BASINGSTOKE CANAL

ASSET MANAGEMENT PLAN

THIRD EDITION

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EXECUTIVE SUMMARY

This document marks the third in a series of Asset Management Plans for the Basingstoke Canal, hereafter referred to as the 'Plan'. The first edition of the Plan (Sept 2009) achieved the following:

- Creation of a database system capable of storing asset inventory data and asset condition data
- Identification of the canals principal and secondary assets
- Collection of inventory data for a significant proportion of the principal assets
- Collection of formal condition data for the lock principal asset
- Collection of informal condition data for several of the principal assets
- Setting the scene for the aims and objectives of future editions of the Plan

The second edition of the Plan (Jan 2010) achieved the following:

- Removal of the discrepancies between the BCA and SCC bridge inventory data
- Collection of formal condition data for the embankment principal asset

The third edition of the Plan (June 2010) achieved the following:

- Adoption of an inspection regime and procedure for the Canal based on industry best practice
- Development of the lock gate lifecycle plan

Development and implementation of the Plan will be an ongoing improvement process. Gaps still exist in the necessary information to produce a final version of this Plan and, therefore, some sections in the later part of this report are incomplete. Until all the remaining gaps in inventory and condition data are filled it is difficult to make holistic judgements for the long-term management and maintenance of the canal. As such, this has not been attempted within this edition.

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ACRONYMS

AI	Annual Inspection
AIP	Asset Inspection Procedure
AMG	Asset Management Geodatabase
AMP	Asset Management Plan
BCA	Basingstoke Canal Authority
BCI	Bridge Condition Index
BW	British Waterways
CC	County Council
CSS	County Surveyors Society
GIS	Geographical Information System
HCC	Hampshire County Council
JAG	Joint Advisory Group
JMC	Joint Management Committee
LI	Length Inspection
PDO	Potentially Damaging Operation
PI	Principal Inspection
RSI	Reservoir Surveillance Inspection
SCC	Surrey County Council
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Urban Drainage System

1. INTRODUCTION

1.1 Background

1.1 The Basingstoke Canal, hereafter referred to as the 'Canal', runs for 32 miles from Greywell in Hampshire to its junction with the Wey Navigation in Byfleet, Surrey.

1.2 The Canal was first completed in 1794. Throughout its lifetime the Canal has faced commercial difficulties and as a result it was eventually allowed to deteriorate. The Canal was subsequently bought by the two County Councils of Hampshire (HCC) and Surrey (SCC) in 1974 and was restored for recreational use. Re-opening took place in 1991. This was achieved with significant assistance from the Inland Waterways Association and the Surrey and Hampshire Canal Society.

1.3 However, after re-opening it soon became clear that one organisation should represent the interests of both County Councils and the six Borough Councils along the length of the canal. Therefore the Basingstoke Canal Authority (BCA) was formed in 1992.

1.4 Currently, the BCA manages the operation of the Canal from its headquarters at Mytchett, Surrey. The BCA staff is employed by HCC, who are therefore responsible for their health and safety. The BCA is not a legal entity and the two County Councils are responsible for land ownership and safety issues within their respective areas. The BCA organisational structure is shown in Appendix 1.

1.5 The two County Councils provide the majority of funding for the Canal. However, the riparian district councils are also asked to contribute in proportion to the length of the Canal within their boundaries. Unfortunately, in the past not all of these authorities contribute the amount asked for, despite the major impact that the Canal makes to leisure and recreation activities in these districts.

1.6 To help address this issue a formal agreement was sought between the local authorities and BCA in the form of a Memorandum of Agreement [1]. The memorandum sets out arrangements as from April 2009 onwards. The process resulted in agreement on the need for the following:

- *"a memorandum of agreement between the local authority partners to cover the current arrangements for the joint operation and management of the Canal;*

- *a formal funding agreement on a rolling three year basis linked to a service level agreement to secure guaranteed funding from all the local authorities;*

- *consideration of the option of establishing a charitable Trust which could organise the day-to-day operation of the Canal;*

- *organisation of a condition survey of the Canal and production of an Asset Management Plan to repair and maintain the structure".*

1.2 Purpose of Asset Management

1.2.1 The purpose of asset management is to provide a systematic and holistic framework for the management of a group of assets to deliver specified, or agreed Levels of Service, while minimising whole life costs or maximising whole life values [2].

1.2.2 Other recognised definitions of asset management are:

"Asset management is a strategic approach that identifies the optimal allocation of resources for the management, operation, preservation and enhancement of the highway infrastructure to meet the needs of current and future customers" [3].

"Asset management is the systematic and coordinated activities and practices through which an organisation optimally manages its assets, and their associated performance, risks and expenditures over the lifecycle for the purpose of achieving its organisational strategic plan" [4].

1.2.3 The Basingstoke Canal is a very substantial asset that has been under funded since its restoration. There is a significant backlog of maintenance and the levels of risk are high [5]. The development of an asset management plan can help identify the most effective way of determining and then dealing with this backlog of maintenance.

1.2.4 SCC and HCC have written Asset Management Plans for their Transportation and Property portfolios. There are clear advantages in following a similar approach for the future management of the Basingstoke Canal. A British Waterways report [6] also recommended that a comprehensive asset management plan should be developed.

1.2.5 This document presents the third edition of an Asset Management Plan (AMP) for the Basingstoke Canal. The Plan ultimately aims to develop a framework that provides a sustainable future for the Canal. It is generally recognised that the preparation of an Asset Management Plan is a continuous improvement process and it is anticipated that further editions of this document will be issued on an ongoing basis.

1.2.6 It should be noted that this Plan considers the Canal as a single entity, irrespective of ownership and responsibility.

2. AN ASSET MANAGEMENT FRAMEWORK

2.1 One of the aims of the British Waterways Board is:

"…to maintain and operate our assets as efficiently and effectively as possible in order to ensure the continued serviceability and safe operation of our canals and navigations whilst providing best value for our customers, partners and stakeholders" [7].

The BCA has similar aims (see Section 4). However, the Basingstoke Canal is not registered as a navigation authority. Therefore, it does not have the same duties imposed upon it as other canals within the UK.

2.2 The development of an asset management plan can help identify the most effective way of determining, and then dealing with, any backlog of maintenance. It is important to realise that it is not necessarily cost effective for every element of an asset to be in perfect condition. Some caution is therefore necessary when discussing backlog figures.

2.3 The ideal situation is to be able to maintain the asset in a condition that permits the desired level of service to be achieved at the minimum whole life cost. The backlog is the amount of work required to get from the present condition to the desired condition (see Fig. 1). It is not necessary, or indeed practical, to deal with the entire backlog in a single year.

