close season	15 March to 15 June	FA.4
	Monitor competitions	Annually	FA5
	Repair damage to banks	Continuous	FA7
	Monitor ground baiting	Continuous	FA.8

Bank protection	Repair bank erosion which causes hazards	Continuous	BP.1 BP.2 BP3
Non-native species	Control of Floating pennywort and Japanese Knotweed	Annual programme	NN1 NN4
	Control Signal crayfish and American mink	Continuous	NN.5 NN.6
	Educate user groups	Continuous	NN9
Greywell Cutting & bats	Check bat boxes	Annually	GC4
Off-channel areas	Engage with landowners	Continuously	OC1

5.2. Reactive CMAs

Table 2 – CMAs where reaction is required

Water supply	Scheduled dewaterings	As circumstances require	WL.3
	Emergency dewaterings	As circumstances require	WL.4
	Develop new backpumping	As circumstances permit	WL.5
	Develop new water supplies	As circumstances permit	WL.6 WQ.6
Water quality	Detect pollutions	As circumstances require	WQ.3
	Manage pollutions	As circumstances require	WQ4
	Assess new water supplies	As circumstances permit	WL5 WQ6
Navigation	Assess and organise boat rallies: monitor impacts	As circumstances require	NV.5
Fisheries & angling	Requests for stocking	Refer to CSG, also requires authorisation from NE & EA	FA.1
	Fisheries surveys	As circumstances require	FA.3
	Disabled angling provision	As circumstances require	FA6
Dredging	Main length dredging: plan and carry out	Dredging Plan submitted to CSG	DR.1 DR.2 DR.3
	Spot dredging	As local conditions require	DR.4
Bank protection	Post installation measures	As circumstances require	BP6
	Engineered banks	As circumstances require	BP7
Vegetation control	Reeds in channel	When reed fringe >2m wide	VC.1
	In navigation track	As required in early summer	VC.2
	Free-floating vegetation	As required	VC.3
	Bankside, including any use of herbicides	As required	BV.1 BV.2
Non-native species	Control of Australian swampweed, Water fern, and Parrots Feather	As required	NN.2 NN.3
	Control of human pests	As circumstances require	NN10

Greywell Cutting	Manage tree cover	Monitor every-other year, sapling growth as required	GC.1 GC2
	Bat surveys	Every-other year with safety inspection	GC3
	Bat training	As circumstances require	GC5
Minor engineering operations	Control materials design, and methodology	As circumstances require	ME1 ME2

5.3. CMAs to reviewed by Conservation Steering Group

Table 3 - CMAs to be reviewed by CSG

Water supply	Report water levels and supply development proposals	WL2 WL.7
Water quality	Report monitoring and EA results and trends	WQ.7
Tree management	Report proposed tree management for year ahead	TR.2
Navigation	Report boat traffic	NV.1
	Request increases in boat traffic	NV2
	Suggest "boating hotspots"	NV4
	Report previous year's boat rallies and impacts	NV.5
Fisheries & angling	Request re-stocking	FA1
	Report any records of non-native species	FA.2
	Report any fisheries surveys	FA.3
Dredging	Report work done, impact assessments, proposed new work	DR.5
Vegetation control	Channel and banks. Report work done and trends requiring further actions	VC.4 BV.3
Non-native species	Report trapping records for Signal crayfish and American mink	NN.5 NN.6
	Report any new species records and responses thereto	NN.7
	Report any potentially relevant advances in control methods for non-native species and consider their applicability to the SSSI	NN.8

Target plan 2018-2023

2018-2019					
Plan Targets	**Action**	**By Whom**	**Status**	**Funding**	**CMA Ref**
Water Quality	Monitor Water Quality at agreed monitoring points	EA		EA	WQ 7
	Turbidity survey of feeder streams	BCA ?		None	WQ 3
Water Level Management	Record water levels daily	Duty ranger		Revenue	WL2
	Report on scheduled and unscheduled dewaterings annually at CSGM	Canal Manager			WL7
Tree Management	Tree Survey High Risk Areas	Contractor		Revenue	TR 1
	Saplings management	Volunteer team			TR 3
	Off-side cutting & appropriate wood disposal	Ranger Team x 3 Winter 1 month			TR 3

Navigation	Monitor Boat use numbers and report annually to CSGM	BCA			NV 1
Fisheries & Angling	Fish Surveys - carry out as opportunities arise & report to CSGM	BCA			FA 3
	Maintain close season	BCA			FA 4
Dredging	Spot dredge high priority areas	Contractor			DR 4
	Report on any dredging to CSGM	BCA			DR 5
Bank Protection	Soft bank protection (Hampshire) priority areas A	Contractor		Capital	BP 1
	Soft bank protection (Surrey) priority areas A	Contractor		Capital	BP 1
Vegetation Control in the Channel	Weedcutting to maintain a maximum of 1.5-2m fringe	Volunteer team			VC 1
	Record vegetation control and report to CSGM	BCA			VC 4
Bankside Vegetation Control	Winter cut towpath and bankside	Ranger Team flail mower		Revenue	BV 1
	Record vegetation control and report to CSGM	BCA			BV 3
Management of Non Native Species	Mink control	Ranger Ad Hoc			NN 6
	Japenese Knotweed Injection	Ranger x 2 Every August		Revenue	NN 4
	Bamboo control	Volunteer Team			NN
	Himlayan Balsam pulling	Volunteer Team			NN
	Floating Pennywort removal	Volunteer Team			NN 1
	Australian Swampweed removal	Volunteer Team			NN 2
	Signal Crayfish trapping	Commercial trapper		N/A	NN 5
	Cabomba removal	BCA			NN
	Parrrots Feather removal	BCA			NN 3
Management of Greywell Tunnel	Continue implementation of tree management plan	BCA			GC 2
Off Channel Areas	Work with partners to maintain and enhance where opportunities arise	BCA		None	OC 1
Monitoring Progress of the Plan		BCA		Revenue	
2019-2020					
Plan Targets	**Action**	**By Whom**	**Status**	**Funding**	**Ref**
Water Quality	Monitor Water Quality at agreed monitoring points	EA		EA	WQ 7
					WQ 3
Water Level Management	Record water levels daily	Duty ranger		Revenue	WL2
	Report on scheduled and unscheduled dewaterings annually at CSGM	Canal Manager			WL7

Tree Management	Tree Survey High Risk Areas	Contractor			TR 1
	Saplings management	Volunteer team			TR 3
	Off-side cutting & appropriate wood disposal	Ranger Team x 3 Winter 1 month			TR 3
Navigation	Monitor Boat use numbers and report annually to CSGM	BCA			NV 1
Fisheries & Angling	Fish Surveys - carry out as opportunities arise & report to CSGM	BCA			FA 3
	Maintain close season	BCA			FA 4
Dredging	Spot dredge high priority areas	Contractor			DR 4
	Report on any dredging to CSGM	BCA			DR 5
Bank Protection	Soft bank protection (Hampshire) priority areas A	Contractor		Capital	BP 1
	Soft bank protection (Surrey) priority areas A	Contractor		Capital	BP 1
Vegetation Control in the Channel	Weedcutting to maintain a maximum of 1.5-2m fringe	Volunteer team			VC 1
	Record vegetation control and report to CSGM	BCA			VC 4
Bankside Vegetation Control	Winter cut towpath and bankside	Ranger Team flail mower			BV 1
	Record vegetation control and report to CSGM	BCA			BV 3
Management of Non Native Species	Mink control	Ranger Ad Hoc			NN 6
	Japenese Knotweed Injection	Ranger x 2 Every August			NN 4
	Bamboo control	Volunteer Team			NN
	Himlayan Balsam pulling	Volunteer Team			NN
	Floating Pennywort removal	Volunteer Team			NN 1
	Australian Swampweed removal	Volunteer Team			NN 2
	Signal Crayfish trapping	Commercial trapper		N/A	NN 5
	Cabomba removal	BCA			NN
	Parrrots Feather removal	BCA			NN 3
Management of Greywell Tunnel	Continue implementation of tree management plan	BCA			GC 2
Off Channel Areas	Work with partners to maintain and enhance where opportunities arise	BCA		None	OC 1
Monitoring Progress of the Plan					
	2020-2021				
Plan Targets	**Action**	**By Whom**	**Status**	**Funding**	**Ref**

Water Quality	Monitor Water Quality at agreed monitoring points	EA		EA	WQ 7
	Turbidity survey of feeder streams	BCA ?		None	WQ 3
Water Level Management	Record water levels daily	Duty ranger		Revenue	WL2
	Report on scheduled and unscheduled dewaterings annually at CSGM	Canal Manager			WL7
Tree Management	Tree Survey High Risk Areas	Contractor		Revenue	TR 1
	Saplings management	Volunteer team			TR 3
	Off-side cutting & appropriate wood disposal	Ranger Team x 3 Winter 1 month			TR 3
Navigation	Monitor Boat use numbers and report annually to CSGM	BCA			NV 1
Fisheries & Angling	Fish Surveys - carry out as opportunities arise & report to CSGM	BCA			FA 3
	Maintain close season	BCA			FA 4
Dredging	Spot dredge high priority areas	Contractor			DR 4
	Report on any dredging to CSGM	BCA			DR 5
Bank Protection	Soft bank protection (Hampshire) priority areas B	Contractor		Capital	BP 1
	Soft bank protection (Surrey) priority areas B	Contractor		Capital	BP 1
Vegetation Control in the Channel	Weedcutting to maintain a maximum of 1.5-2m fringe	Volunteer team			VC 1
	Record vegetation control and report to CSGM	BCA			VC 4
Bankside Vegetation Control	Winter cut towpath and bankside	Ranger Team flail mower		Revenue	BV 1
	Record vegetation control and report to CSGM	BCA			BV 3
Management of Non Native Species	Mink control	Ranger Ad Hoc			NN 6
	Japenese Knotweed Injection	Ranger x 2 Every August		Revenue	NN 4
	Bamboo control	Volunteer Team			NN
	Himlayan Balsam pulling	Volunteer Team			NN
	Floating Pennywort removal	Volunteer Team			NN 1
	Australian Swampweed removal	Volunteer Team			NN 2
	Signal Crayfish trapping	Commercial trapper		N/A	NN 5
	Cabomba removal	BCA			NN
	Parrrots Feather removal	BCA			NN 3
Management of Greywell Tunnel	Continue implementation of tree management plan	BCA			GC 2
Off Channel Areas	Work with partners to maintain and enhance where opportunities arise	BCA		None	OC 1

Monitoring Progress of the Plan	Full botanical survey of Canal (excluding off channel areas)	BCA		Revenue	
2021-2022					
Plan Targets	**Action**	**By Whom**	**Status**	**Funding**	**Ref**
Water Quality	Monitor Water Quality at agreed monitoring points	EA		EA	WQ 7
	Turbidity survey of feeder streams	BCA ?		None	WQ 3
Water Level Management	Record water levels daily	Duty ranger		Revenue	WL2
	Report on scheduled and unscheduled dewaterings annually at CSGM	Canal Manager			WL7
Tree Management	Tree Survey High Risk Areas	Contractor		Revenue	TR 1
	Saplings management	Volunteer team			TR 3
	Off-side cutting & appropriate wood disposal	Ranger Team x 3 Winter 1 month			TR 3
Navigation	Monitor Boat use numbers and report annually to CSGM	BCA			NV 1
Fisheries & Angling	Fish Surveys - carry out as opportunities arise & report to CSGM	BCA			FA 3
	Maintain close season	BCA			FA 4
Dredging	Spot dredge high priority areas	Contractor			DR 4
	Report on any dredging to CSGM	BCA			DR 5
Bank Protection	Soft bank protection (Hampshire) priority areas B	Contractor		Capital	BP 1
	Soft bank protection (Surrey) priority areas B	Contractor		Capital	BP 1
Vegetation Control in the Channel	Weedcutting to maintain a maximum of 1.5-2m fringe	Volunteer team			VC 1
	Record vegetation control and report to CSGM	BCA			VC 4
Bankside Vegetation Control	Winter cut towpath and bankside	Ranger Team flail mower		Revenue	BV 1
	Record vegetation control and report to CSGM	BCA			BV 3
Management of Non Native Species	Mink control	Ranger Ad Hoc			NN 6
	Japenese Knotweed Injection	Ranger x 2 Every August		Revenue	NN 4
	Bamboo control	Volunteer Team			NN
	Himlayan Balsam pulling	Volunteer Team			NN
	Floating Pennywort removal	Volunteer Team			NN 1
	Australian Swampweed removal	Volunteer Team			NN 2
	Signal Crayfish trapping	Commercial trapper		N/A	NN 5
	Cabomba removal	BCA			NN

	Parrrots Feather removal	BCA			NN 3
Management of Greywell Tunnel	Continue implementation of tree management plan	BCA			GC 2
Off Channel Areas	Work with partners to maintain and enhance where opportunities arise	BCA		None	OC 1
Monitoring Progress of the Plan					
2022-2023					
Plan Targets	**Action**	**By Whom**	**Status**	**Funding**	**Ref**
Water Quality	Monitor Water Quality at agreed monitoring points	EA		EA	WQ 7
	Turbidity survey of feeder streams	BCA ?		None	WQ 3
Water Level Management	Record water levels daily	Duty ranger		Revenue	WL2
	Report on scheduled and unscheduled dewaterings annually at CSGM	Canal Manager			WL7
Tree Management	Tree Survey High Risk Areas	Contractor		Revenue	TR 1
	Saplings management	Volunteer team			TR 3
	Off-side cutting & appropriate wood disposal	Ranger Team x 3 Winter 1 month			TR 3
Navigation	Monitor Boat use numbers and report annually to CSGM	BCA			NV 1
Fisheries & Angling	Fish Surveys - carry out as opportunities arise & report to CSGM	BCA			FA 3
	Maintain close season	BCA			FA 4
Dredging	Spot dredge high priority areas	Contractor			DR 4
	Report on any dredging to CSGM	BCA			DR 5
Bank Protection	Soft bank protection (Hampshire) priority areas C	Contractor		Capital	BP 1
	Soft bank protection (Surrey) priority areas C	Contractor		Capital	BP 1
Vegetation Control in the Channel	Weedcutting to maintain a maximum of 1.5-2m fringe	Volunteer team			VC 1
	Record vegetation control and report to CSGM	BCA			VC 4
Bankside Vegetation Control	Winter cut towpath and bankside	Ranger Team flail mower		Revenue	BV 1
	Record vegetation control and report to CSGM	BCA			BV 3
Management of Non Native Species	Mink control	Ranger Ad Hoc			NN 6
	Japenese Knotweed Injection	Ranger x 2 Every August		Revenue	NN 4
	Bamboo control	Volunteer Team			NN
	Himlayan Balsam pulling	Volunteer Team			NN

	Floating Pennywort removal	Volunteer Team			NN 1
	Australian Swampweed removal	Volunteer Team			NN 2
	Signal Crayfish trapping	Commercial trapper		N/A	NN 5
	Cabomba removal	BCA			NN
	Parrrots Feather removal	BCA			NN 3
Management of Greywell Tunnel	Continue implementation of tree management plan	BCA			GC 2
Off Channel Areas	Work with partners to maintain and enhance where opportunities arise	BCA		None	OC 1
Monitoring Progress of the Plan					

Appendix 1 – Locations and ownerships

The navigation channel

From the eastern portal of the Greywell Tunnel, Hampshire, at SU719 514 to the boundary with Surrey at Ash Vale, SU886 514 and thence within Surrey to Hermitage Bridge, Woking, SU967574 and from Monument Bridge, Woking, TQ016597 to the junction with the River Wey Navigation at Byfleet, TQ053 618. The total distance, excluding the undesignated 6.5 km length in Woking, is 45.1 km.

The Freehold for the whole length from Greywell to Byfleet is held by the two County Councils, each within their jurisdiction.

Greywell Tunnel is the subject of a separate SSSI for its bat interest and is largely excluded from this Plan. 3km of Canal channel west of the Greywell Tunnel is also in Canal ownership, and is managed as a Local Nature Reserve with its own Management Plan.

The off-channel areas

Diagrams of the areas are on a CD supplied with Annex 2 to the Conservation Objectives (Appendix 2 to this Plan). They consist of 1999 aerial photographs of the areas, superimposed on which are lines showing the SSSI boundaries, the extents of open water at the time of the photograph and the minimum acceptable open water after siltation and vegetation encroachment before major clearance is needed for conservation purposes.

Some of these areas are in Canal ownership, most are not with large proportion being owned by the Ministry of Defence [MoD], and some by private landowners. In the latter two cases, the BCA will seek co-operation of the owners and occupiers of these areas in the conservation management of these parts of the SSSI. It may be easier to influence management of some of the MoD areas within Hampshire in future, as they now leased to the Land Trust, who in turn have a management arrangement with the Blackwater Valley Countryside Management Project; with whom the BCA have close ties.