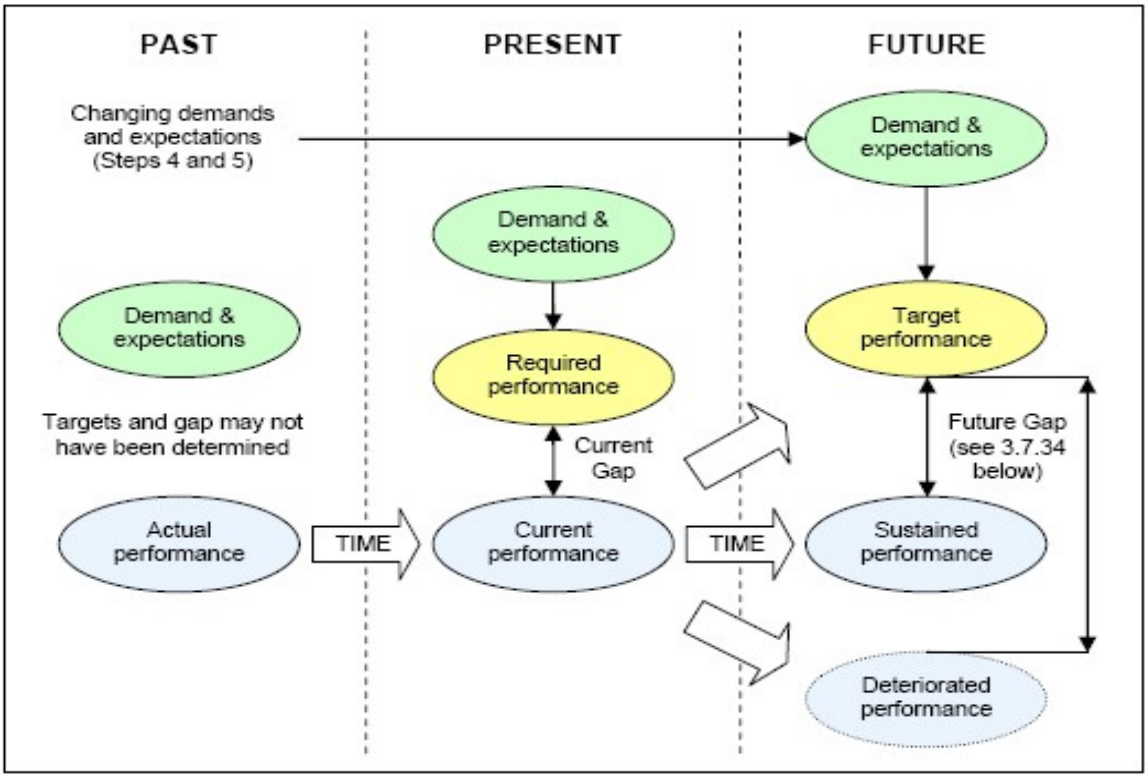

Fig. 1 – Performance Gap Analysis
(Source: [2])

2.4 Owners and operators have obligations under health and safety legislation (Health and Safety At Work Act 1974, Management of Health and Safety at Work 1999, CDM Regulations 2007 etc) to maintain the asset in a safe condition to protect employees and the public. The production of an asset management plan can help discharge these responsibilities. It should be remembered that it is not possible to insure against breach of statute.

2.5 Good asset data underpins the creation of a reliable asset management plan. Significant effort has been made by BCA, HCC and SCC staff, assisted by consultants as necessary, to itemise the individual assets of the Canal and evaluate their existing condition. This work followed an agreed model [8] and was supported by a project steering group attended by the key contributors, the Surrey & Hampshire Council Society and the British Waterways Board.

2.6 This Plan is based on the format recommended by the Code of Practice for the Management of Highway Structures (the Code) [2]. The format in the Code is itself based on the recommendations of the International Infrastructure Management Manual [9] and PAS 55 [4]. A typical framework for a long-term asset management planning process has been provided (see Fig. 2). Progress against this framework is discussed in the following sections of this Plan and has been summarised against Fig. 2. An improvement plan has also been suggested in Section 16.

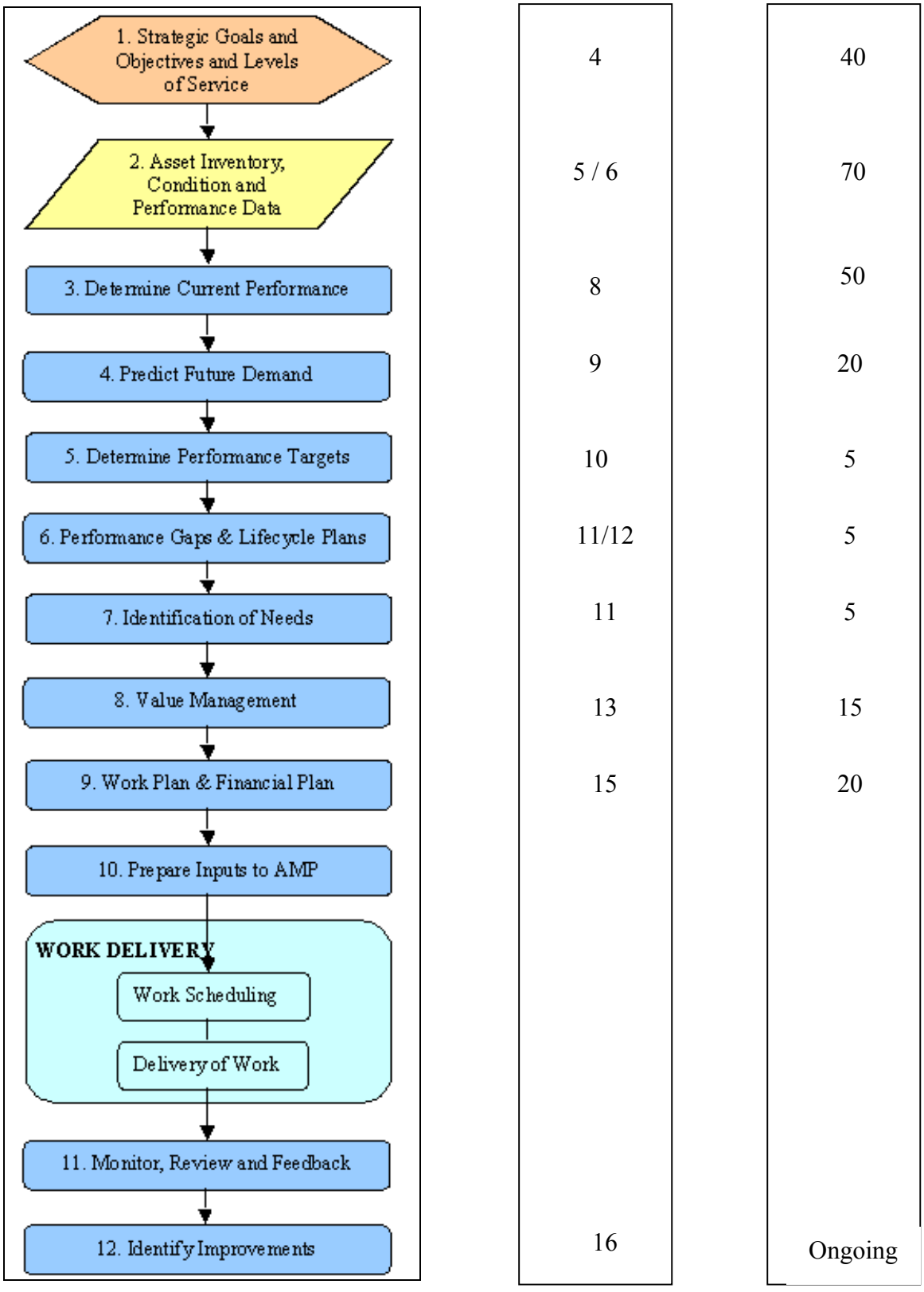

Fig. 2 – Framework for an Asset Management Plan
(Source: [2])

3. ENVIRONMENTAL CONSIDERATIONS

3.1 Introduction

3.1.1 There are a number of key considerations and additional constraints on the Canal. These include the geology and ground conditions of the Canal (See Section 3.2). In addition, a total of 28 miles out of the overall 32 miles of Canal have been designated as a Site of Special Scientific Interest (SSSI) (see Section 3.3). As a result the Canal operates under a Conservation Management Plan (see Section 3.4). A significant length of the Canal is also included in a Conservation Area (see Section 3.5), and a number of the structures have been scheduled as Ancient Monuments (see Section 3.6). These influences significantly effect how the Canal is currently managed and how it might be managed in the future. It would be inappropriate to consider engineering matters in isolation from their surroundings.