Hampshire

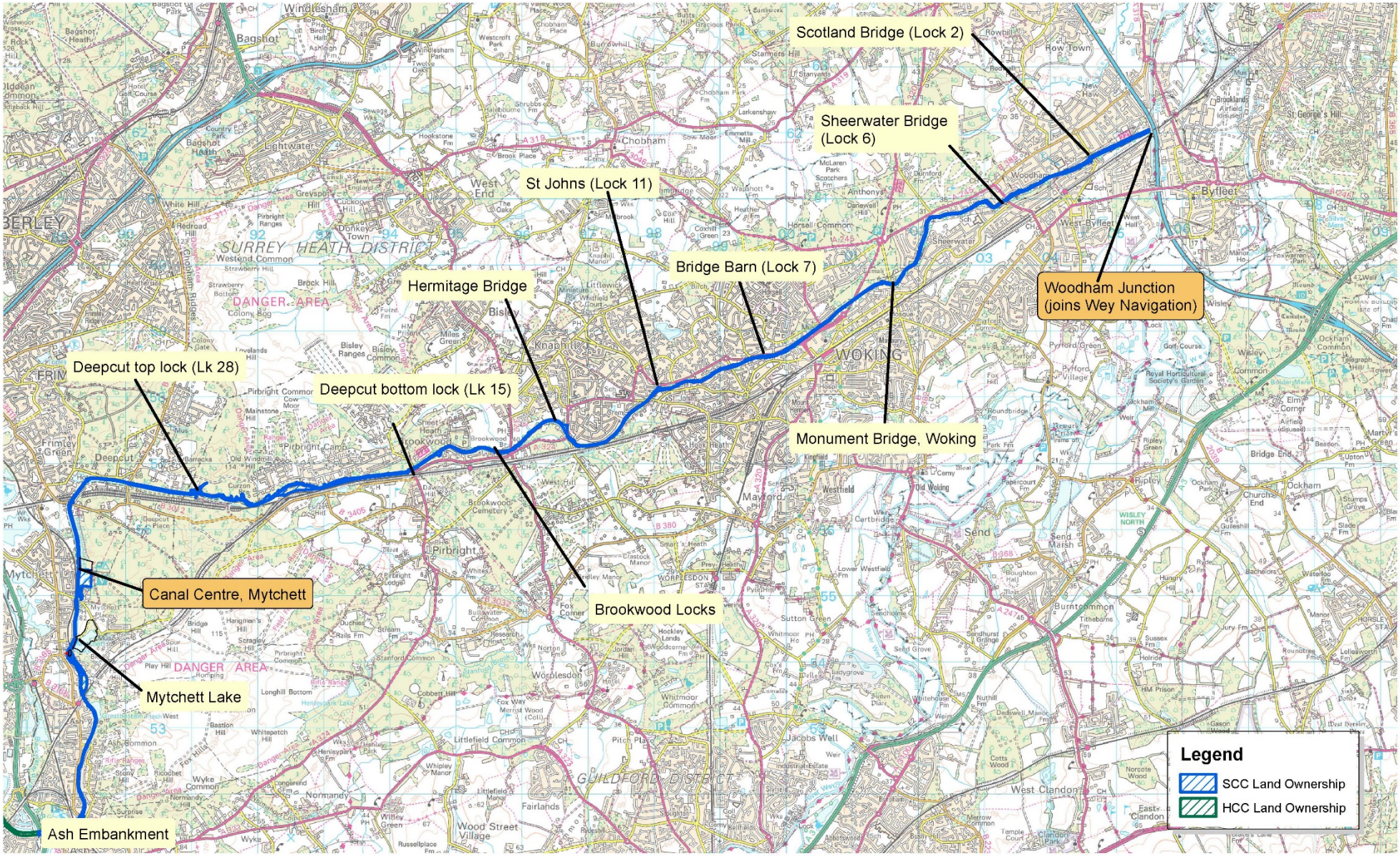
Area no.	Name	NGR SUxx	Notes, including condition recorded by Hall (2004).[1]
1	Dogmersfield Lake	75805180	Lake with narrow surrounding belt of marsh and trees. **Not connected to the Canal, or in Canal ownership.**
2	Pondtail Flash	82345370	Small, shaded area liable to road pollution, fly tipping and trampling.
3	Miles Hill	83645310	Small marsh below Miles Heath; in summer two small inlets from canal, perhaps more extensive water in winter. **Not in Canal ownership.**
4	Eelmoor West	84025284	Seasonally flooded hollow W of Eelmoor Flash, but not connected thereto. **Not in Canal ownership.**
5	Eelmoor Flash	84235280	Large. **Mostly not in Canal ownership**
6	Claycart Flash	85105266	Large, a history of overgrowth by sallows etc. periodically cleared back. **Partly not in Canal ownership.**
7	Claycart Hill Flash	85425252	Overgrown by trees until cleared as part of offside tree management in 2000, after which rapidly re-colonised by wetland flora. Now again being invaded by scrub etc.

[1] The assertions as to ownership in the previous iteration of this plan did not match landownership records, which show that in fact a much larger proportion of the flashes are in fact outside Canal ownership and control. This has now been corrected.

8	Rushmoor Flash	85565226	Large. **Partly not in Canal ownership.**
9	Little Rushmoor Flash	85705223	Overgrown.
10	Wharf Bridge	86185228	Bay at slipway near bridge.

Surrey

Area no.	Name	NGR SUxx	Notes
11	Great Bottom Flash	89555332	Large. **Not in Canal ownership**
12	Fisherman's Flash	89375360	Just N of Ash Vale Bridge. Perhaps old winding hole.
13	Ash Vale North 1	89365383	Small and threatened by trees and leaf litter.
14	Ash Vale North 2	89195400	Small and threatened by trees and leaf litter.
15	Mytchett Lake	89405440	Large. **Not in Canal ownership**
16	Potter's Pool	89335547	Pond connected to canal. Tree-shaded. **Not in Canal ownership.**
17	Frimley Green	89185642	Winding hole - shaded by trees, former stand of Japanese Knotweed now controlled.
18	Lodge Hill West (Lock 27)	91605651	Narrow S facing inlet flanked by trees.
19	Lodge Hill Central (Lock 26)	91695647	Narrow S facing inlet flanked by trees.
20	Lodge Hill East (Lock 26)	91795648	Larger than previous two.
21	Curzon Bridge West	91925640	Small S facing bay W of bridge.
22	Curzon Flash	92155649	Large; great potential but very neglected.
23	Lock 21 (west of)	92685667	Wide S facing offside bay.
24	Lock 19 (west of)	93055666	Bay on N side.
25	New Pond	93355670	**Not connected to the Canal, nor in Canal ownership.**
26	Howfield Flash	94325691	Winding hole just W of Pirbright Bridge.
27	Sheets Heath Flash	94755716	Offside, bordered by private gardens.
28	Brookwood Locks	95685715	Bay on S side.
29	Hermitage Flash	96655756	Attempts in 2008 to establish a reed bed following tree management have largely not been successful.



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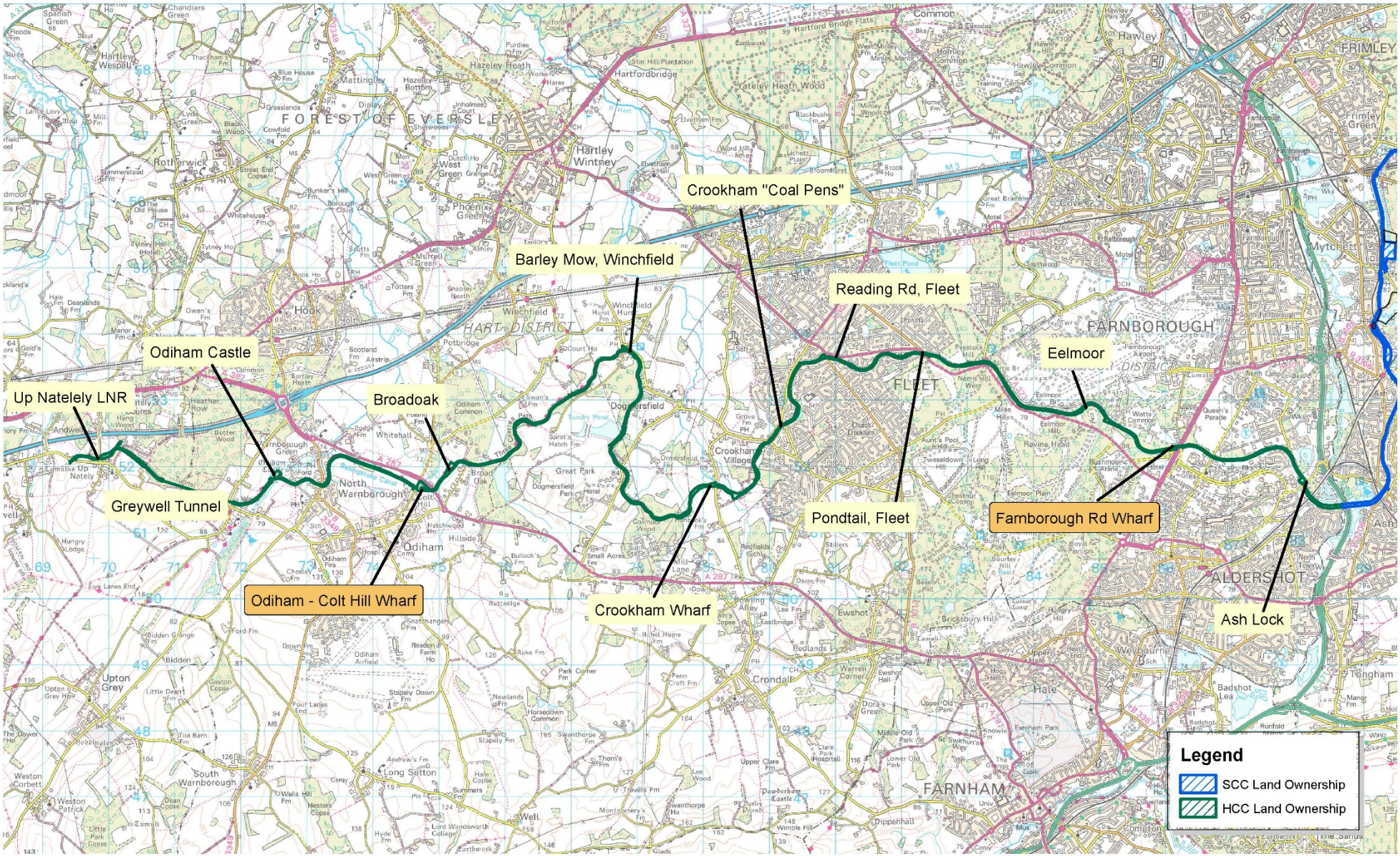
Surrey Canal locations

SURREY COUNTY COUNCIL



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Hampshire Canal locations

Hampshire County Council

Appendix 2 – Conservation Objectives and Favourable Condition Tables

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CONSERVATION OBJECTIVES and DEFINITIONS OF FAVOURABLE CONDITION for DESIGNATED FEATURES OF INTEREST:

These Conservation Objectives relate to all designated features on the SSSI, whether designated as SSSI, SPA, SAC or Ramsar features.

Name of Site of Special Scientific Interest (SSSI)	
Basingstoke Canal SSSI	
Names of designated international sites	
Special Area for Conservation (SAC)	N/A
Special Protection Area (SPA)	N/A
Ramsar:	N/A
Relationship between site designations	

Version Control information	
Status of this Version (Draft, Consultation Draft,	Consultation Draft
Prepared by:	John Eaton
Date of this version:	04/03/08
Date of generic guidance on favourable condition used:	Freshwater 07/05 Canals 03/05 Invertebrates 09/06 (provisional) Heathland 2003
Other notes/version history :	Editing by Jo Clarke: March 2008

Quality Assurance information		
Checked by	**Name:**	**Date:**
	Signature	

Conservation Objectives and definitions of Favourable Condition: notes for users

Conservation Objectives

SSSIs are notified because of specific biological or geological features. Conservation Objectives define the desired state for each site in terms of the features for which they have been designated. When these features are being managed in a way which maintains their nature conservation value, then they are said to be in 'favourable condition'. It is a Government target that 95% of the total area of SSSIs should be in favourable condition by 2010.

Definitions of Favourable Condition

The Conservation Objectives are accompanied by one or more habitat extent and quality definitions for the special interest features at this site. These are subject to periodic reassessment and may be updated to reflect new information or knowledge; they will be used by Natural England and other relevant authorities to determine if a site is in favourable condition. The standards for favourable condition have been developed and are applied throughout the UK.

Use under the Habitats Regulations

The Conservation Objectives and definitions of favourable condition for features on the SSSI may inform the scope and nature of any 'appropriate assessment' under the Habitats Regulations. An appropriate assessment will also require consideration of issues specific to the individual plan or project. The habitat quality definitions do not by themselves provide a comprehensive basis on which to assess plans and projects as required under Regulations 20-21, 24, 48-50 and 54 - 85. The

scope and content of an appropriate assessment will depend upon the location, size and significance of the proposed project. Natural England will advise on a case by case basis.

Following an appropriate assessment, competent authorities are required to ascertain the effect on the integrity of the site. The integrity of the site is defined in paragraph 20 of ODPM Circular 06/2005 (DEFRA Circular 01/2005) as the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified. The determination of favourable condition is separate from the judgment of effect upon integrity. For example, there may be a time-lag between a plan or project being initiated and a consequent adverse effect upon integrity becoming manifest in the condition assessment. In such cases, a plan or project may have an adverse effect upon integrity even though the site remains in favourable condition.

The formal Conservation Objectives for European Sites under the Habitats Regulations are in accordance with paragraph 17 of ODPM Circular 06/2005 (DEFRA Circular 01/2005), the reasons for which the European Site was classified or designated. The entry on the Register of European Sites gives the reasons for which a European Site was classified or designated.

Explanatory text for Tables 2 and 3

Tables 2, 2a and 3 set out the measures of condition which we will use to provide evidence to support our assessment of whether features are in favourable condition. They are derived from a set of generic guidance on favourable condition prepared by Natural England specialists, and have been tailored by local staff to reflect the particular characteristics and site-specific circumstances of individual sites.

Quality Assurance has ensured that such site-specific tailoring remains within a nationally consistent set of standards. The tables include an audit trail to provide a summary of the reasoning behind any site-specific targets etc. In some cases the requirements of features or designations may conflict; the detailed basis for any reconciliation of conflicts on this site may be recorded elsewhere.

Conservation Objectives

The Conservation Objectives for this site are, subject to natural change, to maintain the following habitats and geological features in favourable condition[1], with particular reference to any dependent component special interest features (habitats, vegetation types, species, species assemblages etc.) for which the land is designated (SSSI, SAC, SPA, Ramsar) as individually listed in Table 1.

Habitat Types represented (Biodiversity Action Plan categories)

Standing open water and canals

Dwarf shrub heath

Geological features (Geological Site Types)

N/A

Standards for favourable condition are defined with particular reference to the specific designated features listed in Table 1, and are based on a selected set of attributes for features which most economically define favourable condition as set out in Table 2, Table 2a and Table 3.

[1] *or* restored to favourable condition if features are judged to be unfavourable.

Table 1 - Individual designated interest features

BAP Broad Habitat type / Geological Site Type	Specific designated features	Explanatory description of the feature for clarification	SSSI designated interest features	SAC designated interest features	SPA bird populations dependency on specific habitats			Ramsar criteria applicable to specific habitats			
					Annex 1 species	**Migratory species**	**Waterfowl assemblage**	**1a Wetland characteristics**	**2a Hosting rare species &c**	**3a 20000 waterfowl**	**3c 1% of population**
Standing open water and canals **Fen, marsh and swamp**	Canal systems with emergent fringing vegetation	Emergent fringing vegetation includes the following NVC communities: S4 *Phragmites australis* swamp and reed beds S5 *Glyceria maxima* swamp S6 *Carex riparia* swamp S7 *Carex acutiformis* swamp S8 *Scirpus lacustris ssp lacustris* swamp S10 *Equisetum fluviatile* swamp S12 *Typha latifolia* swamp S13 *Typha angustifolia* swamp S14 *Sparganium erectum* swamp S16 *Acorus calamus* swamp S19 *Eleocharis palustris* swamp S22 *Glyceria fluitans* swamp S26 *Phragmites australis – Urtica dioica* tall-herb fen S28 *Phalaris arundinacea* tall-herb fen	*								
Standing open water and canals	Odonata assemblage	Outstanding Dragonfly assemblage	*								
Standing open water and canals	Plant assemblage	Plant assemblage including: Shore Horsetail (*Equisetum x litorale*) River Water-dropwort (*Oenanthe fluviatilis*) Tasteless Water-pepper (*Persicaria laxiflora*) Hairlike Pondweed (*Potamogeton trichoides*) Stream Water-crowfoot (*Ranunculus pencillatus*	*								

		ssp *pseudofluitans* var *vertumnus*)									
Standing open water and canals	Outstanding assemblage of invertebrates	Broad assemblage type: W21 open water Specific assemblage type: W211 open water on disturbed sediments	*								
Fen, marsh and swamp	Outstanding assemblage of invertebrates	Broad assemblage type: W31 permanent wet mire Specific assemblage type: W314 rich fen	*								
Dwarf shrub heath	Dry heath including: H2 ***Calluna vulgaris - Ulex minor*** heath Wet heath including: M16 *Erica tetralix - Sphagnum compactum* wet heath	Dwarf shrub heath found on Pondtail Heath, Hampshire, adjoining the canal.	*								

NB. Features where asterisks are in brackets (*) indicate habitats which are not notified for specific habitat interest (under the relevant designation) but because they support notified species.