3.2 Geology

3.2.1 The Surrey section of the canal, and a substantial amount of the Hampshire section is founded in a group of rocks called the Bracklesham Group [10]. This group is made up of the Camberley Formation Sand, Bagshot Formation Sand and Windlesham Formation. The remainder of the Hampshire section comprises: London Clay, Woolwich and Reading and Oldhaven beds and finally Chalk. A plan showing the bedrock geology is given in Appendix 2.

3.2.2 Descriptions of the more common materials are given as follows:

- Bagshot Formation Sand: fine to medium-grained, yellow-brown, with thin silt and clay laminae: flint pebble bed at base.

- Windlesham Formation: sand and clay, highly glauconitic, dark green and brown, with discontinuous flint pebble bed at base.

- Camberley Formation Sand: sand, fine-grained locally glauconitic, yellow-brown, with thin clay lenses and flint pebble beds near base.

- London Clay: stiff dark/bluish-grey clay, with organic content and low oxygen concentration. Concentrations of agillaceous limestone. The bottom of the deposit is a sand bed with black flint-pebbles (siliceous) and occasional layers of sandstone.

3.2.3 The majority of the Canal is founded in sandy soils. The engineering properties of these soils are particularly susceptible to changes in moisture content – an unfortunate situation for a canal.

3.3 The Basingstoke Canal SSSI

3.3.1 An SSSI is a Site of Special Scientific Interest. The objective of the SSSIs is defined as:

"…to form a national network of areas representing in total those parts of Great Britain in which the features of nature, and especially those of greatest value to wildlife conservation, are most highly concentrated or of highest quality."..."each site represents a significant fragment of the much-depleted resource of wild nature now remaining in this country." [11]

Natural England (formally known as English Nature) currently designates, inspects and deals with any breaches of legislation regarding SSSIs.

3.3.2 The Basingstoke Canal SSSI incorporates two sections. The western section runs from Greywell Tunnel to Hermitage Bridge in Woking, and the eastern section runs from Monument Bridge to Scotland Bridge. In addition, the Greywell Tunnel at the western extremity of the canal is a SSSI in its own right.

3.3.3 The Canal is initially supplied by alkaline water from springs situated at the junction of the chalk and Reading beds near Greywell. As it progresses downstream the water becomes steadily more acidic. The slight west-east gradient allows it to flow and makes it comparable to a slow flowing river with initially alkaline water that becomes more acidic. This is a very unusual feature in Great Britain.

3.3.4 The changing water chemistry encourages a large variety of vegetation along the Canal length. Natural England recorded 90 different varieties of aquatic plants on the canal in a 1992/93 survey [12]. Five of these plants are classified as 'nationally scarce' and since the survey a further 2 'nationally scarce' varieties have been recorded. There is similar richness in fauna along the canal, with 24 species of dragonflies and damselflies being recorded in the survey. These form part of the 85 varieties of insects found on the Canal. Of these, 10 are classified as 'nationally scarce' and one as 'nationally rare'.

3.3.5 The SSSI designation places restrictions on the type and timing of activities that may be performed. In simple terms, consent must be sought from Natural England if an organization or individual wishes to carry out any of the activities specified as a Potentially Damaging Operation (PDO) for that SSSI.

3.4 Conservation Management Plan

3.4.1 The BCA has published a comprehensive Conservation Management Plan for the Canal [13]. The plan is *"designed to guide the actions needed to set the Basingstoke Canal Site of Special Scientific Interest on a path towards recovery from its present unsatisfactory state, while the waterway continues to be a major recreational and amenity resource for the areas through which it passes.*

The plan is for the ten year period from autumn 2008, and within that period provision is made for adjusting actions at intervals as necessary."

3.4.2 The fundamental aim of conservation management for the Canal is to provide suitable conditions for the growth of the SSSI's diversity. Many of these requirements may have a direct impact on the more traditional engineering aspects of managing infrastructure assets. Hence, special consideration should be given to the environmental impacts of any policy within this Plan, to minimise any conflict of interest.

3.5 Conservation Areas

3.5.1 Conservation areas are areas designated by local authorities under the Planning (Listed Buildings and Conservation Areas) Act 1990, as having 'special architectural or historical interest. In these areas, the local authority has additional controls over:

- Demolition of buildings or structures
- Minor improvements or alterations to structures; and
- Protection of trees

3.5.2 Conservation areas do not aim to halt development altogether, merely to give the local planning authority greater control to manage any changes so the special character of the area is preserved. The Basingstoke Canal conservation area encompasses the entire canal in both Hampshire and Surrey [14]. Generally the conservation area includes the canal itself, the banks and towpath, and some tree belts.

3.6 Scheduled Ancient Monuments

3.6.1 Scheduled Ancient Monuments are protected archaeological sites which are defined by the government under the Ancient Monuments and Archaeological Areas Act 1979 and the National Heritage Act 1983. English Heritage is responsible for the inspection and maintenance of Scheduled Ancient Monuments in England. Most Ancient Monuments that are scheduled are taken into state ownership to help protect them. Damage to a Scheduled monument is a criminal offence and any construction or development works which take place within the boundaries of one, or that may affect one, require Scheduled Monument Consent. It is very rare that this is given unless the development is deemed essential.

3.6.2 On the Basingstoke Canal two monuments exist. One of these monuments is the remains of a castle at Odiham, in Hampshire, alongside the canal. The other is a bridge which crosses the canal in the St Johns area of Woking [15]. It is unlikely that any works that might affect these sites would be allowed to

proceed, unless they were works necessary for protecting the integrity of the canal.

3.7 Additional Constraints

3.7.1 The terms of abstraction licences and the SSSI status also limit the amount of water that can be recycled and the number of boat movements that can be made. Historically, the Canal has suffered from water supply problems and there are periods in the summer months when parts of the Canal are usually closed to navigation. However, recent legal opinion suggests that it may be possible to relax the current abstraction limitations with respect to back pumping. The terms of the SSSI limit the number of boat movements to 1300 per year. This figure is unlikely to change in the foreseeable future. The current cost of licences is such that it is unlikely that the Canal could ever become financially self-sufficient given this restriction on boat movements.

3.7.2 There are a significant number of stakeholders on the Canal. These include the users of powered pleasure craft (both resident and visitors), commercial boat operators, houseboat owners, canoeists, anglers, walkers, cyclists and ecologists amongst others. There are also a large number of organisations involved with the Canal, as well as the BCA and owning County Councils, including riparian local authorities, Natural England, the Environment Agency, the Surrey and Hampshire Canal Society and the Inland Waterways Association. Consultation is undertaken by the BCA to ensure the needs of these stakeholders and organisations are considered.

4. STRATEGIC GOALS AND OBJECTIVES

4.1 An asset management plan should not exist in isolation. It is intended to demonstrate a cost-effective way of delivering the strategic goals and objectives of the organisation. The objectives of the BCA are set out in detail elsewhere (see Fig. 3). Crucially, the objectives include a requirement to maintain an ecological balance, a recreational facility, and a heritage transportation infrastructure.

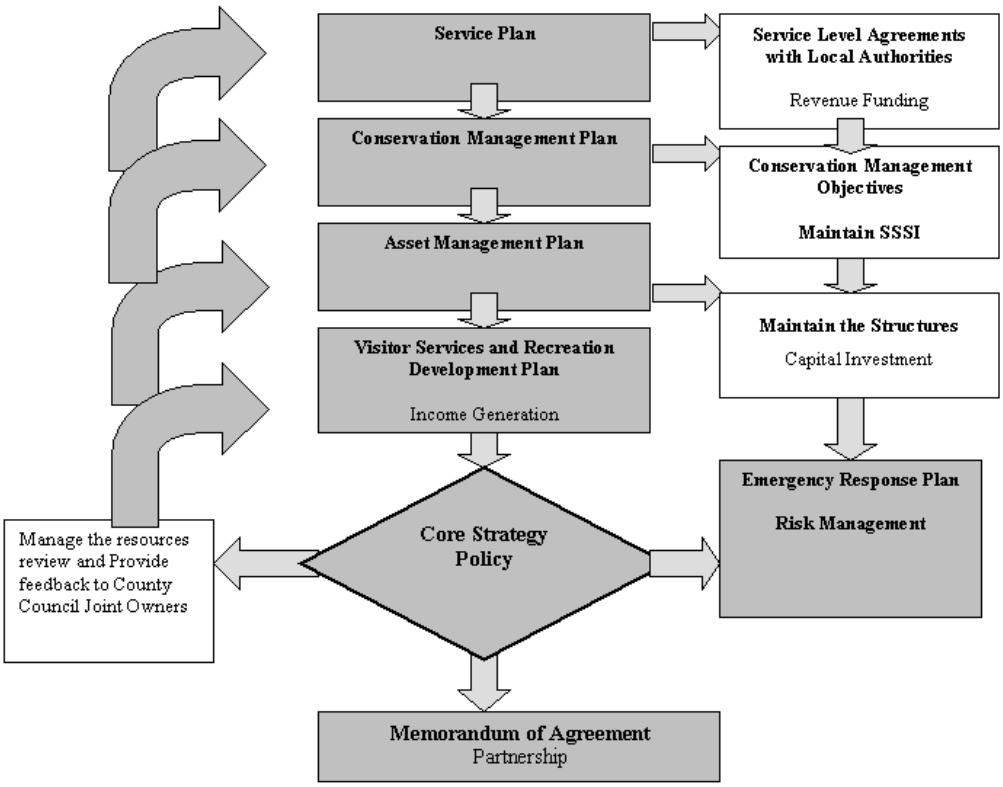

Fig. 3 – Basingstoke Canal Strategic Management Diagram
(Sourced BCA, September 2009)

4.2 The various processes and documents associated with the management of the Canal can be set out in a simple 'Strategic', 'Tactical' and 'Operational' hierarchy (see Fig. 4).

Fig. 4 – Examples of Strategic, Tactical, and Operational Documentation

4.3 The management of the BCA is advised by an officers group, the Joint Advisory Group (JAG), and a members group, the Joint Management Committee JMC, from all of the local authorities involved. The JMC is a statutory committee under the Local Government Act 1972.

4.4 The JMC undertook a comprehensive review of its activities in the latter part of 2005. Part of this review investigated an option to close the navigation. An engineering review of the Basingstoke Canal was completed as part of this option [5]. The JMC decided to keep the Canal open to navigation at present. However, the final options report included the following recommendations:

- the development of an asset management plan should be started
- the extent of the asset should be determined
- the condition of the asset should be determined
- the outstanding maintenance should be determined
- a risk assessment matrix for weirs and sluices should be determined
- a risk workshop should be held to help determine the relative importance of the asset groups
- a whole life costing exercise should be carried out on detailed structural engineering options
- a prioritised maintenance programme should be established
- consideration should be given to reviewing the method of works delivery

4.5 The County Councils are determined to progress with the first stage of these recommendations. Consequently, the Structures Group of the Transportation Service at SCC was asked to contribute to the development of a condition survey using an asset management-planning framework for the Basingstoke Canal. This Plan is one of the outcomes of that request.

4.6 The purpose of this Plan should be to:

- help convert the policy of the Basingstoke Canal Authority into appropriate actions
- provide a decision making mechanism for the management of the Canal
- aid deployment of finite resources in an open, fair and analytical way
- manage risks in maintaining and operating the asset
- enable monitoring of progress against targets
- support funding submissions to the two County Councils

4.7 To help achieve the above this Plan should:

- quantify the number, type and condition of assets
- quantify business and safety related risk
- analyse serviceability and rates of deterioration of assets
- ensure that appropriate and timely remedial works are carried out
- prioritise arrears expenditure on the basis of need
- report progress on targets
- identify long-term investment needs

4.8 Note; not all of the items listed above have been completed for this edition of the Plan. Outstanding items have been transferred to the Improvement Plan (see Section 16), and should be included in future editions of the Plan.

5. DATA MANAGEMENT SYSTEM

5.1 The key questions to be answered in the initial part of the asset management planning process are:

- How are we going to set up an asset management plan? (see Section 2)
- What information do we need? (see Section 5)
- How are we going to present this information? (see Section 5)
- What have we got? (see Section 6)
- What condition is it in? (see Section 8)
- What condition should it be in? (see Section 10)
- What is the outstanding maintenance? (see Section 11)

5.2 Good asset data and a secure asset database underpin the objective of providing a safe, reliable and sustainable Canal. Therefore, it was important to determine the method of data storage before data collection began. There was little point in commencing a data collection exercise without having first set out the 'ground rules'. It was also crucial that the inspection process and procedure was set down before the data collection exercise started. Failure to carry out basic preliminary steps could have resulted in significant abortive costs. The process for the overall management of data has been provided (see Fig. 5).

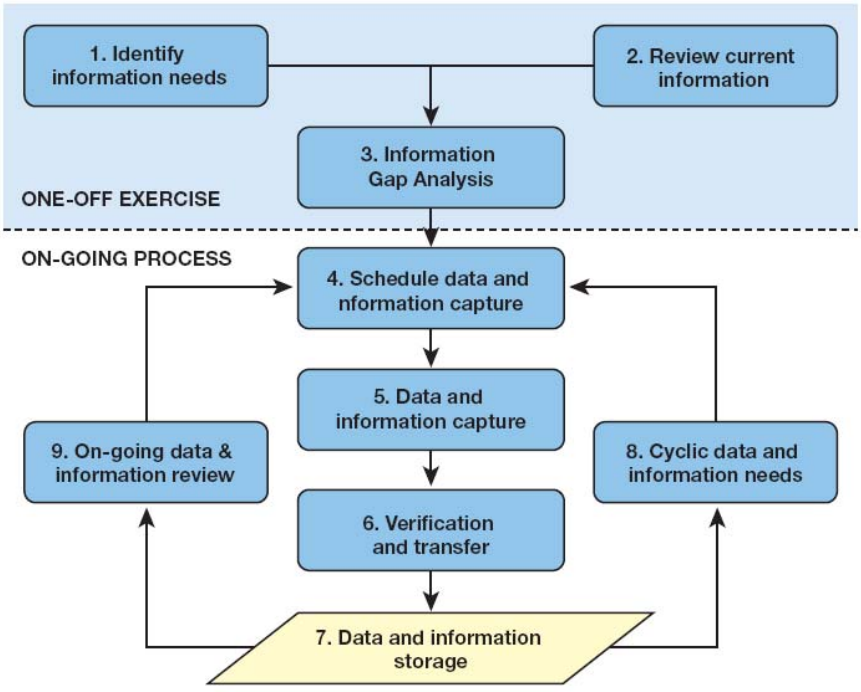

Fig. 5 – Information Management Process (Source: [2])

5.3 The ultimate objective for the Canal's data management system was to create an electronic database, linked to a GIS system, that would hold inventory and condition data on all the Canals assets, which could be viewed by the BCA staff and, remotely, by the headquarters teams at HCC and SCC.

5.4 To meet this objective the British Waterways (BW) document 'Process for Inspection of Assets (AIP) 2005 [16] was reviewed with the approval of BW officers. The data management requirements for the BCA database were largely based on this document, but with modifications to suit the nature of the much smaller canal network being considered. The concept of principal and secondary assets was also introduced (some examples of which are given in Appendices 3 and 4). The asset types used were checked against the definitions used by BW [16].

5.5 Staff at the BCA developed an Access database in 2009 that was capable of holding all of the asset data required to manage the Canal, namely the Asset Management Geodatabase (AMG). A screen shot of the menu page has been provided (see Fig. 6). A more detailed data entry sheet for the embankment asset type has also been provided (see Fig. 7). Work was also undertaken to create a Geographical Information System (GIS), a form of mapping software, which presents inventory data linked to location. A screen shot of the GIS application has been provided (see Fig. 8).