Table 2a – Habitat extent objectives

Conservation Objective for habitat extent	To maintain the designated features in favourable condition, which is defined in part in relation to a balance of habitat extents (extent attribute). Favourable condition is defined at this site in terms of the following site-specific standards:		
Extent - Dynamic balance	On this site favourable condition requires the maintenance of the extent of each in-channel and off-channel habitat type (either designated habitat or habitat supporting designated species). Maintenance implies restoration if evidence from condition assessment suggests a reduction in extent.		
Habitat Feature (BAP Broad Habitat level, or more detailed level if applicable)	**Estimated extent (ha) and date of data source/estimate**	**Site Specific Target range and Measures**	**Comments**
Standing open water and canals	96.36 hectares (1995 revision of 1985 citation)	No reduction in the extent of vegetation types for which the canal was designated. Observations on the balance between cover of emergent and submerged + floating-leaved vegetation and on the aquatic species present, during section surveys. Application of method described in Section 7.1. Site specific targets for different canal sections **Open water:** Navigation channel: no reduction in area of open water, which includes that colonised by marginal emergent vegetation. Observation during surveys and enquiry from Canal Manager. No development should be permitted either in or adjacent to the canal which will cause loss of habitat. Off-channel areas: maintain balance of areas of open water, emergent vegetation and marsh. See site-specific standards for target ranges and measures. No development should be permitted in, adjacent to, or in the catchment area supplying water to the off-channel areas which will cause loss of habitat.	This attribute relates to the botanical reasons for which the canal was notified. In some canals the swamp/fen vegetation is outstanding, in some there is extensive open water vegetation, and others have a combination of the two. Characteristic species assemblages are closely related to water chemistry, with intensity of use (e.g. boat traffic density) influencing deviation from these patterns. Most canal SSSIs contain good examples of the vegetation of eutrophic, base-rich watercourses, but others are important for their oligo-mesotrophic, mesotrophic or base- poor characteristics. Some of the best canals have a range of trophic types, reflecting the source of the inflows. Targets must be set on a site-by-site basis, within the framework of the simple classification given in Section 7.1 The canal (i) from Greywell Tunnel eastern portal, Hampshire to Hermitage Road Bridge, Surrey and (ii) from Monument Bridge, Surrey to Scotland Bridge, Surrey, together with off-channel areas, here defined as flashes and other open waters and marshes associated with each of these two canal lengths. The canal navigation channel is divided into two units, Canal West (CW) from Greywell Tunnel eastern portal to Norris Bridge (OS SU833535) and Canal East (CE) from Norris Bridge to Hermitage Road Bridge and from Monument Bridge to Scotland Bridge. OW comprises the two off-channel areas associated with CW and OE is the group of 27 areas associated with CE. The areas are listed in Appendix 1.

		Floating-leaved and submersed vegetation: Navigation channel: CSM vegetation monitoring to show no reduction in the extent of vegetation types for which the canal was designated below 30% cover. Off-channel areas: see site-specific standards for target ranges and measures. **Emergent vegetation:** Navigation channel: CSM vegetation monitoring to show 0.8 m wide average margin on both banks, minus (i) lengths where dense tree cover is maintained for conservation purposes and (ii) lengths at lock approaches, bridge holes and moorings. The extent of lengths where dense tree cover is to be maintained for conservation purposes is defined in Table 2a as 10% of the total length of the SSSI channel. The 0.8 m width of vegetation gives a cover of ~12%. Off-channel areas: see site-specific standards for target ranges and measures. The extent of lengths where dense tree cover is to be maintained for conservation purposes is defined in Table 2a as, on average over each of OW and OE, 10% of the total length of the margins.	As the citation includes only the overall extent (99.15 hectares), the individual areas of the habitats quoted are estimated from maps. By monitoring this habitat, the indirect attributes for the individual members of the plant assemblage will also be assessed.
Outstanding assemblage of Odonata	Standing open water and canals: navigation channel: one part of the core larval habitat	No reduction. Observation during surveys and enquiry from Canal Manager.	For most of the dragonfly assemblage, suitable larval habitat comprises belts of emergent, floating-leaved and submersed vegetation, heterogeneous in structure, along the edges of the waterbodies. For at least two of the species, there is a requirement for tree cover overhanging the water surface.
	Standing open water and canals: off-channel areas: the other part of the core larval habitat	No more than 10% reduction in open water. Mapped.	For most of the dragonfly assemblage, suitable larval habitat comprises belts of emergent, floating-leaved and submersed vegetation, heterogeneous in structure, along the edges of the waterbodies. For at least two of the species, there is a requirement for tree cover overhanging the water surface.

	Standing open water and canals: navigation channel + off-channel areas: the larval habitat	Open water to have ~10% tree cover.	Tree cover is important for the two of the most notable species cited (*Somatochlora metallica* and *Cordulia aenea*). *Salix* and *Alnus* are the preferred genera of trees.
Lowland heathland	Dry heath = 1.01ha Communities associated with dry heath = 0.17ha Wet heath = 1.61ha	>source of data< No unconsented decline in the area of the habitat, except where a target has been set to increase the extent of other habitat features on the site at the expense of lowland heathland	Lowland heathlands are habitats created mostly through human management by grazing, cutting and burning. If they are left to natural processes, then they lose their open character and disappear under thick scrub or secondary forest. However some fluctuations and variations from year to year are normal and acceptable. The lowland heathland area is located at Pondtail Heath.

Audit Trail

Rationale for habitat extent attribute
(Include methods of estimation (measures) and the approximate degree of change which these are capable of detecting).

Loss of channel area is unlikely so long as the canal remains an active navigation: field observation and periodic enquiry to the Canal Manager will show any such changes.

Off-channel areas are susceptible to siltation from both the navigation channel (if connected thereto) and from any streams which flow into them. They also experience change by natural succession from open water through reed swamp to wet woodland. To maintain the requisite balance of habitats, active conservation management is needed, standards for which are in Table 3. Mapping, together with the use of the latest aerial photographs, provides information on which sites have reached the stage where intervention by tree clearance and dredging is needed. These methods are capable of detecting <5% change between mappings.

The canal should be classed as Type B (JNCC 2005, 5.1), on account of its supporting both floating-leaved + submersed and emergent vegetations of conservation interest. Type A classification is not practicable because of the cover constraints described below on the emergent vegetation component. These constraints are desirable in that they limit the extent to which encroachment of emergent cover down the batters can occupy habitat for submersed and floating-leaved plants. For Type B, the highest target cover range for emergent vegetation is 10-30%. With a mean channel width of ~13 m, 30° batters and a central navigation track ~5 m wide (i.e. ~35% of the total width) and carrying ≤1300 boat movements per year, emergent vegetation should colonise to ~0.5 m water depth, which is ~0.8 m width from each side of the channel. Emergent cover will therefore be, at maximum, ~12%, leaving ~53% of the channel bed available to floating-leaved and submersed vegetation outside the navigation track. The Type B target cover range for floating-leaved + submersed vegetation compatible with these conditions is 30-70%.

The division of the canal into units CW and CE is derived from the Detrended Correspondence Analysis diagram of the gradation of plant assemblages along the SSSI in James & Eaton (1999). This gradation of assemblages is a distinctive feature of the SSSI and is a major influence in creating the high species richness of the SSSI as a whole. The division of this continuum at Norris Bridge must be recognised as somewhat arbitrary.

Rationale for site-specific targets (including any variations from generic guidance)

The site survey method used in 1994 (BIOSCAN 1994), immediately prior to production of the 1995 Citation, was sufficiently close to that in JNCC (2005 8.3) for its results to be adopted as a baseline for site surveys. The walking survey method used by Hall (2003) is likewise sufficiently close to that in JNCC (2005 8.2) to be adopted as a baseline for section surveys.

Other Notes
Off-channel areas supplied by streams are vulnerable to drying out due to silt inputs and reduced water supply when the catchments of those streams are subject to some forms of development; hence the need to regulate and/or mitigate changes in the wider catchments wherever possible. Adjacent forestry development can be another cause of drying which requires control.

Table 2b Species population objectives for the Basingstoke Canal

Conservation Objective for species populations	To maintain the designated species in favourable condition, which is defined in part in relation to their population attributes. Favourable condition is defined at this site in terms of the following site-specific standards:
Population balance	On this site favourable condition requires the maintenance of the population of each designated species or assemblage. Maintenance implies restoration if evidence from condition assessment suggests a reduction in size of population or assemblage.

Species Feature (species or assemblage)	List supporting BAP Broad Habitats	Population Attribute (e.g. presence/absence, population size or assemblage score)	Site Specific Target range and Measures (specify geographical range over which target applies i.e. site, BAP broad habitat or more specific)	Comments
Members of the vascular plant assemblage: Shore Horsetail (*Equisetum x litorale*) River Water-dropwort (*Oenanthe fluviatilis*) Tasteless Water-pepper (*Persicaria laxiflora*) Hairlike Pondweed (*Potamogeton trichoides*) Stream Water-crowfoot (*Ranunculus pencillatus* ssp *pseudofluitans* var vertumnus)	**Standing open water and canals**	Presence/absence by identification of the species	Navigation channel units CW plus CE: 95% of the total of (a) notable native aquatic species listed for the channel in CW and/or CE in the 1995 Citation, and (b) the other less notable native aquatic species recorded in the BIOSCAN (1994) CSM-type surveys of 13 sites and in the Hall (2003) walking survey. Results of repeat CSM surveys every six years. Off-channel areas OW plus OE: (i) 90% of the total of (a) the range of notable native aquatic species listed for off-line areas in the Citation, and (b) other native aquatic and marsh species listed in Hall (2004), including	95% allows for the low species detection turnover (high 're-find rate') expected in favourable condition channels. The use of the 1994 and 2003 datasets provides the best available baseline at SSSI Revision confirmed in June 1995. The Citation does not distinguish between CW and CE. The Citation does not distinguish between CW and CE. 90% allows for the higher turnover in these areas, where rapid succession is natural. The re-find rates, which are from Hall

			those stated in Tables 2A–10 (Hampshire) and Tables 2A-17 (Surrey) to have been recorded over the period 1985-2002, but not in 2003. (ii) mean re-find rates *per area* over all off-channel areas of at least 20% for floating-leaved species, 30% for submersed species and 65% for emergent species. Results of repeat CSM surveys every six years.	(2004), are a measure of the effectiveness of active conservation management in reversing succession in different areas at different times and thereby achieving overall species retention against the tendency for succession to cause losses. The rate for floating-leaved species is based on only a little data and should be reviewed as more survey information accumulates.
Outstanding assemblage of invertebrates Broad assemblage type: W21 open water Specific assemblage type: W211 open water on disturbed sediments	**Standing open water and canals**	Specialist direct monitoring of assemblage score based on presence/absence of specified proportion of species typical of habitat listed in ISIS	Monitor assemblage once in every 6 year monitoring cycle. Using defined invertebrate sampling protocols thresholds to be met: W21 open water: SQI score = 170 W211 open water on disturbed sediments: Weighted Species Score = 4	This attribute is to be assessed through specialist survey.
Outstanding assemblage of invertebrates Broad assemblage type: W31 permanent wet mire Specific assemblage type: W314 rich fen	**Fen, marsh and swamp**	Specialist direct monitoring of assemblage score based on presence/absence of specified proportion of species typical of habitat listed in ISIS	Monitor assemblage once in every 6 year monitoring cycle. Using defined invertebrate sampling protocols thresholds to be met: W31 permanent wet mire: SQI score = 160 W314 rich fen: Weighted Species Score = 10	This attribute is to be assessed through specialist survey.

Outstanding assemblage of Odonata	**Standing open water and canals:** navigation channel plus off-channel areas	Number of species	≥24 species. Monitor the assemblage once in every six year monitoring cycle. Survey visits should be at least one month apart, spanning from late spring (May/June) through mid-summer (Late June – July) to late summer (late July-August). Specific Assemblage Types: W211 open water on disturbed sediments: weighted species score 4 and W314 rich fen: weighted species score 10.	Existing records can be used as long as they are within three years of any reporting round. Both the British Dragonfly Society (BDS) and the National Biodiversity Network (NBN) hold dragonfly records these can be utilised for condition assessment purposes. If data not available, survey is needed.
Outstanding assemblage of Odonata	**Standing open water and canals:** navigation channel plus off-channel areas	Number of species for which evidence of confirmed/probable breeding	≥19 for which breeding is inferred from one of the following states (based on Taylor 2003): 1. Confirmed breeding: exuviae or larvae present or teneral (newly emerged) imagos adjacent to suitable water body. 2. Probable breeding: pair copulating, or female ovipositing, or regular presence of both sexes at a suitable water body on consecutive reporting rounds or visits.	Existing records obtained in accordance with the survey methodology in Heaver, Kay & Webb (2006, 2.4.2) can be used as long as they are within three years of any reporting round. Both the BDS and the NBN hold dragonfly records these can be utilised for condition assessment purposes. If data not available, survey is needed.

Audit Trail

Rationale for species population attributes
(Include methods of estimation (measures), and the approximate degree of change which these are capable of detecting).

'Presence' is used as the attribute for the vascular plant assemblage because (i) there are no more detailed data for a substantial number of the less common species and (ii) the general extent targets in Table 2 (0.8 m emergent zones, 30% cover of floating-leaved + submersed vegetation) provide adequate habitat support for the full range of species.

For the Odonata, Bioscan (1996) reported 27 species, 20 of which were breeding and a further three may have been breeding on the canal and its side-waters.

Rationale for site-specific targets (including any variations from generic guidance)

The site survey method used in 1994 (BIOSCAN 1994), immediately prior to production of the 1995 Citation, was sufficiently close to that in JNCC (2005 8.3) for its results to be adopted as a baseline for site surveys. The walking survey method used by Hall (2003) is likewise sufficiently close to that in JNCC (2005 8.2) to be adopted as a baseline for section surveys.

Other Notes

The total score for the outstanding vascular plant assemblage on the criteria sheet is 250 (a score of at least 200 is needed to qualify for a designated assemblage).

The individual species scores are as follows:

Shore Horsetail (*Equisetum x litorale*) = 50
River Water-dropwort (*Oenanthe fluviatilis*) = 50
Tasteless Water-pepper (*Persicaria laxiflora*) = 50
Hairlike Pondweed (*Potamogeton trichoides*) = 50
Stream Water-crowfoot (*Ranunculus pencillatus* ssp *pseudofluitans* var *vertumnus*) = 50

The species lists in BIOSCAN (1994) and Hall (2003) include native taxa which are not considered aquatic in JNCC (2005 9) and so should be excluded here, together with some non-natives which should be listed separately and not included in target species totals (JNCC 2005 6).

Table 3a Site-specific definitions of Favourable Condition for the Basingstoke Canal

CONSERVATION OBJECTIVE FOR THIS HABITAT / GEOLOGICAL SITE-TYPE	To maintain the **standing open water and canal habitat, which includes some adjacent off-line waters and marshes** at the **Basingstoke Canal SSSI** in favourable condition, with particular reference to relevant specific designated interest features. Favourable condition is defined at this site in terms of the following site-specific standards:
Site-specific details of any geographical variation or limitations (where the favourable condition standards apply)	
The notified feature forms one part of the SSSI, the other part being Pondtail Heath.	

Site-specific standards defining favourable condition

Criteria feature	**Attribute term in guidance**	**Measure**	**Site-specific Targets**	**Comments**	**Use for CA?**
Canals including off-line waters and marshes.	Habitat structure: shading	Visual assessment during section surveys (estimate of vertical projection)	On average about 10% of the water surface should be shaded by overhanging vegetation in each section length.	Excessive overhanging vegetation results both in shading of the channel and large inputs of organic matter in the form of leaf litter. Both these influences are damaging to the rich aquatic flora. Regular management is required to control bank side trees and also to protect the integrity of channel structure	Yes
Canal: navigation channel	Habitat structure: sediment depth and texture	Record any re-suspension caused by the use of the grapnel during site surveys	Extent of fine and unconsolidated sediments limited: passage of grapnel should not result in excessive gas eruptions or re-suspension of sediments or leaf litter in at least 90% of throws	The hydraulic stresses caused by boat traffic make unconsolidated sediments an insecure rooting medium and plants may be subject to uprooting. Also, fine sediments are readily re-suspended leading to high turbidity levels and smothering of plant surfaces. Large quantities of leaf litter may lead to anoxic benthic conditions unsuitable for plant roots and for other organisms.	Yes

Canal: navigation channel	Aquatic plant community: quantity of vegetation	During surveys of 150 m sampling sites, record the mean number of random grapnel throws bringing up submersed and floating-leaved vegetation.	In at least 80% of sample sites at least 8 out of 10 transects should have emergent fringes,	Filamentous algae, *Enteromorpha intestinalis* and the four most invasive non-natives (*Azolla* spp., *Crassula helmsii*, *Hydrocotyle ranunculoides* and *Myriophyllum aquaticum*) are not counted in the assessment	Yes
Canal: navigation channel	Indicators of local distinctiveness: rare species and quality indicator - west to east species	The continued presence of populations should be checked during section surveys	CSM vegetation monitoring to show that western channel unit (CW) supports Berula erecta, Hippuris vulgaris, Oenanthe fluviatilis and Ranunculus penicillatus ssp.	A checklist of native aquatic plants is given in JNCC (2005 Appendix 2). This should be used as the standard when numbers of species are counted.	Yes
Canal: navigation channel	Indicators of local distinctiveness: nusual plant communities	The continued presence of characteristic plant communities should be checked during section surveys	Maintain the Ranunculus penicillatus ssp. pseudofluitans var. vertumnus - Berula erecta – Callitriche – Lemna minor chalk stream community at Greywell. >90% of species	Indicates overall functioning as habitats for species and as sources of species for colonisation of the navigation channel during recovery phases of the latter.	Yes
Canal: navigation channel and off-line areas	Indicators of negative change: introduced plant species	Presence of all alieb and introduced aquatic plants should be noted during the section surveys. They should be recorded on the DAFOR scale for every site survey.	The four most invasive species (*Azolla* spp., *Crassula helmsii*, *Hydrocotyle ranunculoides*, *Myriophyllum aquaticum*) should be absent or at the most occupy less than 50 m of the whole designated site AND likely that other species may become of concern in the future. New non-native	The four invasive species of major concern at present are listed, but it is likely that other species may become of concern in the future. New non-native arrivals should be recorded and their	Yes

Canal: navigation channel	Habitat functioning: water quality - transparency	Secchi disk measurement or visual observation during section and site surveys.	In at least 90% of observations, the canal bed is clearly visible in water 1m deep in summer. Measurements should not be made within 48h after the end of heavy rainfall, to avoid recording the temporary effects of influxes of turbid side drainages Observations in the length from Colt Hill Bridge to Chequers Bridge should be excluded from the assessment.	Elevated turbidity levels as a result of boat traffic, high phytoplankton densities, or the presence of benthic-feeding fish, have adverse impacts on submersed plant communities. Temporal and spatial variability of turbidity in canals makes direct measurement difficult hence a subjective measure of water clarity is utilised here	Yes
Canal: navigation channel and off-line areas	Habitat functioning: water quality - cover of algae/Lemna/Azolla	Assessment of cover in section surveys	Filamentous algae and combined *Lemna/Azolla* cover, each less than 10% cover on average (no more than Occasional on the DAFOR scale)	Excessive growths of filamentous algae or *Lemna spp* and *Azolla* can result in the competitive exclusion of submersed vegetation and can indicate nutrient enrichment. Monitoring growths of these taxa may serve as an indirect and integrated measure of eutrophication.	Yes
Canal: navigation channel	Habitat functioning: biological quality and water chemistry	Desk study using data collected by Environment Agency. National River Quality Classification - biological class or equivalent. Assess every 6 years.	Biological GQA Class ‘a’ or ‘b’ depending on reach type. In addition, no drop in class from existing situation. No data are currently available.	There is currently no way in which compliance with this mandatory target can be tested.	Yes

		National River Quality Classification - chemical class or equivalent. Assess every 6 years.	Chemical GQA Class 'A' or 'B' depending on reach type. In addition, no drop in class from existing situation. Current targets are Greywell - Winchfield B and Winchfield – Eelmoor D, with no data currently available from Eelmoor eastward to Scotland Bridge.	The current target for Winchfield – Eelmoor is two quality classes below the minimum target in JNCC (2005). Eastwards from Eelmoor, there is currently no way in which compliance with this mandatory target can be tested.	Yes
		Total phosphorus concentrations (annual mean)	Annual mean 35µ g/l There should be no increase in annual concentrations over time.	Elevated phosphorus levels may lead to dominance by attached or planktonic algae and a loss of characteristic plant species. Functionally canals are closely aligned to shallow lake ecosystems but some canals may have significant flows of	Yes
		Alkalinity as mg/l CaCO3 at pH4.5	A gradient from >200 mg/l in the Greywell – Colt Hill Bridge length generally decreasing eastwards to <125 mg/l in the Hermitage Road Bridge – Scotland Bridge length.	May vary considerably over time at individual locations, depending on rainfall and canal hydraulic conditions, but an eastwards decrease should always be present.	Yes
Canal: navigation channel and off-line areas	Habitat functioning: water availability	Obersvations during section survey and enquiry from Canal Manager.	A drop in overall depth of less than 10 cm throughout the canal and in connected off-channel waters, except on lock flights, where temporary decreases of up to 20 cm may occur.	Consistently low water levels may stress emergent and aquatic vegetation. In non-navigable canals water supply may be a problem and aquatic species may be lost through drying out.	Yes

Canal	Presence of non-native species	Non-native species should be controlled and, where feasible, eradicated. Species of concern at present are *Azolla spp., Crassula helmsii, Hydrocotyle ranunculoides and Myriophyllum aquaticum*	Advice on control and eradication should be sought from the Centre for Ecology and Hydrology's Aquatic Plant Management Unit, Wallingford and any proposals for control operations within the SSSI should be discussed with Natural England. The appearance of any other non-native species should be followed by prompt action as above to eradicate them before they become established. Although non-native, *Acorus calamus*, *Elodea canadensis* and *E. nuttallii* are nowadays regarded as sufficiently long-naturalised and beyond their invasive stage to not warrant control.	Non-native species should be controlled and, where feasible, eradicated. Species of concern at present are *Azolla spp., Crassula helmsii, Hydrocotyle ranunculoides and Myriophyllum aquaticum*.	Yes
Canal	Recreational use: boat traffic	Traffic records from electronic counters, lock counters and/or logbook surveys: from Canal Manager.	Boat traffic on channel not to exceed 1300 movements per year	1300/yr in the (on average) 13 m² channel corresponds to 1000/yr in a standard 10 x 1 m channel. Below this traffic density encroachment by reeds pre-emptively occupies habitat for submersed and floating-leaved vegetation. Above it disturbance progressively reduces all types of channel vegetation and exposes banks to erosion.	Yes
Canal	Recreational use: angling	Fishery surveys.	A balanced mixed fishery of native species with a total standing crop ≤200 kg/ha		Yes

Emergent fringing vegetation	Habitat structure	Visual estimate of % cover.	Discretionary attribute: Targets should be set to register high or increasing litter cover as unfavourable. As a generic standard, total extent across the area assessed should be no more than 25% cover. Lower thresholds may be appropriate for some communities – e.g. short-sedge mires (M9, M13, etc.).	A high frequency and cover of exposed substrate will usually be undesirable and may indicate, inter alia, over- grazing, and water scour. Patches of exposed substrate are likely to be more typical/desirable for M10, 13-14, 37, S1-23 and some examples of M1-3 and M6. M29 is often based on unconsolidated sloppy peat exposed beneath a water film. More than 25% litter cover indicates insufficient removal of biomass by grazing.	Yes
Emergent fringing vegetation	Habitat structure	Visual estimate of % cover.	Targets should be set to register too much or too little exposed substrate (see comments). As a generic standard, total extent across the area assessed should be no more than 10%. Higher covers of between 5% (min.) and 25% (max.)_should be considered for those communities listed under comments. Higher upper	A high frequency and cover of exposed substrate will usually be undesirable and may indicate, inter alia, over- grazing, and water scour. Patches of exposed substrate are likely to be more typical/desirable for M10, 13-14, 37, S1-23 and some examples of M1-3 and M6. M29 is often based on unconsolidated sloppy peat exposed beneath a water film. More than 25% litter cover indicates insufficient removal of biomass by grazing	Yse

Emergent fringing vegetation	Habitat composition	A baseline map showing the boundary of the components (where appropriate), should be used to assess any changes in extent. Aerial photographs can offer a convenient means of rapidly assessing extent in some cases.	Targets should be set for key components of the wetland where relevant and appropriate (see descriptions in sect. 8). As a generic target there should be no loss of the component types, and in some instances target extents should be set for key elements. (For lowland fens the balance between open fen and wet woodland/ dense scrub should always be addressed as part of this.)	Lowland fens: Variety within fens is determined by water supply mechanism, hydroseral succession and land management practices. Account should be taken of successional processes and management aims/priorities (i.e. what a particular site is important for) in setting limits on extent of fen components. Intervention is often required to give the desired range of habitats and dependent species. The practicality of mapping certain vegetation types may also be a consideration. For Fen woodland and scrub see comments under Negative indicators (woody species) in Table 6. Lowland springs & flushes: These features are often small in extent and their boundaries may be difficult to determine. Their extent may also vary in relation to season and/or recent rainfall events. These should be taken into account when making an assessment.	Yes

Emergent fringing vegetation	Vegetation composition: positive indicators	Visual assessment of cover, using structured walk or transects and recording quadrates. Comparison against accurate baseline maps, assessments of whether a certain percentage of sample points laid out upon a grid conform to the community or not, shifts in the position of community interfaces along permanent transects.	For each component wetland other than fen woodland and fen meadow that has been identified on the site (according to the descriptions given in sect.8), one characteristic NVC community should be selected, any rare NVC communities present should also be monitored. Targets should be set for each of these NVC communities according to the generic limits set out in Table 5. As a generic standard, the frequencies of positive indicators should at the very least, confirm the presence of the target community. Local targets could also be set for site-specific positive indicator species, to register a decrease in frequency of 20% or more as unfavourable. Targets should be set locally to register an increase or decrease in the extent of key communities.	The suite of key communities to be monitored is chosen on a site-specific basis. Characteristic and rare communities would be chosen, e.g.those indicative of Annex I habitat type where these are SAC interests (although note that these must be reported on separately). Site-specific targets should be set using Table 5 as a framework. See text (section 3.5) for examples of instances where this attribute is critical.	Yes
Emergent fringing vegetation	Vegetation composition: indicators of negative change - undesirable non-woody	Visual assessment of cover, using structured walk or transects and recording quadrates	(a) Invasive non-native species[1] should be absent or no more than rare if present (b) Taget should be set to register high or increasing frequency/cover of other undesirable spp.[1] as unfavourable. See Table 6 for negative indicators for each of the key vegetation communities that were monitored for positive indicators, and adapt as relevant.	Spread of alien spp. Can often be very rapid once established. Other negative indicator species have been chosen as indicative of dereliction,	Yes

Emergent fringing vegetation	Vegetation composition: indicators of negative change - undesirable non-woody	Visual assessment of cover of the whole feature, using structured walk or transects. Aerial photography may be a useful aid though will not pick up small saplings and seedlings	As a generic target for open fen(excluding west woodland), woody species (including Betula, Salix, Rhododendron, Pinus, other gymnosperms) should be no more than scattered, predominantly <1.5m high. Cover should be <10% on open fen Saplings/seedlings should be no more than rare. None of these species should be present on flushes & springs, although Salix is acceptable at least 5m from petrifying springs	Scrub and woodland are integral components of many fen systems and may be particularly important for invertebrates. However invasion by woody species and their development to maturity may indicate drying out, dereliction, disturbance and/or enrichment for both fen. Trees and shrubs may also exacerbate drying out.	Yes
Emergent fringing vegetation	Indicators of local distinctiveness* eg notable spp., transitions to other habitats, presence of pools or other structural features	Visual assessment of frequency/cover of rare/scarce/local species in sample points chosen to represent their known distribution. Structured observation or sampling. Aerial photos may offer a convenient means of rapidly assessing these.	There are no generic targets for this attribute. Local targets should be set to ensure: - feature (forming part of the reason for to other habitats, presence of pools or distribution. Structured observation or sampling. Aerial photos may offer a	This attribute is intended to cover any site-specific aspects of this habitat feature (forming part of the reason for the notification) which are not covered adequately by the previous attributes, or by separate guidance (eg for notified species features). Targets to be determined locally. Transitions from fen to other habitats eg grassland, heath are often important and vulnerable features.	

Audit Trail

Rationale for limiting standards to specified parts of the site

Transparency: the Colt Hill Bridge to Chequers Bridge section should be excluded because natural turbidity from precipitation of supersaturated calcium from Greywell occurs variably over this length.

Rationale for site-specific targets (including any variations from generic guidance)

Variations from canal open water guidance = *Habitat structure: shading*: to provide adequate habitat for the notable Odonata which require some trees overhanging the water, the usual target of ≤5% (JNCC 2005, 6) is here raised to ~10%.

Habitat structure: sediment depth and texture: gas eruption is here added to the CSM criteria, as it indicates benthic anoxia deleterious to rooted vegetation and to many invertebrates.

Phosphorus: Phosphorus concentrations consistent with mesotrophic status are not specifically stated for canals. Environment Agency (2000) provides interim standards for mesotrophy of 25µg/l P for standing waters and 60µg/l P for running waters. An interim target of 35µg/l is proposed here, to recognise the significant flow which occurs at times on

*Alkalinity as mg/l $CaCO_3$ at pH4.*5: added because of the importance of the gradient from alkaline to acidic water quality, upon which the overall outstanding aquatic plant species richness depend. The limits quoted are based upon pre-1996 National Rivers Authority data and the 2003-2004 results in McGruer (2004).

Aquatic plant community: quantity of vegetation - tree shading over 10% of the canal's length is the reason for specifying 80% rather than the usual 90% of sampling sites, since

where substantial shading is present, development of the aquatic flora is severely restricted. *Aquatic plant community: species richness* - the criterion of 9 in 90% of sites represents the state in 1994 (James & Eaton 2000). Tree shading over 10% of the canal's length is the reason for specifying 90% rather than the usual 100% of sampling sites, since where substantial shading is present, development of the aquatic flora is severely restricted.
Rationale for selection of measures of condition (features and attributes for use in condition assessment) **(**The selected vegetation attributes are those considered to most economically define favourable condition at this site for the broad habitat type and any dependent designated species).
Other Notes
The monitoring of this habitat will mean the indirect attributes of the vascular plant assemblage are also monitored.