5.6 Further development needs to be made so that both SCC and HCC staff can view the AMG, GIS, and policy documents for the Canal on a single system. The system must continue to be 'backed up' or there is a very real risk that irreplaceable asset data will be lost. Currently it is envisaged that the information will be shared on a secure Internet site to which all appropriate members of the three organisations (BCA, SCC, HCC) will have password-protected access.

5.7 The consultants who were engaged in the later data collection exercise were also involved in developing the database. This was to ensure that the data could be collected in a way that permitted simple entry to the database and that all the data required would be collected during the inspections.

5.8 Distinctions between primary and secondary assets on the Basingstoke Canal have been proposed in a progress report by BCA [17] (the results of which are shown in Figure 9). The principal assets have been investigated as priority within this Plan, in order to compile inventory and condition data (see Section 6 and Section 8).

5.9 It is also important to consider other types of ancillary data that the BCA may use. This could include:

- land ownership details
- financial agreements with riparian authorities
- wayleave agreements with landowners

- operational protocols with the Environment Agency, Network Rail and highway authority
- historic drawings and photographs
- health and safety files for construction projects

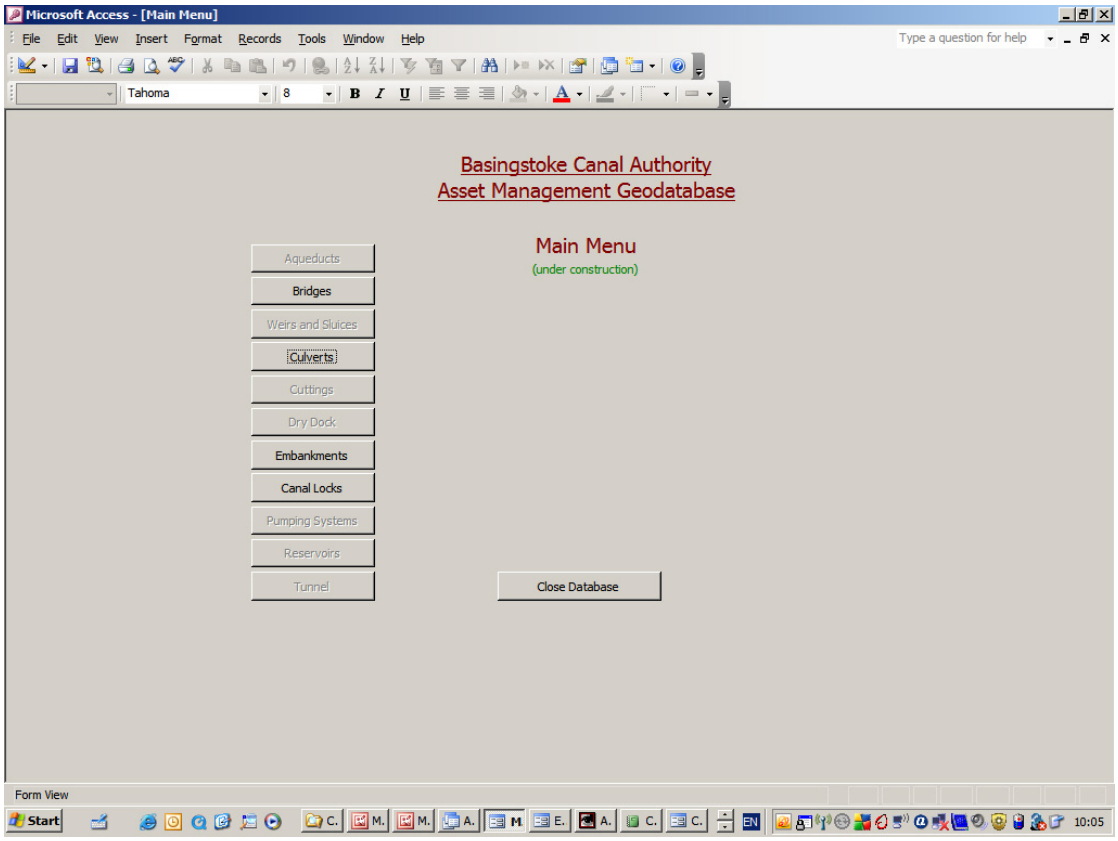

Fig. 6 – BCA Asset Management Geodatabase, Main Menu

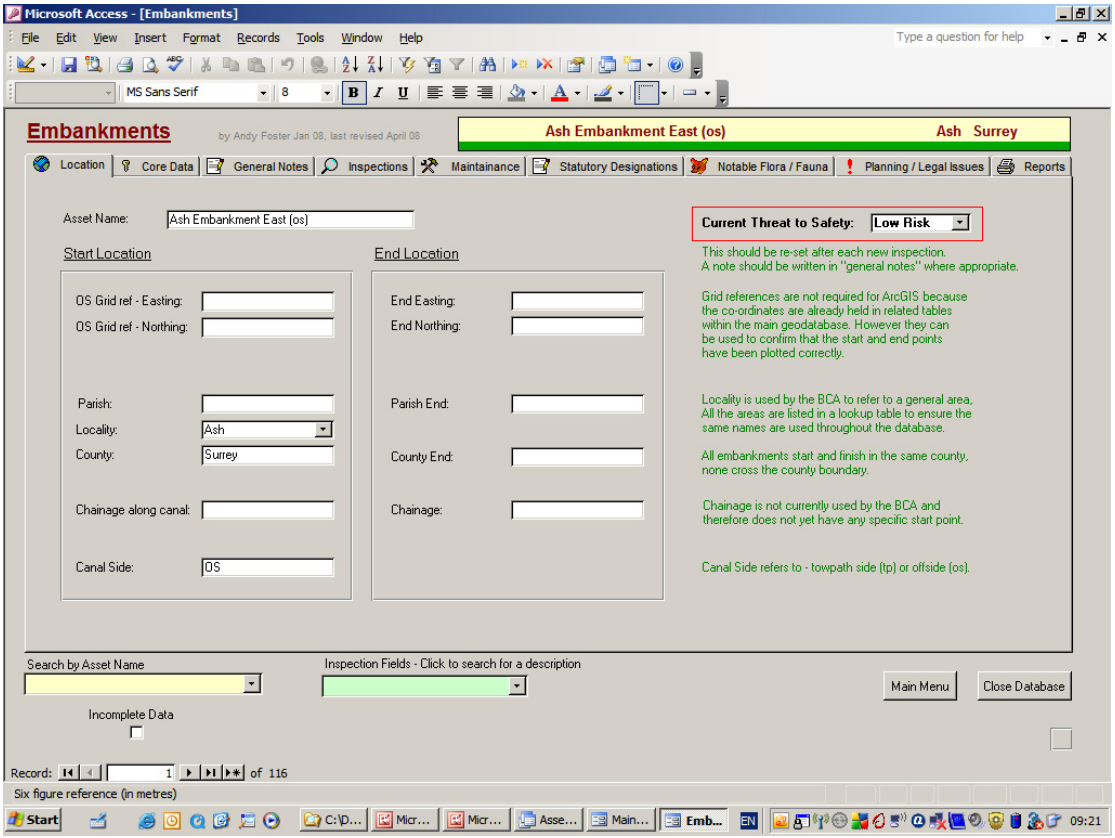

Fig. 7 – BCA Asset Management Geodatabase, Embankment Data Sheet

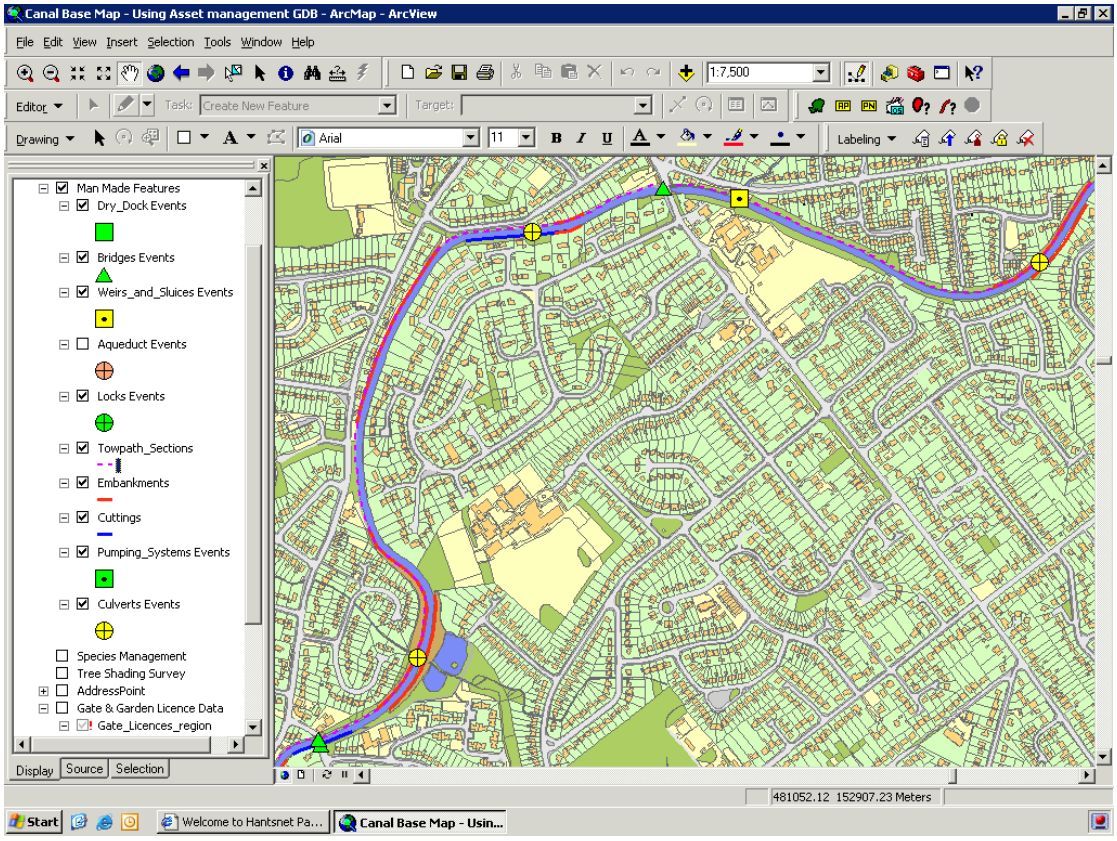

Fig. 8 – BCA ArcGis GIS Application

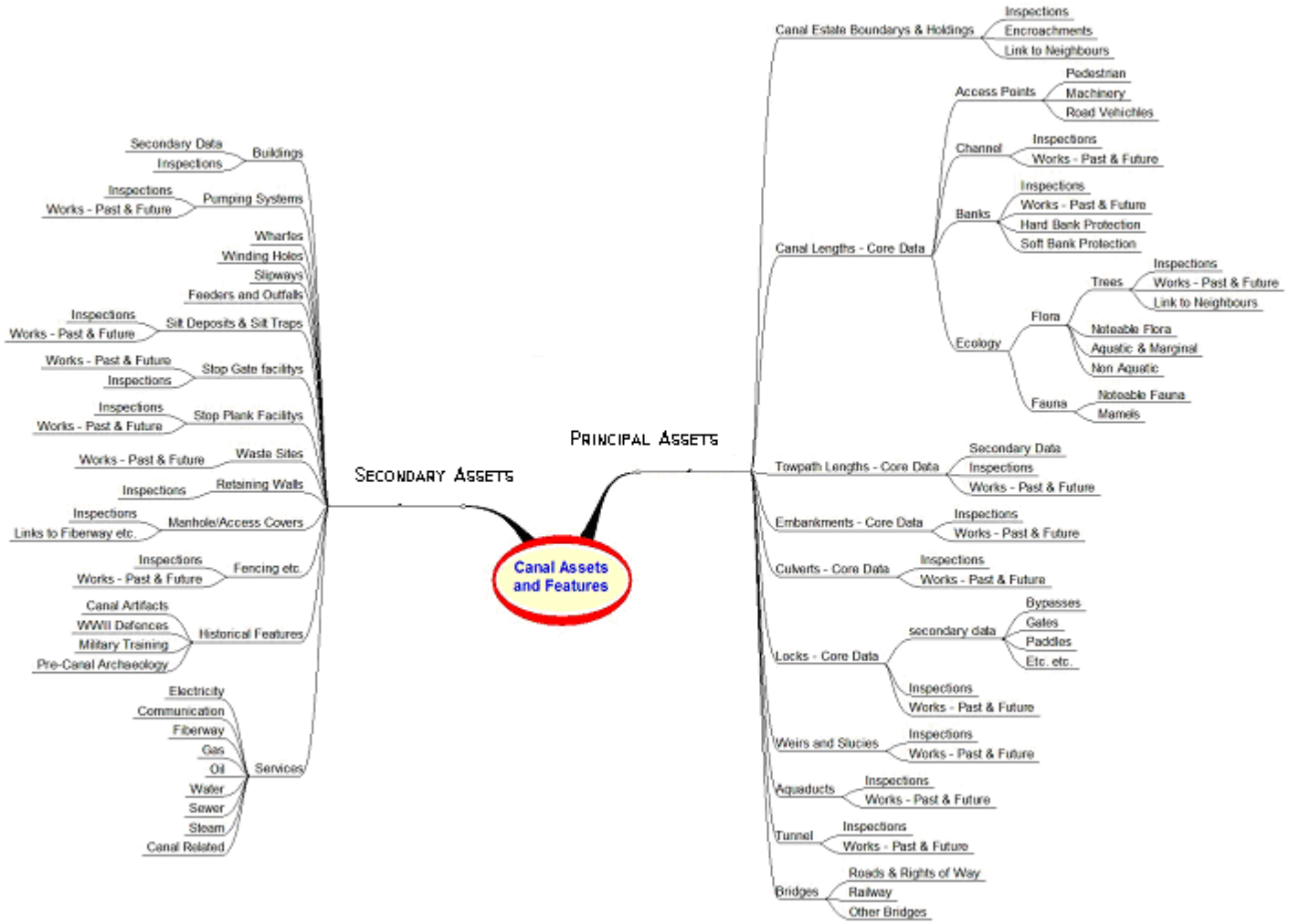

Fig. 9 – Basingstoke Canal Principal and Secondary Asset (Source [16])

6. ASSET INVENTORY

6.1 Introduction

6.1.1 The canal contains the following principal assets:

- 32 miles of main navigation channel and towpath (see Section 6.2)
- 144 embankments and 53 cuttings (see Section 6.3)
- 26 sluices and weirs (see Section 6.4)
- 29 locks and 1 dry dock (see Section 6.5)
- 1 reservoir (see Section 6.6)
- 58 culverts (see Section 6.7)
- 4 pumping systems (see Section 6.8)
- 108 bridges (see Section 6.9)
- 3 aqueducts (see Section 6.10)
- 1 tunnel (see Section 6.11)
- Numerous trees (see Section 6.12)
- 1 canal centre and 2 workshops (see Section 6.13)

6.1.2 Note; some secondary assets have also been considered within this edition of the Plan (namely buildings and pumping systems). However, the majority of secondary assets have been excluded at this initial stage. Maintenance vehicles, boats, plant and other equipment have also been excluded from this analysis.

6.2 Canal Navigation Channel and Towpath

6.2.1 The basic structure of any canal is the water channel and towpath. The Canal and the adjoining towpath runs for a total of 32 miles from Greywell in Hampshire to the Wey Navigation in Byfleet, Surrey.

6.2.2 The channel itself is formed in cutting or embankment depending on the localised topography. Unusually, the channel of the Basingstoke Canal was not lined with clay at the time of construction. Some embankments, particularly the Ash Embankment, which was reconstructed following a breach in 1968, have subsequently been lined with clay.

6.2.3 Generally, the absence of clay did lead to seepage problems in places when the Canal was refilled following restoration. However, this is generally considered to be much less of a problem at the present time. Nevertheless, there will be some loss of water as the result of an absence of a clay lining.

6.2.4 Absence of water for any length of time will encourage shrinkage within the fill material and result in a potential future increase in seepage or even breach when water levels return to normal. Water loss is also caused by evaporation (uncontrollable) and by the number of trees lining the route of the Canal (controllable).

6.2.5 When the Canal was restored, the shape opted for the channel was one of a deep saucer. The sides of the channel were to be nearly vertical in order to allow boats to come close enough to the side to moor without causing an obstruction in the main channel. However, the soils from which the canal is formed were not suitable for this and have slowly moved back towards their natural angle of repose. This movement has resulted in the banks being undercut and the formation of wash-outs and embayments.

6.2.6 The BCA have had problems with dredging of the Canal largely because of the unavailability of suitable equipment. Consequently, this task has not been carried out for several years. Dredging provides the necessary draught for boats to navigate safely. It also improves the condition of the canal bed which benefits aquatic life. Therefore, a programme of dredging needs to be carried out to facilitate navigation and to maintain the conditions appropriate to the SSSI status.

6.3 Embankments and Cuttings

6.3.1 In total there are 144 embankments and 53 cuttings currently registered on the Asset Management Geodatabase. These measure approximately 30,241m (18.79 miles) and 14,153m (8.79 miles) respectively, in combined length.

6.3.2 The embankments and cuttings are, apart from some minor repair works over the years, the original structures from when the canal was constructed in the 1790s. As such they could not have been built with the knowledge of geology and soil mechanics that exist today. The construction methods used were also more primitive than those currently in use. Therefore, in general, the earthworks have lower factors of safety than would be considered appropriate today.

6.3.3 An example of the effects of this poor construction occurred when a section of the Ash Embankment collapsed in 1968 [18]. A more recent study has been carried out into the stability of the Mytchett Lake embankment [19]. The report concluded that the embankment had an adequate factor of safety despite having been constructed from ‘as-dug’ material and no special measures having been taken to ‘key-in’ the embankment material into the sub-soil. The report concluded that the biggest threat to the embankment was that of over topping, leading to catastrophic erosion and failure. This is a key consideration for the future management of all embankments along the Canal.

6.3.4 The problems with the embankment structures have now developed into physical flaws, such as erosion, undercutting of banks and subsidence that are affecting their integrity. This is most noticeable in the most intensively navigated areas of the Canal. Measures will need to be taken to protect the banks of the Canal.

6.3.5 The bank stability problems are exacerbated by poor design and construction of some of the locks and their associated structures, which cause water to impinge on the banks at high velocity in several areas. In addition, the towpath is used by BCA vehicles, which operate and maintain the locks, and other infrastructure. These vehicles can create deep rutting of the path, particularly during wet weather, and water collecting in the ruts can soak into the embankments. This will encourage movement within the core material of the embankment and could conceivably lead to failure. There are also problems caused by crayfish and mammals that burrow into the embankment creating voids.

6.4 Sluices and Weirs

6.4.1 There are currently 26 independently registered sluices and weirs within the Asset Management Geodatabase, distributed at 18 separate locations along the Canal.

6.4.2 Sluices are channels through which the flow of water is controlled by a gate. They are used to regulate water levels in canals and rivers. When the gate is raised, water is allowed to flow under it. Weirs are small dams which restrict water flow and try to keep the water level upstream constant. They also provide an easy way of measuring the flow rate at any given time. The BCA has water retention procedures in place for drought and storm conditions and uses the sluices and weirs along the Canal as guides to decide when these measures should be employed.

6.4.3 The sluices and weirs form part of the Sustainable Urban Drainage System (SUDS) for the area. SUDS is a concept in storm drainage system design, which considers water quality, public amenity and improving the urban environment in addition to reducing the flood risk. SUDS are desirable, especially in a conservation area and SSSI like the Basingstoke Canal because they:

- Reduce the impact of further urbanisation on the frequency and size of floods
- Protect or enhance groundwater and river quality
- Are sympathetic to the needs of the local environment and community
- Provide a habitat for wildlife in urban watercourses
- Encourage natural groundwater recharge

6.4.4 The Canal is used to dispose of surface water from large paved areas such as the Aldershot Garrison and Deepcut Barracks. It also collects highway water from the many road crossings as well as general run off from the 32 miles of hinterland. The storm event of Sunday 13 August 2006 created flooding problems in the Ash and Mytchett areas even though the Canal was being operated under drought condition water levels at the time. This event illustrated the importance of the Canal to the drainage of the area and the need to maintain the efficient operation of the weirs and sluices. There are also restrictions imposed on the maintenance of minimum water levels because of the SSSI status of the majority of the Canal.

6.5 Locks

6.5.1 There are 29 locks on the Canal and 28 of these occur in the Surrey section. In addition there is also one dry dock located next to Lock 28.

6.5.2 Locks are the engineering devices that give canals the facility to change levels and hence the ability to cope with the topography of the countryside. Although the concept of a lock is straightforward, the construction and maintenance problems that they pose are significant.

6.5.3 The condition of the locks was very poor before restoration commenced. Since then all of the gates have been replaced or refurbished, the lock chambers have been refaced with brickwork and by-wash culverts reconstructed. The restoration was largely carried out using a mix of volunteer and Manpower Services Commission labour and although this was well intentioned, experience has shown that materials and methods could have been improved. There was also a desire to minimise the total capital cost of the restoration – access to sources of funding such as the Heritage Lottery Fund was not available at the time.

6.5.4 The main framework of the lock gates and the secondary planking should have design lives of 30 and 10 years respectively (see Section 12). However, these lives do not always appear to have been achieved to date. Problems with the original choice of oak, the accelerated corrosion of metalwork fittings and even an attack by ants at one location have lead to a shorter than expected service life. This creates problems with water retention that is one of the key issues for the Canal.

6.6 Reservoirs

6.6.1 The Reservoirs Act 1975 includes the following requirements:

- The owners ("undertakers") of the reservoirs, in this case Surrey and Hampshire County Councils, have ultimate responsibility for the safety of their reservoirs.

- Any enlargement of, or alteration to, a large raised reservoir cannot be carried out without being designed and supervised by a qualified civil engineer.

- A suitably qualified civil engineer must inspect any large raised reservoir that has been abandoned, before it is brought back into use.

- Large raised reservoirs must be inspected at least every 10 years by a suitably qualified civil engineer. They should also be inspected following any alterations or other works. Any recommendations made in the interests of safety by the engineer must be carried out in the specified time period and will be subject to inspection by the engineer on completion.

- Large raised reservoirs must be supervised at all times by a suitably qualified civil engineer who will be employed by the undertakers.

- If a large raised reservoir is to be abandoned, a report should be obtained from a suitably qualified civil engineer of the measures (if any) that need to be taken for the safety of the public.

6.6.2 The Environment Agency is the enforcement authority for the Reservoirs Act. It has recently determined that the Mytchett Lake pound (National Grid Reference: SU 894 543) is a reservoir under the terms of the Act. Therefore, Surrey County Council has now employed an inspecting and supervising engineer.