Table 3b Site-specific definitions of Favourable Condition for Pondtail Heath

Omitted: not relevant to this Plan

Table 3c Site-Specific definitions of Favourable Condition

CONSERVATION OBJECTIVE FOR THIS HABITAT / GEOLOGICAL SITE-TYPE	To maintain the **open water invertebrate and Odonata assemblages** at **Basingstoke Canal** in favourable condition, with particular reference to relevant specific designated interest features. Favourable condition is defined at this site in terms of the following site-specific standards:
Site-specific details of any geographical variation or limitations (where the favourable condition standards apply)	
Site-specific standards defining favourable condition	

Criteria feature	Attribute	Measure	Site-specific Targets	Comments	Use for CA?
Outstanding assemblage of invertebrates Broad assemblage type: W21 open water Specific assemblage type: W211 open water on disturbed sediments Odonata assemblage (Proxy habitat table = ponds, pools, ditches, reens and lakes)	Vegetation heterogeneity Diverse surface topography of vegetation types	Record Structural Recording Surveys (SRS) of 6m radius at sample stops to determine number of structural surfaces and representation of preferred surfaces within the assessed unit. Preferred surfaces for the water margins are: Wet mud's, peats or thin water covered substrates. Typically bare, maybe with algal mats, sparse higher plants. Marginal hygrophilic vegetation with typical species including *Lycopus*, *Scutellaria* etc and grazed grassy vegetation.	Which surfaces and layers are required critically depends on the successional stage required. Single surface present in no more than 5 out of 10 SRSs. 3 or more different surfaces present in at least 20% of SRSs.	Wetland systems should generally be assessed between July and September, as it is important for the vegetation to reach its full surface expression before assessing it. Preferred features are micro-habitat features which should always be targeted during an assessment. These should be recorded and mapped. The preferred features for this assemblage are: Good benthic vegetation structure (in oligotrophic waters.) Complex structure of submerged vegetation (where appropriate.) Areas with high proportion of macrophytes with floating leaves. Any emergents with abundant flowers. Small patches of marginal scrub or trees. Fallen wood in water. 'Beach' areas of bare wet sediment.	Yes

		Possible preferred surfaces for the water margins (depending on fauna and circumstances) include: Young to medium-aged scrub - often maintained by rotational coppice. Typical species include marginal *Salix spp, Alnus, Frangula.* Preferred layers for the water body are: A water column layer with typical species including *Ceratophyllum, Calitriche, Myriophyllum, Potamogeton spp.* A water surface layer with typical species including *Nuphar, Nymphaea Stratiotes,* crowfoots *Ranunculus etc Glyceria fluitans, Polygonum amphibium.* A low emergent layer with typical species including *Alisma, Ranunculus flammula, Mentha, etc Eleocharis.* Possible preferred layers for the water body (depending on		Negative factors should be regarded as mandatory parts of the condition assessment process. If a preferred feature is significantly impacted by a negative factor then the unit should fail. The presence of negative factors on the rest of the unit depends on the level of impact, whether it is increasing/ declining, and its location. Negative indicators for this assemblage include: Steeply shelving banks. Deepening of shallow water. Excessive stock access to banks. Eutrophication characterised by green algal blooms. Addition of large fish (trout & coarse fish) to otherwise fish-free water. Removal of fallen timber from water. Excessive marginal trees and scrub leading to excess shading >50% of margin. Aquatic and marginal invasive species - *Azolla, Lemna minuta, Crassula, Hydrocotyle* etc.	

		fauna and circumstances) include: Benthic layer with typical species including *Chara spp, Lobelia, Littorella*			
Outstanding assemblage of Odonata	Canal: navigation channel and off-line areas: vegetation heterogeneity and structure	Floating and emergent vegetation suitable for Odonata oviposition. Vegetation surveys.	At least 5% of water surface to have floating or emergent vegetation, suitable for Odonata oviposition. CSM surveys of 13 channel sites, visual observation of OW and OE.		Yes
Outstanding assemblage of Odonata	Canal: navigation channel and off-line areas: vegetation heterogeneity and structure	Submerged vegetation providing cover for Odonata nymphs. Vegetation surveys.	Submerged vegetation to be present over at least 30% of water area, to provide cover for Odonata nymphs and their prey. CSM surveys of 13 channel sites, visual observation of OW and OE.		Yes
Outstanding assemblage of Odonata	Canal: navigation channel and off-line areas: vegetation heterogeneity and structure	Emergent vegetation suitable for Odonata emergence. Vegetation surveys.	At least 2% of water surface to have emergent vegetation, suitable for Odonata emergence. CSM surveys of 13 channel sites, visual observation of OW and OE.		Yes
Outstanding assemblage of Odonata	Canal: navigation channel and off-line areas: vegetation heterogeneity and structure	Emergent and bankside vegetation, suitable for adult foraging, basking and territory holding. Vegetation surveys.	At least 20% of margins to have emergent vegetation or adjacent tall bankside herbage, suitable for adult Odonata to bask and hold territories. CSM surveys of 13 sites, with additional recording of general structure of bankside vegetation to 1 m from water's edge, visual	Include all emergent vegetation (see above); plus any tall grasses such as *Glyceria* and *Phalaris* or any non-graminaceous species greater than 0.5m in height, which are within 1m of the water's edge.	Yes

			observation of OW and OE.		
Outstanding assemblage of Odonata	Canal: navigation channel and off-line areas: vegetation heterogeneity and structure	Open water areas. Vegetation surveys.	At least 30% of total water surface to be unobstructed. CSM surveys of 13 channel sites, visual observation of OW and OE.	Excessive cover of *Lemna* or *Azolla* may hinder or prevent Odonata oviposition and/or emergence.	Yes
Outstanding assemblage of Odonata	Canal: navigation channel and off-line areas: vegetation heterogeneity and structure	Tree cover for refuge and foraging by adults. Measured in vegetation surveys.	About 10% of margins to have overhanging tree cover. CSM surveys of 13 channel sites, visual observation of OW and OE.	Tree cover is important for the two of the most notable species cited (*Somatochlora metallica* and *Cordulia aenea*). *Salix* and *Alnus* are the preferred genera of trees.	Yes

Audit Trail

Rationale for limiting standards to specified parts of the site

Rationale for site-specific targets (including any variations from generic guidance)

Rationale for selection of measures of condition (features and attributes for use in condition assessment)

(The selected vegetation attributes are those considered to most economically define favourable condition at this site for the broad habitat type and any dependent designated species).

Other Notes

Table 3d 3d Site-Specific definitions of Favourable Condition

CONSERVATION OBJECTIVE FOR THIS HABITAT / GEOLOGICAL SITE-TYPE	To maintain the **wet mire invertebrate assemblage** at **Basingstoke Canal** in favourable condition, with particular reference to relevant specific designated interest features. Favourable condition is defined at this site in terms of the following site-specific standards:
Site-specific details of any geographical variation or limitations (where the favourable condition standards apply)	
Site-specific standards defining favourable condition	

Criteria feature	Attribute	Measure	Site-specific Targets	Comments	Use for CA?

Outstanding assemblage of invertebrates Broad assemblage type: W31 permanent wet mire Specific assemblage type: W314 rich fen (Proxy habitat table = fen, reed and other swamp)	Vegetation heterogeneity Diverse surface topography of vegetation types	Record Structural Recording Surveys (SRS) of 6m radius at sample stops to determine number of structural surfaces and representation of preferred surfaces within the assessed unit. Preferred surfaces are: Taller grasses, rush swards and herb surfaces, including those contained within reed or sedge swards. Main reed or sedge sward surface. Possible preferred surfaces (depending on fauna and circumstances) include: Open water (where appropriate.) Open mud or reed/sedge litter surface. (In 10% SRSs.) Short grass swards, usually along paths and tracks. Young to medium-aged scrub - usually maintained by rotational coppice. (In 10% SRSs if appropriate.)	A single surface present in no more than 50% of SRSs. More than 3 different Surfaces present in at least 20% of SRSs.	Wetland systems should generally be assessed between July and September, as it is important for the vegetation to reach its full surface expression before assessing it. Preferred features are micro-habitat features which should always be targeted during an assessment. These should be recorded and mapped. The preferred features for this assemblage are: Scrub patches and margins - including small areas or mosaic with wet woodland. Pools and pool margins. Flowery areas, including those on other habitats (verges, ruderal etc) including 'unwelcome' weeds such as ragwort and thistles. Localised poaching with water filled hoof prints and wet bare substrate. Paths, tracks and their margins. Negative factors should be regarded as mandatory parts of the condition assessment process. If a preferred feature is significantly impacted by a negative factor then the unit should fail. The presence of negative factors on the rest of the unit depends on the level of impact, whether it is increasing/ declining, and its location. Negative indicators for this assemblage include: Change from grazing to mowing Invasive balsams - Impatiens species Excess grazing leading to loss of flowers or winter structures (seed heads - standing dead stems) Closure and coalescence of scrub patches to >20% cover.	Yes

	Dead organic matter litter	Record percentage cover of litter layer of grass/sedge or heather litter (Excluding Molinia) >1cm depth	**Favourable condition if**: 10%-25% of herbaceous, graminoid or ericoid layers with litter layer beneath		Yes
	Cover – seed heads	Percentage of site where seed heads and hollow stems are able to persist through winter	**Favourable condition if:** At least 10% of herbaceous, graminoid swards with erect dead stems and seedheads persisting until late		Yes
	Tussocks	Percentage age of graminoid swards with perceptible tussock structure.	**Favourable condition if:** There is a minimum of 10% of herbaceous and graminoid swards tussock structure, especially in winter		Yes
	Nectar sources (See floweriness table in CSM guidance)	Record percentage occupation of species able to flower throughout the year.	**Favourable condition if:** At least 10% of sward, hedgerow or scrub able or likely to be able to flower at time of year appropriate to flowering species present There should be no reduction in seasonality of existing distribution of flowering through loss of species with a particular flowering phenology but year		Yes

Audit Trail

Rationale for limiting standards to specified parts of the site

Rationale for site-specific targets (including any variations from generic guidance)

Rationale for selection of measures of condition (features and attributes for use in condition assessment)
(The selected vegetation attributes are those considered to most economically define favourable condition at this site for the broad habitat type and any dependent designated species).

Other Notes

References for Appendix 2

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Mapping of Off-channel areas including permanent open water

This is a separate CD not included in the Plan because of the large amount of pictorial data involved. A copy is held by the Basingstoke Canal Authority.

The areas are presented west to east. For most areas there is an aerial photograph, with the SSSI boundary shown as a black line, the water's edge in

1999 (date of most recent aerial photographs) in blue, and the position of minimum acceptable reduction by siltation and/or vegetation encroachment before action needed to return the water body to its previous size in red.

Appendix 3 - The ecology of the Basingstoke Canal and unitisation of the SSSI on the basis of its ecology

Water quality and channel vegetation

The designated lengths are part of an ecocline, grading from a base-rich (chalk) ecosystem at the western end to a base-poor system at the eastern end, after the water has travelled over and received side drainages from heathland, woodland and their associated acidic clays and sands.

The transition is gradual, as the water quality only slowly adjusts to its surrounding landscape. A De-trended Correspondence Analysis of vegetation composition at sites along the canal shows that the downstream series of assemblages mostly overlap with those on either side of them. The analysis uses data obtained by the standard University of Liverpool quantitative survey procedure (the precursor of the method adopted in JNCC, 2005). Summer survey data were available from

14 sites over 11 consecutive years from 1988 to 1998; see Table 1 below, which is from James & Eaton (1999). This period included the time when the SSSI Citation was last revised (1994).

The DCA diagram is also shown below, as Fig.2 from James & Eaton (1999).

Table 1
Site information from BIOSCAN surveys

Site No.	Site name	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1	Greywell Tunnel	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Lift Bridge / North Warnborough	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2A	Broad Oak				Y	Y	Y	Y	Y	Y	Y	Y
3	Barley Mow	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Crookham Wharf / Chequers	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	Reading Road	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	Pondtail	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	Eelmoor (West)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	Ash Lock	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	Mytchett Lake	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
10	Frimley Aqueduct	Y										
11	Curzon Bridge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11A	Brookwood							Y	Y	Y	Y	Y
12	St. John Bridge	Y			Y	Y	Y	Y	Y	Y	Y	Y
12A	Sheerwater							Y	Y	Y	Y	Y
13	Scotland Road Bridge	Y										
	Total number of sites:	13	9	10	12	12	12	14	14	14	14	14

Y = Data available

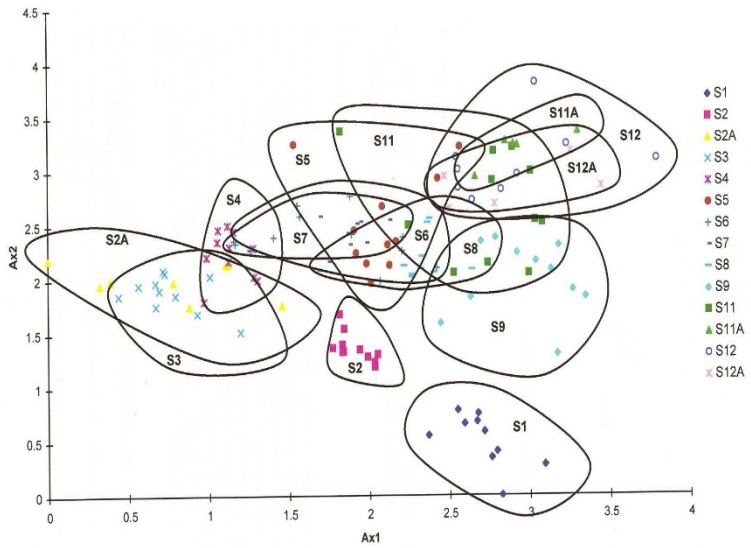

Fig. 2 DCA diagram produced from analysis of abundance data showing the distribution of data points at each site.

Only Sites 1 and 2 (Greywell and North Warnborough) come out as strongly distinct. Greywell is very shallow, visibly flowing and with obvious chalk stream features (e.g. Ranunculus penicillatus ssp. pseudofluitans var. vertumnus, Fontinalis antipyretica). The temperature regime is seasonally buffered by input of spring water at ~10C and the site is not canal-like in its physical structure. North Warnborough also shows calcareous flora features (e.g. Oenanthe fluviatilis, Hippuris vulgaris), along with a range of more usual canal species. The channel is now wholly that of a canal, i.e. deeper and with steeper batters, which probably explains its less specialist overall flora. From Site 2A (Broad Oak) onwards, the channel has started to receive significant side drainages and all remaining sites from 2A eastwards to 12A (Sheerwater) show overlaps with their neighbours. There is no clear boundary between the base-rich and base-poor types, as is to be expected from the hydraulic character of the canal outlined above. The nearest approach to a transition is perhaps Sites 5, 6 and 7 (Reading Road, Pondtail and Eelmoor), but any attempt to define a boundary, or even an ecotone, must be rather arbitrary. Only from Brookwood (11A) eastwards to Sheerwater (12A) is some degree of floristic homogeneity indicated.

Although the SSSI Citation states that the canal 'is botanically the most species-rich aquatic system in Britain', this status is created by the wide range of water qualities within its overall length, enabling the waterway as a whole to support an exceptional number of plant species. It is not, however, particularly species-rich on an individual site basis; some other canals show greater species richness per standard 150 m survey length. This serves to emphasise the importance of maintaining the water quality gradient in the Basingstoke Canal SSSI, as this has probably been historically the single most important factor shaping the observed richness.

Berula erecta, Ranunculus penicillatus ssp. pseudofluitans var. vertumnus, Hippuris vulgaris and Oenanthe fluviatilis, species mainly or wholly towards the western end and are used as indicators of base-rich water. Oenanthe crocata, Potamogeton obtusifolius and Utricularia australis are mainly or wholly in the eastern parts and are used as indicators of base-poor water.

The marginal vegetation

In canal fringe vegetations there is insufficient width for development of multi-species systems at any one point.

The main 'reeds' are clump-forming pre-emptive occupiers of habitat and the particular species recorded at a given site is of little significance. Only over a long length can the full range of species be determined 'like beads on a string'. The associate mainly broad-leaved marginal and marsh species present depend partly on the density of the main 'reed' species. Where boat traffic disturbance and local damage opposes achievement of maximum shoot density of the dominant 'reed', this favours a diversity of associate species.

Most of the emergent species are distributed throughout the canal from west to east. Exceptions are Hippuris vulgaris and Oenanthe fluviatilis. Both are characteristic of base-rich water and are found only in the western section. Also Equisetum x littorale is only found eastwards from Iron Bridge west of Ash.

Off-channel areas

Included in the SSSI are 29 water bodies and marshes associated with the main canal channel. These comprise winding holes, bays, widening adjacent to locks (perhaps part of the original design aimed at limiting level variations on short lock pounds), together with the large flashes and a few much smaller side waters and marshy areas. Dogmersfield Lake and Pirbright New Pond

are also included in the Citation. In addition to their aquatic flora, most of these water bodies have surrounding marsh supporting conservational important vegetation. It is clear from Hall (2004) that many of these areas are important as sources of species for replenishing populations in the main navigation channel, as well as providers of habitat for some species unlikely to colonise the canal. It is also clear from Hall's report that they are ecologically unstable and undergo quite

rapid vegetation succession, from open water with submersed, floating-leaved and emergent vegetation, through reed swamp to scrub and wet woodland (mainly willow and alder). At each stage in this succession different species are favoured. These off-channel areas are best treated as a group, as they will contain a range of succession states at any one time. As each area becomes overgrown, it should be cleared and, if necessary dredged, to restore open water habitat.

The trophic status of the canal

In the Citation, the canal is classified as mesotrophic. JNCC (2005, p.7) proposes that if 'any three or more species marked 'Meso' in Appendix 2 occur in a section, this indicates that the canal water is mesotrophic or oligo-mesotrophic.' This criterion is certainly fulfilled for the SSSI as a whole (e.g. Menyanthes trifoliata, Potamogeton alpinus P. obtusifolius, Ranunculus penicillatus ssp. pseudofluitans var. vertumnus), of which P. alpinus and R. penicillatus ssp. pseudofluitans var. vertumnus occur at the western end. The foregoing assumes that var. vertumnus has approximately the same trophic preference as the subspecies, in line with Webster (1988). Water quality analyses show that the western end of the canal is fed by very

nitrogen-rich chalk spring water (6-7 mg/l N), but phosphorus is low (20-30 µ g P/l). The high N probably accounts for periodic abundance of green filamentous algae at Greywell, but apart from this local feature, the general mesotrophic ranking of the SSSI appears justified and this accords with the conclusions of McGruer (2004 pp.53-54), based on a review of the rather scanty water quality records available for the SSSI.

Unitisation of the SSSI

In the previous (2008) edition of this plan Dr John Eaton proposed that for the purpose of conservation management, the Basingstoke Canal channel (C) be divided into two units; a western section (CW), predominantly supplied with base-rich (chalk spring) water from Greywell and an eastern section (CE) where the water becomes increasingly base-poor as it receives drainages off acid sands and gravels. The boundary between the units was to be at Norris Bridge (SU834536) drawn from analysis of vegetation change down the canal.

Dr Eaton agreed this position with Natural England, who agreed to modify the formal SSSI units to match the proposal. In 2016 it became evident that Natural England had not in fact modified the units as proposed in 2008, but had retained the boundary between the two main canal channel units of the SSSI at the County Boundary – where the Canal passes over the River Blackwater – some 6.5km further east. Natural England Officers made it clear that they did not now want the boundary of the SSSI units modified.

This means that where previously most of the off-channel areas were associated with Canal East they now are spread more evenly between the two associated Canal channel units.

Appendix 4 - Natural England's Citation of the SSSI

FILE REF: LB/BAS

COUNTY: SURREY/HAMPSHIRE

SITE NAME: BASINGSTOKE CANAL

STATUS: SITE OF SPECIAL SCIENTIFIC INTEREST NOTIFIED UNDER SECTION 28 OF THE WILDLIFE AND COUNTRYSIDE ACT 1981.

Local planning authorities:

Hampshire County Council/Surrey County Council

Hart District Council/Rushmoor Borough Council

Guildford Borough Council/Surrey Heath Borough Council

Woking Borough Council/Runnymede Borough Council

National Grid Ref:

SU 719514 to SU 967575

TQ 016597 to TQ 046616

Ordnance Survey Sheets:

1:50,000: 186

1:10,000: SU75SE, SU75SW, SU85NE, SU85SE, SU85SW, SU95NE, SU95NW, TQ05NW, TQ06SW

Hectares/Acres: 99.15 hectares

244.99 acres

Date notified (under 1949 Act): 1955 Date of last revision: 1975

Date notified (under 1981 Act): 1985 Date of last revision: 30 September 1994

Date confirmed: 22 June 1995

Other Information:

Basingstoke Canal SSSI incorporates and extends the Basingstoke Canal (Greywell - Odiham Castle) and Basingstoke Canal (Eelmoor) SSSIs in Hampshire, notified under the Wildlife and Countryside Act 1981 and the Basingstoke Canal East and West SSSI in Surrey, notified under the National Parks and Access to the Countryside Act, 1949. It is largely owned by Hampshire and Surrey County Councils. Eelmoor, Claycart and Rushmoor Flashes (Hampshire) are managed by the Hampshire Wildlife Trust under an informal reserve

agreement. The Basingstoke Canal was added to the Nature Conservation Review (NCR) list of sites in 1989. It lies within the London Basin Natural Area.

Description and Reasons for Notification:

The Basingstoke Canal, together with associated "flashes" and heathland, is nationally important for aquatic plants and invertebrates. The transition from calcareous spring water to slightly acidic conditions produces an extremely diverse flora, containing approximately half (87) of Britain's native aquatic higher plant species, including 5 nationally scarce* species. The Basingstoke Canal is botanically the most species-rich aquatic system in England. Twenty-four species of dragonfly occur on the Canal and other insects, including two nationally rare** (Red Data Book) species, are well represented.

Two sections of the Basingstoke Canal are of SSSI status. The western section lies between Greywell in Hampshire and Hermitage Bridge in Surrey; the eastern section lies between Monument Bridge and Scotland Bridge in Surrey.

The relative lack of pollution in the Canal and the variation in water chemistry throughout its length have given rise to a diversity of plant species and communities that has no parallel elsewhere in Britain. This, together with a rich and varied invertebrate fauna, makes the Basingstoke Canal a waterway of exceptional value to nature conservation.

The Canal is largely supplied by calcareous water from springs situated at the junction of the chalk and Reading Beds (clays) at Greywell. Moving downstream, it is supplemented by progressively more acidic spring and stream water from the Aldershot heathland district. Due to a slight west-east gradient, which gives rise to a definite water movement, the overall system is analogous to a slow-flowing river with initially alkaline water that gradually becomes more acidic and less charged with calcium. Such a combination is a rare feature in Britain.

The vegetation types reflect this gradual change in water chemistry. At Greywell the flora is typical of that of a nutrient-rich southern chalk stream. Here it is dominated by the moss *Fontinalis antipyretica*, the starworts *Callitriche obtusangula* and *C. stagnalis*, fool's watercress *Apium nodiflorum*, lesser water- parsnip *Berula erecta* and water crowfoot *Ranunculus penicillatus subspecies pseudofluitans var. vertumnus*, the latter here in its *locus classicus*, from which it was formally studied and described. As the calcareous waters move across the London Clays the flora changes, with locally abundant mare's tail *Hippuris vulgaris*, river water dropwort *Oenanthe fluviatilis*, arrowhead *Sagittaria sagittifolia*, the pondweed *Potamogeton alpinus* and *P. berchtoldii*, and stoneworts including *Nitella flexilis* and several varieties of *Chara vulgaris*.

The Canal then passes onto the Bracklesham Beds and Bagshot Sands of the Aldershot heathland district. In the downstream stretch some of the species abundant upstream disappear, to be replaced by a very species-rich flora which comprises a remarkable assemblage combining both nutrient-rich and acidic elements. Amongst the characteristic plants of this long stretch are the pondweeds *Potamogeton natans* and *P. perfoliatus*, water solider *Stratiotes aloides*, Canadian and Nuttall's pondweeds *Elodea canadensis* and *E. nuttallii* and great bladderwort *Utricularia australis*. Frog-bit *Hydrocharis morsus-ranae* and greater duckweed *Spirodela polyrhiza* occur amongst the emergent vegetation.

Plants typical of acidic waters, which occur in this stretch, are bulbous rush *Juncus bulbosus*, floating club- rush *Eleogiton fluitans*, alternate- flowered water-milfoil *Myriophyllum alterniflorum*.

The Monument Bridge-Scotland Bridge stretch at Sheerwater to the east of Woking, is rich in open water and emergent species characteristic of the main part of the Canal such as the pondweed *Potamogeton natans*, frogbit *Hydrocharis morsus-ranae*, greater duckweed *Spirodela polyrhiza*, water plantain *Alisma plantago-aquatica*, and narrow leaved water plantain *Alisma lanceolatum*. Of particular note within the Monument Bridge-Scotland Bridge stretch are the nationally scarce pondweed *Potamogeton trichoides* and the nationally scarce tastleless water pepper *Persicaria laxiflora*.

Certain stretches of the Canal are less species-rich, due to shading by overhanging trees, or very localised pollution problems, but these stretches have been included in the SSSI because they enable the continuum from calcareous to acidic water to be expressed within the SSSI.

Ninety species of aquatic plants, including a number of native stoneworts (charophytes) and the aquatic moss *Fontinalis antipytretica*, have been recorded in 1992 and 1993 from the main line of the canal and its extensions (or “flashes”); an additional 16 native wetland species have been recorded on the Canal system since 1986.

Of the 90 plants recorded in 1992 and 1993, 5 are nationally scarce* being river water dropwort *Oenanthe fluviatilis*, the pondweed *Potamogeton trichoides*, tasteless water pepper *Persicaria laxiflora*, the horsetail *Equisetum x litorale* and the water crowfoot *Ranunculus pencillatus subspecies Pseudofluitans var vertumnus*. The nationally scarce water soldier *Stratiotes aloides* and fringed water lily *Nymphoides peltata* have been introduced.

Other noteworthy plants include needle spike rush *Eleocharis acicularis* and various-leaved pondweed *Potamogeton gramineus*.

The invertebrate fauna is correspondingly rich. Twenty four species of Odonata (dragonfly and damselfly) have been recorded on the Canal in 1992 and 1993, making the Canal one of the most important sites for *Odonata* in terms of species diversity in Britain. Surveys undertaken during 1992 and 1993 revealed evidence of breeding of 19 species. Of particular note are populations of the nationally scarce brilliant emerald *Somatochlora metallica*, the hairy dragon fly *Brachytron pratense* and the downy emerald *Cordulia aenea*. In addition to the *Odonata* fauna, the Canal supports a wide range of other insects, associated particularly with the rich emergent vegetation. Hoverflies are well represented. About eighty five species have been recorded along the Canal, including the nationally scarce *Anasimyia contracta*, *Didea intermedia*, *Epistrophe diaphana*, *Volucella inanis* and *Xylota tarda*. The scarce snail-killing fly *Psacadina verbeckei*, the rare (Red Data Book**) solitary bee *Macropis europaea* and the scarce dentated pug moth *Anticollix sparsata* are also present. The Canal also supports populations of water birds such as little grebe, kingfisher and grey wagtail which are of considerable local importance.

Several off-line "flashes" have been included in the site, as they are an integral part of the hydrological system, and provide shallow-water conditions which are rare in the restored main line of the Canal. Of particular significance are Eelmoor Flash, the extensive Mytchett Lake and Great Bottom Flash and the small, shallow Potter's Pool.

Great Bottom Flash is fringed on the eastern side with reed *Phragmites australis* and supports a rich marginal flora including water violet *Hottonia palustris* and royal fern *Osmunda regalis*. Mytchett Lake is an extensive area of open water with abundant white water lily *Nymphaea alba*, and common bulrush *Schoenoplectus lacustris*, and is notable for its fringing colony of purple willow *Salix purpurea*, which is rare in Surrey. The lake supports a large colony of red-eyed damselfly *Erythromma najas*. Potter's Pool, adjacent to open heathland, is an excellent site for dragonflies and supports a rich flora dominated by great bladderwort *Utricularia australis*, with bottle sedge *Carex rostrata* in the emergent fringe of vegetation.

Adjacent to the canal, but not linked to it, is New Pond at Pirbright, which supports an acid bog marginal flora including a number of plants not recorded from the Canal, for example marsh St John's wort *Hypericum elodes*, bog myrtle *Myrica gale*, many-stalked spike-rush *Eleocharis multicaulis*, cotton grass *Eriophorum angustifolium* and lesser bladderwort *Utricularia minor*. Of additional note are the sedges *Carex rostrata*, *C. vesicaria* and *C. curta* and floating club-rush *Eleogiton fluitans*.

Dogmersfield Lake is included within the SSSI as it forms part of the Canal's water catchment, and supports a rich flora including some species which are very rare in or extinct from the remainder of the Basingstoke Canal system for example lesser water plantain *Baldellia ranunculoides*, bogbean *Menyanthes trifoliata* and water purslane *Lythrum portula*. The lake also has strong populations of needle spike rush *Eleocharis acicularis* and fan-leaved water-crowfoot *Ranunculus circinatus*.

The hinterland of woodland, heath, unimproved meadows and fens through which the Canal flows increases the value of the aquatic habitats. Pondtail Heath (Fleet) has been included within the SSSI since it is of direct importance to invertebrates such as the dragonflies, which hawk over this area. Pondtail Heath comprises an area of largely wet heath dominated by ling *Calluna vulgaris*, cross-leaved heath *Erica tetralix* and purple moor-grass *Molinia caerulea*. The flora is rich, with species such as oblong-leaved sundew *Drosera intermedia*, meadow thistle *Cirsium dissectum*, petty whin *Genista anglica* and blunt-flowered rush *Juncus subnodulosus*, the latter in an atypical acidic locality.

The invertebrate fauna includes the nationally rare** (Red Data Book) hoverfly *Pelecocera tricincta*, and a population of the keeled skimmer *Orthetrum coerulescens*, which breeds in small bog pools on the heath.

* Nationally scarce species occur in 16-100 of 10 x 10 km squares in Britain.

** Nationally rare species are listed in the relevant Red Data Book i.e. "British Red Data Book 2: Insects".

Appendix 5 Trees and the waterway ecosystem

An example of how tree shading has increased since the canal ceased to be an operating freight waterway

Figure 9 - Eelmoor military bridge looking east - late C19th

Figure 10 - Eelmoor military bridge looking west - c.2000

The development of shading and loss of channel vegetation

On tree-shaded lengths, up to 90 % of incoming radiation is intercepted before reaching the water surface. James & Eaton (1999) showed that 69 % of the canal from Greywell to Mytchett was tree-lined in 1998, up from 54 % in 1971. On 31 % of the length branches overhung to at least half the channel width, up from 23 % in 1971. Comparable data were not available for the remainder of the canal, but visual inspection suggested that tree growth was substantial through to the junction with the Wey Navigation.

This alone explained the near absence of both submersed and emergent vegetation from long lengths of the SSSI, irrespective of any other stress factors which may have been operating locally.

Tree clearance from a formerly heavily shaded length east of Eelmoor Flash in 2000 has been followed by gradual re-appearance of submersed vegetation on the navigation channel batters.

Disposal of wood after clearances

Although some of the wood may have commercial value, either as timber or for chipping, it is important to leave substantial logs on site where they do not cause hazards to the public. This is because dead wood has considerable ecological value.

Many species of invertebrate fauna depend on dead or decaying wood. These 'saproxylic' animals include beetles, flies bees wasps and ants. Loose bark and hollow trees are also important to woodlice, millipedes, centipedes, springtails, pseudo-scorpions and spiders along with slugs and snails. Many of these invertebrates fill an essential role near to the bottom of food webs. By maintaining suitable habitat for such species, a food source is maintained for birds and other larger animals further up the food chain. Dead wood also provides important conditions for many fungi and lichens. It may take many years for the wood of some species such as oak (*Quercus* spp.) to deteriorate and excellent habitat is provided throughout this time.

Appendix 6 - Boat hydraulics and the waterway ecosystem

The forces generated by moving boats

Boats exert direct effects by the impact of moving hulls and the chopping action of propellers. They also create indirect effects via the water flows which they generate, namely return flows past the moving hull, waves and the propeller jet. These cumulatively disturb the canal bed, leading to turbidity in the water and hence a reduction in underwater light for submersed plants.

A detailed analysis of the hydraulic forces created by a boat moving along a canal, including the effects of channel size and craft size and speed, is given by Verheij (2006).

Emergent vegetation, i.e. reed fringes, is fairly robust, being firmly rooted and adapted to tolerating waves and other water movements created by boats travelling at speeds within the 6.4 km/h limit. Submersed vegetation ('pondweeds') and floating leaved-rooted plants (e.g. water lilies) are much more susceptible to damage by boat traffic, partly because they are further into the channel than the reed fringes and partly because they are more delicate in structure. Analyses in Eaton, Godfrey & Willby (2007) indicate that there is no scope for sustainable populations of these plants in the central navigation track, hydraulic forces there being too great. There is, however, considerable potential for maintaining vegetation on the batters (the slopes up on each side of the canal bed from the central track to the water's edges). This potential is strongly controlled by certain basic features. These are as follows.

- *The size of the channel*. Even quite small increases in width and especially in depth confer great improvements in potential plant habitat. For example dredging from 1.0 m to 1.5 m almost halves the boat-induced water velocities and hence the stresses they cause to channel vegetation.
- *The firmness of the canal bed*. A firm rooting medium allows plants to endure the pull generated by boat-induced water flows. In soft silt, plants are easily uprooted and lost.
- *The speed of the boat*. Hydraulic forces rise steeply with boat speed.
- *The availability of underwater light*. At the boat traffic densities currently planned, the turbidity generated should not be sufficient to prevent underwater growth on the batters.

Verheij (2006) also shows how manoeuvring boats, particularly when starting from static, generate much greater forces through their propeller jets than when they are moving steadily at normal cruising speeds. Therefore additional measures to assist conservation include provision of deeply dredged winding holes and hard banked deeply-dredged moorings at intervals along the canal, so that boat manoeuvring is concentrated in a few locations adapted to minimise channel disturbance.

Basis for the target traffic limit

Research on the national canal network indicates the ideal traffic range for long-term conservation to be 600 - 1000 movements per year in a standard trapezoidal channel with a 10 sq metre water cross-sectional area. This is for a typical range of recreational craft types, travelling at no more than 6.4 km/h.

Within the channel size range 7-20 square metres, the ideal traffic range appears to adjust pro rata with size. Thus, for example -

at 7 square metres, the ideal range is: [600 x 7/10] to [1000 x 7/10]
i.e. 420 - 700 movements/yr

at 20 square metres, the ideal range is: [600 x 20/10] to [1000 x 20/10]
i.e. 1200 - 2000 movements/yr

The 600-1000 unit range maintains the greatest species diversity. Below 600, channel blockage by weed and consequent competitive exclusion of species occurs, at least in the long term. Above 1000 movements, species loss becomes significant

The Basingstoke Canal's normal, fully-dredged channel has a cross-sectional area of about 13 square metres, for which the ideal range, as defined above, is

[600 x 13/10] to [1000 x 13/10] i.e. 780 - 1300 movements/yr

In this Plan, the limit has been set at the upper end of the range, i.e. at 1300 movements/yr, to give the greatest possible accommodation to boat use within the requirements for conservation.

Appendix 7 Ecological impact and management of dredging

General

Dredging is a necessary management intervention, to reverse habitat deterioration due to siltation and to ensure the longer-term availability of the habitats upon which the wildlife interest depends. The act of dredging is, however, highly disturbing to the channel ecosystem and is accompanied by the risk of species losses and short-term destabilisation of aquatic community structures. Its immediate effects can be minimised by appropriate management procedures, so that the deeper- water, firm-bedded channel conditions necessary to support a resilient and diverse ecosystem can be achieved. The ideal is restoration of the original, trapezoidal channel section.

Detailed reviews of ecological aspects of dredging are in Eaton (2007) and Eaton, Godfrey & Willby (2007).

Sequence dredging is often considered to be the ideal, whereby a series of 0.5 - 1.0 km lengths is cleared in one year, alternating with similar lengths not cleared until the second or third year. The purpose of this arrangement is to ensure efficient recolonisation of newly dredged lengths by propagules drifting down into them from the adjacent, established communities. Its conservation advantages, which are supposed rather than proven, have to be weighed against practicability and the added expense of extra machinery movement as compared with continuous linear dredging. When the latter is used, it should, wherever possible, work upstream.

As the waterway relies for bank protection mostly upon vegetated, unhardened batters, dredging should not extend to the bank, but wherever possible should leave a 1 m width fringe of reeds undisturbed. Where the protective fringe has to be removed, post-dredging re-instatement of vegetative bank protection must be an integral part of the programme of works.

Pre-dredging preparations

Because of the long lead times needed to obtain permissions and transplant scarce species, planning should be started as far ahead of the proposed operation as possible. A year is probably about the minimum.

Once a section has been selected for dredging, botanical survey records should be checked for the presence of any scarce plants justifying special conservation by being transplanted to refuge areas. Use of SSSI off-channel areas should always be considered here, as these areas can themselves be enriched by use in this way.

Care should also be taken to identify any evidence of water vole activity. These animals have not been recorded on the canal for many years, but are returning to former habitats in many places. If populations are detected then appropriate steps should be taken to mitigate for them. Strachan & Moorhouse (2006) provides advice on this.

Where the reed fringes are to be narrowed, some other nearby length of the canal which lacks adequate reed fringes may be identified as the planned recipient of the excess vegetation.

At this stage plans for the dredging operation should be submitted to Natural England for approval.

This is to allow sufficient time for incorporation of any modifications required by Natural England and for any species transplants to be completed in the summer before the dredging.

Any transplants for conservation purposes should be made between mid-June and early August.

Permission will have to be sought from the Environment Agency if it is proposed to discharge water from dredging sites to rivers. Its discoloured appearance and possibly toxic nature can lead to complaints and liability for fish kills in receiving waters. Where permission is not granted and the water must be retained, temporary raising of downstream weirs will be needed (by sandbagging if the crest is not of adjustable height), noting that this procedure may have to be suspended at short notice in the event of heavy rain creating large influxes of storm water into the canal which require normal operation of weirs to avoid flood risks. In such circumstances dredging also will have to be suspended.

Permission must be sought from both the local authority and either Surrey County Council or Hampshire County Council, depending on location, to operate silt disposal sites under licence from the Environment Agency. Where this is not practical a licensed contractor will be appointed to carry this out to remove the dredgings for disposal at an authorised site elsewhere.

Dredging procedure

Dredging is a very disturbing operation for channel wildlife and should not be carried out during summer. Disturbance of accumulations of organic-rich silt leads to sudden oxygen demand in the water and release of toxic sulphides, methane and ammonia. At warm summer temperatures, when the fauna is most active, chemical processes are fastest and oxygen solubility is least. These conditions can easily combine to cause fish kills and mass mortalities of invertebrates. The work should therefore be scheduled between October and early March. An early finish will be needed in spring on lengths important for nesting birds and for the fishery.

Wherever possible, a marginal fringe of reeds about 1 m wide should be left undisturbed during dredging. This is the best way to provide restart colonisation for bank protection.

Transfer of excess reeds to new sites can be done during the dredging operation. The material will then be in position to start growth in spring. Removal can be by dredger or excavator, depending on the quantity and physical nature of the plants being conserved. In all cases, care should be taken to remove complete plants with rootstocks and to keep them wet during transfer, which should be as rapid as possible, to their new site. Most species are extremely susceptible to frost damage and drying when exposed to air. Reeds only establish in shallow water, colonising out into deeper water at a later stage. Plantings should therefore be made in the 0-0.2 m depth zone. On lengths exposed to wind and therefore to wave lapping, slippage of introduced plants may be a problem before they have time to root. Here anchorage will be needed initially, either by pegging or by planting in hessian sack containers weighted down with stones.

The method of dredging is a matter of engineering and economic convenience, since no particular method has been shown to have conservation advantages over any other. This includes dry dredging, which, despite its apparently drastic regime, has yielded some of the best post-dredging plant communities on the canal, where it was employed in the nineteen eighties.

Sequence dredging will be employed where possible, clearing a series of 0.5-1.0 km lengths in one year, alternating with similar lengths not cleared until the second or third year. Otherwise linear dredging will be used, working upstream.

Management of the recovery phase

Channel bed recolonisation is best left to natural processes, which often produce a rapid succession of 'pioneer' species and then a more gradual development of a diverse, stable plant community. As little interference as possible with these processes is desirable.

In particular the temptation to intervene with weed control measures should be resisted, except in extreme cases of channel blockage, as such intervention merely prolongs the period of ecosystem instability.

To allow time for establishment of aquatic plants with properly anchored below-ground systems, re-vegetating lengths in their first year after dredging should not be subjected to more boat traffic than is absolutely necessary. Therefore for at least 12 months and always including one complete growing season, boat rallies should be scheduled away from such lengths and a 3.2 km/h (2 mph) speed limit should be applied to remaining traffic.

Spot dredging

Spot dredging of silt and other materials around feeder inlets and bridges may be required every few years, or even every year. Such purely local work, removing recently introduced materials, should not require disturbance of the canal margins. Provided it is carried out between September and March and no scarce plant species are involved, the work should not need the above management safeguards, as there is unlikely to be any threat to the wildlife interest of the canal as a whole. Where these conditions apply, prior authorisation by Natural England is not required.

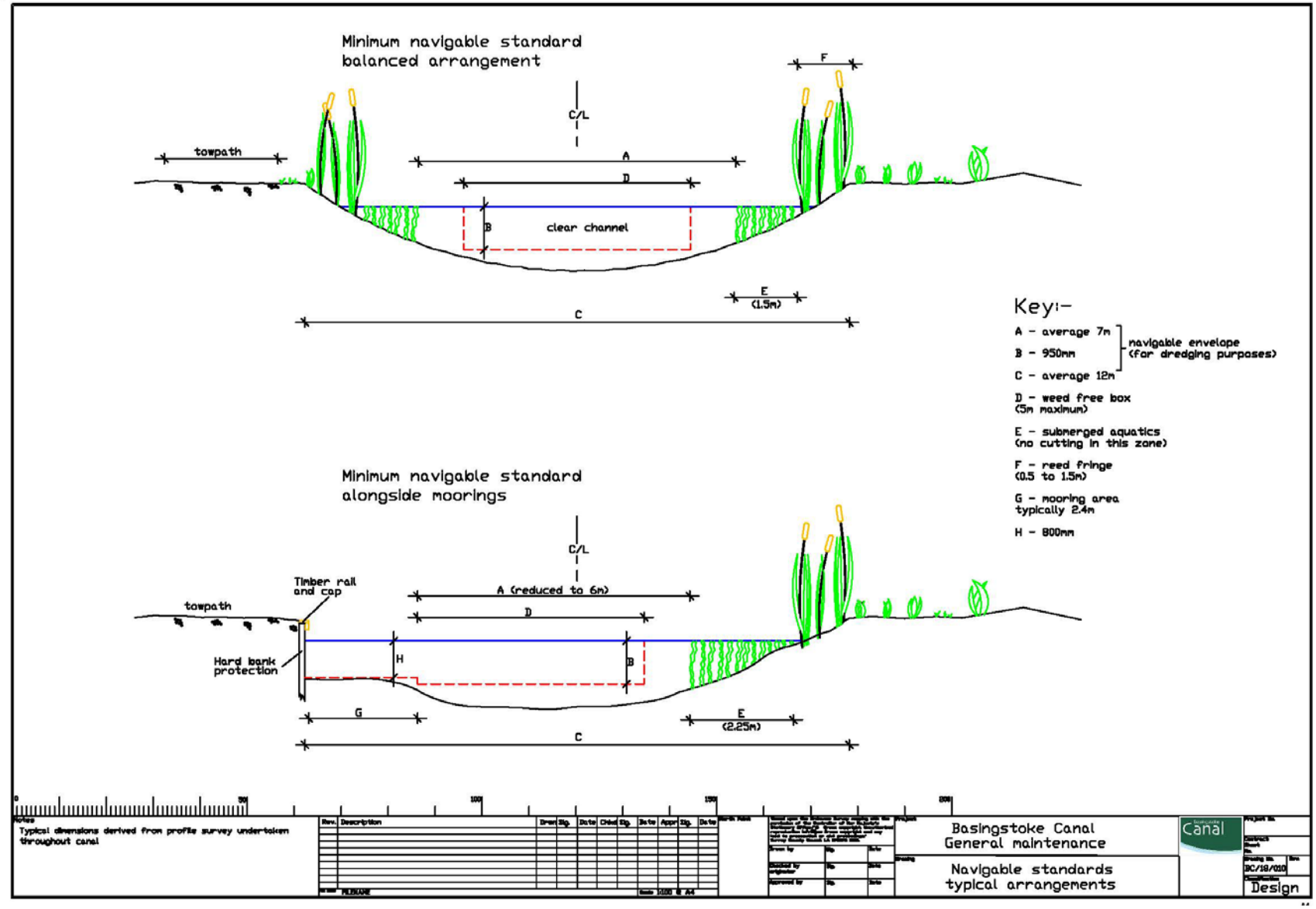

Figure 11 - Drawing showing minimum navigable standards

Appendix 8 - Bank protection

The process of canal bank erosion

There are many factors that contribute to the process of bankside erosion on the Basingstoke Canal including:

- wind-driven wave action, boat wash,
- burrowing animals,
- trampling by anglers, dogs or cattle,
- soil particle size and channel profile.

The dominant cause is the dissipation of wave energy. For the boat component of this, the amount of incoming energy depends considerably on the depth of the channel (Verheij 2006), such that well dredged lengths experience much less erosive wave action than shallower, poorly dredged ones.

Soil constitution and particle size will determine banks susceptibility to erosive influences. Lapping waves gradually cut into the canal banks at the waterline, loosening exposed soils, which then fall into the channel. Steep, unstable banks form as the shoreline erodes back into the ground behind. Once these steep banks have formed the process accelerates, as ledges are further under cut. Often shelves are formed just below the water line and these intensify the problem further, because as waves come onto these shallow areas, their height is increased leading to a higher rate of erosion.

Reflection of wave energy can accelerate erosion. The introduction of hard engineering solutions such as sheet metal piling solves the local erosion problem, but waves hitting the banks are now reflected back across the channel to the opposite bank, rather than absorbed as previously. This may result in intensified erosion of remaining adjacent soft banks, especially just beyond the ends of the hard banking.

By contrast, marginal bankside vegetation absorbs wave energy. There is a resilience limit to the capacity of reeds to dissipate energy, beyond which physical damage to the vegetation exceeds its ability to repair itself by new growth. On the Basingstoke Canal, traffic levels are within those tolerated by reed fringes elsewhere, so vegetated bank protection is potentially a viable system, especially if the rooting systems of the reeds are given some protection from washout of the soil in which they are anchored, by use of techniques described below. However on many parts of the canal the effectiveness of this traditional bank protection system has been compromised by increasing shading from bankside trees. Shading reduces the vigour of the marginal vegetation by limiting its photosynthesis and thus the mechanical strength of the plants and their and ability to repair damage by new growth. In many places the shading is too intense to allow any reed growth and here banks are bare and very susceptible to erosion.

The process of erosion can gain further momentum by the loosening of soil and destabilisation of areas of bank by burrowing mammals the introduced alien Signal Crayfish (*Pacifastacus leniusculus*).

Engineering solutions to bank erosion

Following more than 30 years of experience of bank management, the continued development of engineering techniques, learning from others in the waterway sector (such as contractors and other navigation authorities) the BCA have largely rewritten Appendix 8 in this iteration of the Plan to provide current best practice.

Hard walls

Sheet metal piling

Sheet piles consist of interlocking galvanised steel sheets; their length varies according to project requirements (usually at least 3m long). These sheets can be driven in to create a highly stable edge, and depending on gauge/profile and can be used with or without ground anchors. Soil, dredgings or granular materials can then be used to back fill, creating a hard, stable edge. A steel waling bar, a timber or even a reinforced concrete capping beam may also be required to add stability.

In some circumstances, at canal wharfs, areas where boat mooring is frequent, at structural wing walls of locks, weirs, or bridges, or where there is a technical requirement to effectively stop leakage, or provide structural support this is still a viable, and even a preferred option.

Although there is a moderately high capital cost, the life of galvanised sheet piling is in the 50-120 year range, meaning there is good economy in this type of construction.

However, sheet piling is not desirable for larger stretches of bank stabilisation without other treatments, as it provides an extremely poor environment of the colonisation of marginal aquatic plants and animals.

Where sheet piling is required for technical reasons, especially to resolve leakage or engineering support, and where the resultant bank is not required as a boat mooring; a semi-submerged shelf should be installed in front of the sheet metal wall to provide habitat for marginal plants, or the piles should be buried under dredged material won locally to the site so a naturally vegetated bank may regenerate from roots and seed.

Experiments with cheaper forms of piling, such PVC, have been made – mainly with poor results – and these should be avoided unless the technology improves. Intermittent sheet piling with timber infill panels was a favoured technique during the Canal's restoration period to reduce capital costs; unfortunately, this has the worst of all worlds as having a very limited lifespan plus poor conservation credentials, this technique should also be avoided.

Masonry

Stone and brick were the traditional materials of the canal builders where they required hard edges. These walls largely reflect waves, and therefore contribute to wave action, though designs including crevices and cavities can absorb some of the energy.

After a relatively short period masonry walls start to have voids and rough surfaces as mortar is lost from joints – this offers habitat for invertebrates, and can support small vascular

plants, algae, and mosses. Traditional masonry walls can be very expensive to build or rebuild in the canal environment due to the requirement to dewater.

Masonry should therefore be considered, but only where there is a requirement to repair an existing heritage structure, or create an equivalent new structure.

Reinforced concrete

Reinforced concrete walls are less traditional but are a favoured technique of engineers, as they can be designed to any shape, and have known and easily calculated structural strengths.

From a conservation perspective unless designed with a rough surface they are unlikely to absorb any wave energy, or provide habitat for invertebrates, mosses and lichens.

Concrete has a very high carbon footprint, even compared to steel, and therefore concrete walls should only be used where there is an engineering need for structural strength, and a reason not to use other options.

Gabion baskets

Gabions, i.e. metal wire cages filled with stones, can be used for low rise walls, although modern engineering codes mean that where they offer structural support a relatively massive foundation may be required, rendering the technique very expensive.

They are more aesthetically pleasing and can be favoured by planning officers, considering the heritage nature of the Canal. They provide good energy absorption from wave action, and provide good crevice habitats for all manner of flora and fauna.

The average life of a galvanised basket is around 40 years – after which there is an increased risk of failure leaving loose stones and pieces of wire in the navigation. Gabions therefore should be selected where a hard wall is required with excellent wave absorption properties, and is relatively low to the water not requiring structural support.

“Soft” walls – the vegetative solutions

The following systems are known as soft bank protection. The products installed have a shorter lifespan, but rely on the establishment of marginal vegetation to bind the bank together providing a continuing natural solution once the original installation deteriorates (usually after about 5 -10 years).

Whilst the cost of materials is generally much lower soft bank techniques can be time consuming and labour intensive to install – typically costings in 2018 are between 40% -60% of a sheet steel bank.

Coir fibre rolls

These are made of specially prepared natural coconut fibre, which is compressed into rolls and contained by an exterior mesh netting of synthetic cord. They are approximately 3 metres long and either 300 or 400mm in diameter depending on site requirements. The rolls are fixed using 1.2metre pointed stakes placed both sides (total of 7 per roll) and twine. It is advisable to install a geotextile fabric sheet behind the structure, to prevent the migration of backfill silt.

They are often installed pre-planted with a range of suitable plant stock and allowed to grow on in a nursery. This is not an option on the Basingstoke Canal however as pre planted stock that are not of local provenance cannot be introduced into a SSSI. Therefore, if specified sterile rolls should be installed, then planted with canal vegetation, or left to regenerate naturally.

Faggoting

This technique involves laying bundles of brash horizontally, usually dead willow but occasionally hazel. These faggots are 1m x 0.3m diameter and are secured to a line of stakes that have been driven in to the canal edge. Faggots can either be laid in a line along the toe of the bank or formed into a mattress, which can be used as a foundation for a newly formed bank. The faggot walls are then backfilled with silt from the canal and planted with marginal aquatic plants of local provenance.

Experience on the Canal of this technique has been mixed, with some locations margins re-establishing well and quickly, and in other locations hardly any growth. This may be connected to whether silt is retained in the faggot bundles or washed back into the Canal channel, or other external factors such as shade.

Hazel wattle hurdles

Hazel stakes are driven into the bank of the canal at 500mm centres. Then hazel whips are woven between the stakes until a continuous hurdle is constructed (this is known as spiling). Silt from the canal channel is then used to backfill.

This technique is particularly good for the construction of submerged shelves, which can be backfilled with silt and provide an excellent growing environment for marginal aquatic plants. If materials can be sourced on site it is a low capital cost and low carbon footprint option.

Willow is also commonly used for this technique on other waterways, but can result in vigorous saplings sprouting from the cut willow stakes or whips. In areas with high scour such as on rivers this may be highly desirable, but it should be used with caution on the Canal.

Nicospan

Nicospan is formed of a flexible woven geo-textile material with intermediate pockets to be fitted over timber posts or stakes. As a woven material it is porous and allows water to pass through whilst retaining the majority of silt and granular materials.

The material found particular favour in the late 1990s and early 2000s, as it was cheap, easy to install and had a lifespan of 10-15 years. In many cases it was incorrectly specified as a direct replacement for hard bank techniques such as sheet piling at boat moorings. It should never be used for this purpose, as it results in a sterile vertical bank, with limited support and a relatively short lifespan – thus having the conservation disadvantages of the hard edging, with poor engineering performance and low lifespan.

Nicospan should only now be considered as an alternative to Hazel wattling to retain submerged or semi-submerged plant shelves, or as protection against boat wash at the edge of in-channel reserve areas.

Three-ply geotextile

Where eroded banks now require reinforcement the current preferred option is to use a geotextile envelope to retain silt whilst both terrestrial and marginal plants regenerate on the bank.

The envelope is formed of three geotextile layers – a geo-grid for structural support, a filter membrane (such as Terram 1000) to prevent silt washing out, and an outer coir mesh to aid root growth. The envelope is then filled with locally won silt and soils, and then closed off by wrapping the free end over the placed material. The envelope is supported by cleft chestnut stakes driven at the line of the bank, and shorter stakes used as anchors further back into the bank, which are braced together with fence wire.

The three-ply geotextile can also be used to create open submerged planting shelves in front of the repaired bank – to aid the retention of silt and reduce the effect of boat wash in the margins.

The height of vertical or near vertical bank above water should be kept to the minimum in order to maximise suitable rooting areas.

Dog steps

In areas where there is considerable public use of the towpath dogs are frequently observed to swim in the Canal. Where the dog then re-emerges the scrabbling action leads to eroded embayments especially on the towpath side of the Canal. It is particularly notable in bare soil banks under heavy tree shaded areas, but can occur even in well vegetated banks. It is commonly associated with residential areas along the Canal and where other paths lead away from the towpath.

When specifying soft bank protection, account should be taken of the cause of any erosion; if dog action is suspected or observed then one or more timber “dog steps” should be formed at key locations (especially adjacent to path junctions) to reduce erosion.

Typical detail drawings

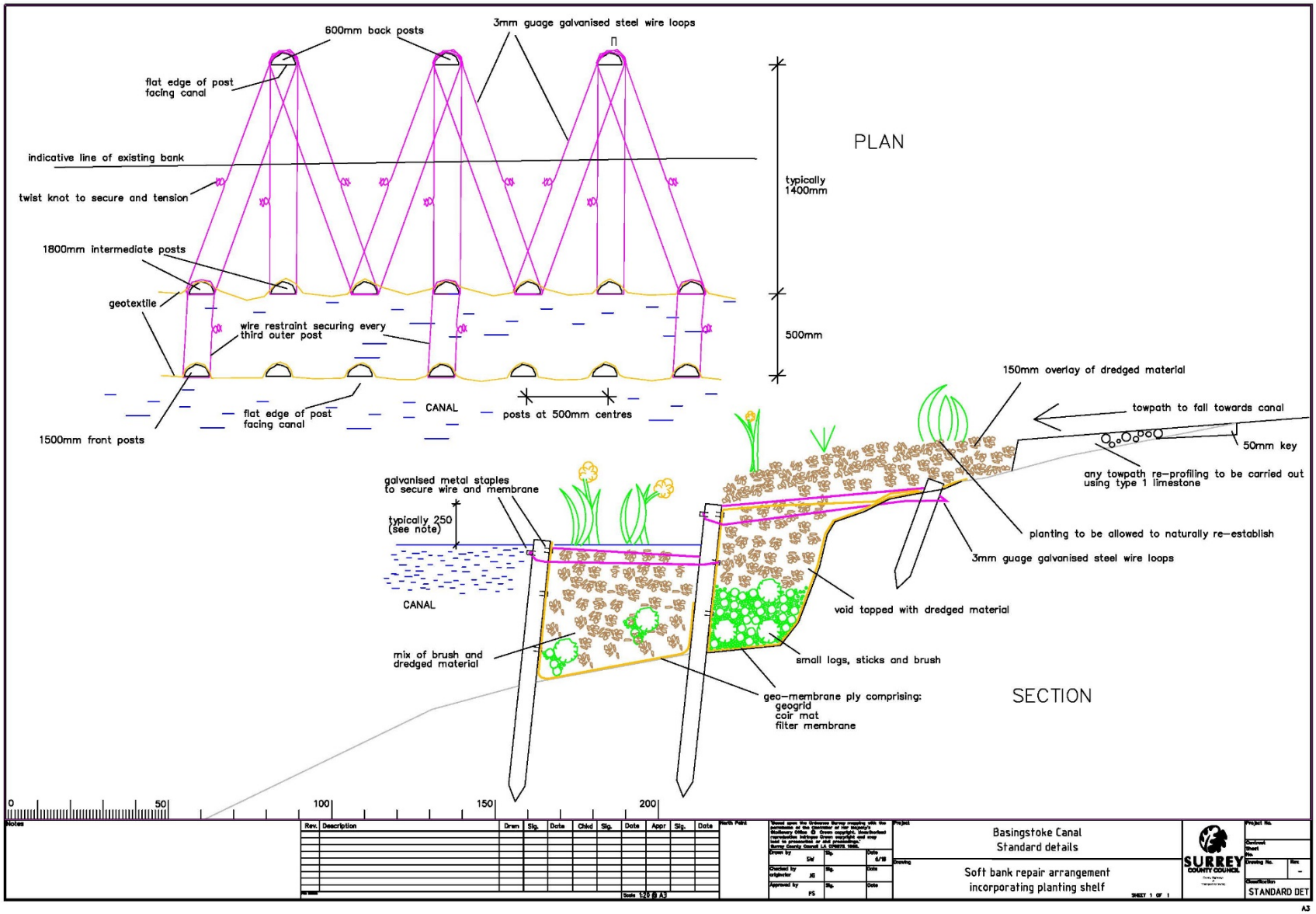

Figure 12 - Soft bank; three-ply geotextile method, including marginal planting shelf

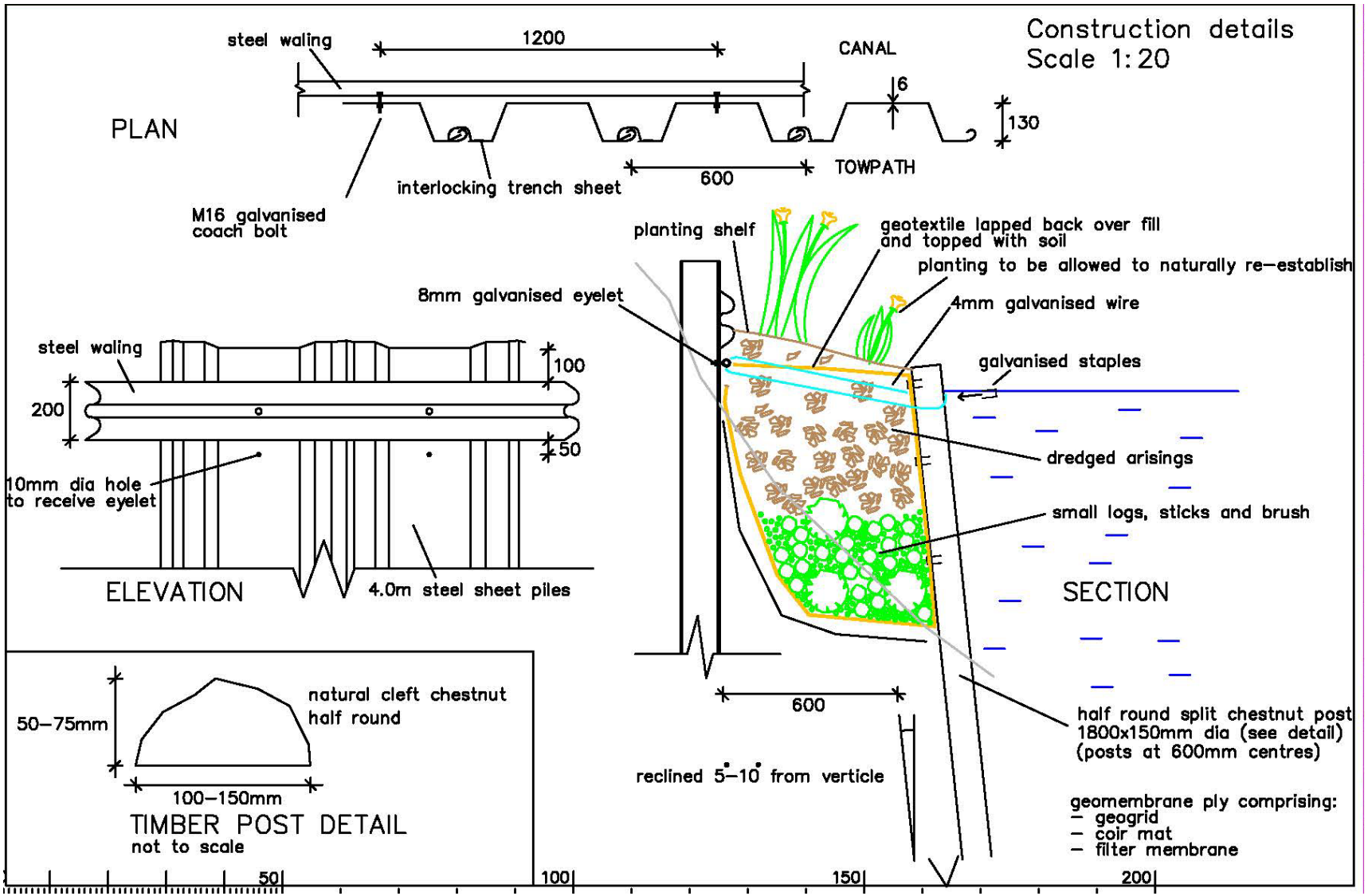

Figure 13 - typical sheet pile wall with planting shelf detail

Planting of soft bank installations

Only plants of local provenance should be used. Natural England has advised that this means native species from the "relatively local area" or from seed bank sources approved by Natural England and checked that they are not contaminated with non-natives.

The following emergent plant species can be collected at certain points along the canal and are suitable for plantings.

At the front on to the channel, in no more than 0.2 m water depth

- Common reedmace (*Typha latifolia*)
- Branched bur-reed (*Sparganium erectum*)
- Flowering rush (*Butomus umbellatus*)

At the rear, between the above and the dry bank, in no more than 0.1 m water depth

- Reed canary-grass (*Phalaris arundinacea*)
- Sedges (*Carex acutiformis, C. paniculata, C. pedula, C. pseudocyperus, C. riparia*.)
- Yellow flag iris (*Iris pseudacorus*)
- Rushes (*Juncus effuses, J. inflexus*)

Although common along the canal, Reed sweetgrass (*Glyceria maxima*) should not be used in plantings, as it outcompetes most other species and so reduces biodiversity; it also forms large decaying oxygen-deficient masses in winter which are poor habitat for invertebrates.

Transplanted plants should be pushed into the silt behind the newly constructed bank, also into the submerged wattle shelves at a spacing of approximately four plants per metre.

To ensure the effective long-term durability of soft bank systems it is essential that bankside tree growth be controlled in order to allow for sufficient sunlight to enter the canal and its margins.

Appendix 9 Dewatering Protocol - Routine Works

Natural England should be notified of all dewaterings. This is a notification rather than application for Assent as long as works follow the protocol below:

- The length of time for any dewatering should be the minimum possible to prevent damage to the canal and its associated wildlife.
- Where possible all dewatering should be done during the autumn or winter months.
- The length of the stretch of canal that is dewatered should be the minimum practically possible to minimise disruption and if possible a partial drain down is preferable.
- Fish rescues will need to be planned if required and the EA informed.(see fish rescue procedure) If dewatering is going to be longer term then crayfish trapping will need to take place to prevent re-burrowing at lower depths.
- Any dewatering will need to be advertised to let the public know. This should be done via the BCA website, Facebook and Twitter and on an email bulletin navigation update.
- Biosecurity should be considered and every effort made to avoid the spreading of invasive species while works are carried out.
- Pollution prevention must be considered for all works in and around the canal. Spill kits should be available in case required. Examples of things to look out for are fuel leaks from machinery, littering and dumping of waste materials such as old mortar and concrete.
- Water should be preserved and passed down the canal system rather than sending it off weirs when dewatering a stretch of canal. Weirs should only be used if necessary to maintain canal safety.
- Consider the protection of the canal banks and lining for any works that are taking place. Ramps may need to be used and as little tracking up the canal bed and banks as possible.

Routine Works Include;

- Gate lifting, fitting
- Cill replacement or repair of canal furniture
- Wing wall repairs
- Repointing of wing walls or chamber
- Sheet piling or soft bank protection works
- Lock Chamber bed clearance
- Obstruction clearance (bed or paddle holes or sunken boat)

Routine works do not include dredging works which are dealt with separately within this Plan.

Any works that require Assent to be sought from Natural England, should include the following additional information in the documentation:

- Biosecurity Measures http://www.nonnativespecies.org the E-learning course should be undertaken by at least the lead member of staff; http://www.nonnativespecies.org/elearning/index.php .

- Safety around water – evidence shown that risk assessments are in place for staff/volunteers working in and around water.
- Pollution Control measures should be in place to ensure that any works do not pose a risk of pollution such as from machinery or materials.
- Damage Control – what measures have been put in place to reduce the risk of long or short term damage to the SSSI.

Fish Rescue Procedure

If dewatering is only for a short period of time, i.e. a few days. If possible leave enough water for the fish to be able to swim and survive. Avoid excessive walking in the channel which will then cloud and suffocate the fish. Any particularly large fish may need to be moved.

Dewatering should be avoided during warmer sunny periods as this quickly deoxygenates the water. If a drain down is unavoidable a constant flow of water should be passed through the centre channel to improve oxygen saturation.

If an area needs to be completely dewatered or if it will be for a longer period of time. Where possible carry out our own fish rescues by hand using nets and buckets and move fish to the next pound. A slow dewatering will also help encourage fish to naturally move to deeper water. Crayfish will also need to be trapped and disposed of.

If the pound is much larger and will require a long period of dewatering the Environment Agency should be informed and a fish rescue arranged to include electrofishing. This is a last resort option as it can result in death of many of the smaller fish.

Fish rescue may also be required in summer months if lack of water in the upper pounds of the Canal results in the closure of the Deepcut / Brookwood lock flights. The short pounds between the locks may start to deplete rapidly once the feed stops at Lock 28.