6.6.3 A geotechnical investigation of Mytchett Lake Embankment [19] noted several features of the Mytchett Lake reservoir. This included; the embankment retains both the Basingstoke Canal and Mytchett Lake, which are separately owned but are a single body of water divided only by a chain-link fence. The combined water surface area is some 6 ha, of which the canal comprises some 0.4 ha. The lake is roughly rectangular in plan, oblique to the line of the embankment, and measures 400m long by 150m wide, giving an area of 60,000m^2. The depth of the canal is approximately 1.5 metres, but the maximum depth of the lake is believed to be 4 metres, although this occurs some distance away from the embankment. Taking an average depth of 2m, the capacity of the lake would be 120,000m^3.

6.6.4 The lake provides a valuable reservoir of water – a commodity which the Canal sometimes lacks. Contoured Ordnance Survey maps show a minor valley with a ditch draining westwards into the lake, the total catchment being approximately 260 ha. Most of the catchment comprises dry heathland with pinewoods, but it includes Keogh Barracks and associated housing.

6.6.5 Other pounds may also be classified as a reservoir in the future. This would almost certainly be the case if the Canal were to be closed to navigation. This potential re-classification could lead to high costs for the Canal. These costs would include:

- The requirement to employ a suitably qualified civil engineer to supervise the pounds designated as large raised reservoirs.

- Any repair works or improvements required to make the new reservoirs safe for both employees and the public. This could be expensive, particularly with regard to embankment strengthening and partial or even total reconstruction of some of the locks and associated structures.

- Reservoirs being repaired or improved must be inspected following the completion of the works.

6.7 Culverts

6.7.1 There are currently 58 culverts and associated drainage features registered within the Asset Management Geodatabase. This information has recently been gathered (May 2010) in order to facilitate a condition survey of the culverts.

6.8 Pumping Systems

6.8.1 Currently there are 4 registered pumping installations:

- Frimley Lodge pump takes water from the railway ditches and pumps it into the canal at Frimley Lodge Park.

- Sheerwater takes water from below lock 1 to above lock 6.

- St Johns takes water from below Lock 7 to above Lock 11.

- Old Rive Ditch pump is now disused.

6.8.2 As water levels in the Canal are becoming increasingly difficult to maintain the pumping systems become more important. However, care is needed as the pumping systems can conflict with the interests of conservation, as set out in the Conservation Management Plan. The BCA has considered these interests in its Water Management Policy [20].

6.9 Bridges

6.9.1 Bridges, in large, are not immediately within the BCA management control, falling either directly under the HCC and SCC highways departments, or the countryside service in the case of a few monument bridges. In total there are 108 registered bridges within the Asset Management Geodatabase. Not all the asset data has been collected on these 108 bridges. Bridges exist in the Asset Management Geodatabase which SCC and HCC do not have a direct interest in, such as rail over canal bridges and lock footbridges. The asset inventory of SCC

and HCC owned bridges are stored within their respective bridge management systems

6.9.2 Approximately half the bridges that pass over the Canal will be regularly inspected by bridge inspectors from Surrey and Hampshire County Councils' respective Structures Groups. Two factors that require consideration are possible damage to the bridges from deterioration of Canal assets, such as undercutting of aprons or wing walls or subsidence caused by failures of sections of the canal bank. Inspectors of these bridges should be aware of the possibility of this and inspect susceptible elements carefully.

6.10 Aqueducts

6.10.1 According to the Asset Management Geodatabase there are three aqueducts along the Canal. Of the three aqueducts:

- Ash embankment aqueduct carries the Canal over the comparatively recently constructed A331 Blackwater Valley Route, which was finished in 1996.

- Frimley aqueduct is a four span brick arch, first built in 1838, and widened in 1902, that carries the Canal over the railway.

- Whitewater aqueduct carries the Canal over the River Whitewater. However, this structure is technically a sump rather than a true aqueduct.

6.11 Tunnel

6.11.1 There is one registered tunnel along the Basingstoke canal, the Greywell Tunnel. The tunnel measures approximately 1125m in length, and passes below Greywell Hill at a depth of 40m. It was first built in 1792 and restored in 1975. It is thought to be the 12th longest canal tunnel in the United Kingdom and the 2nd longest in southern England [21]. The tunnel passes through an area of changing geology from Hampshire chalk through Reading beds and into London clay [22]. There is an abundance of fresh water springs throughout the tunnel.

6.11.2 In 1985 it was discovered that a number of bats hibernated in the tunnel, and as such it was declared a SSSI. Following this discovery, a locked gate was installed at the eastern portal to protect the colony of bats by preventing unauthorised access. In addition, a partial collapse of the tunnel occurred in the 1930's. Hence, the Canal is no longer navigable through its final stretch, and remains solely for the purposes of conservation.

6.11.3 Each winter (traditionally January and February) surveyors go into the tunnel to count hibernating bats. The highest visual count being 618 recorded bats (total for east and western ends of tunnel), made in January of 2006. Counting the bats is made very difficult by the fact that many congregate within the brick sockets left as a result of the tunnels construction. Therefore, the number of bats

using Greywell tunnel for hibernation is believed to be far higher than visual counts suggest.

6.11.4 To date five species of bat have been recorded as using the Greywell tunnel for hibernation (Natterer's, Daubenton's, Brandt's, Whiskered and Brown long-eared). The tunnel supports Europe's second largest hibernation population of the Natterer's bat [22].

6.12 Trees

6.12.1 A serious threat to the embankments along the Canal is the number of mature trees that exist along the banks. A large number of these trees have been poorly managed and this, combined with the erosion and subsidence of the canal banks and embankments that support their roots, could cause them to become unstable and fall in a storm. If one of these trees were to fall within an embankment it could remove sufficient crest material to cause a serious breach. In order to reduce the likelihood of this event the BCA have recently published a draft Tree Management Policy [23].

6.12.2 The exact extent of the tree asset is currently not known. Survey work has been carried out in Surrey and a programme of work established for trees containing defects. The findings of this survey were that 324 trees along the Surrey stretch posed a risk, and subsequently required mitigation actions. A longstanding informal inspection regime, conducted by the BCA, has existed in the Hampshire section. However, it is advisable that a formal tree survey should be completed.

6.13 Canal Centre and Workshops

6.13.1 The Canal Centre is located at Mytchett Place Road, Mytchett, Surrey, GU16 6DD. It provides two functions; working quarters for the BCA staff and a visitor centre for the general public. The facilities of the visitor centre include a function room, picnic and play area, information point and gift shop, tearoom, campsite and a free parking area. The buildings are owned by SCC and are part of the property portfolio, which has its own asset management plan.

6.13.2 The workshops house the maintenance tools and equipment for the BCA staff to perform their various duties. As well as providing storage they are also used to perform maintenance activities such as building lock gates. The BCA are in possession of two workshops; one at Ash Lock, Government Road, Aldershot, and one in Deepcut located beside Lock 28. The latter was formally a military swimming pool and is leased from the Ministry of Defence.

7. INSPECTION REGIME

7.1 Background

7.1.1 The overall purpose of inspection, testing and monitoring is to check that the Canal assets are safe for use and fit for purpose, and to provide the data required to support effective maintenance management and planning. Although the scope, procedures, and work undertaken varies considerably between different inspection types, these core objectives remain [24].

7.1.2 The most important part of any inspection is the inspector, who is relied upon to perform their duties accurately, consistently, thoroughly and safely. The qualities of this experienced inspector should include, but should not be limited to the following [24]:

- *"knowledge of the safe working practices and methods of access required for inspection;*
- *ability to recognise and evaluate defects on the various canal assets;*
- *an understanding of the behaviour of the various canal assets;*
- *knowledge of the construction methods and materials used in the construction of the various canal assets;*
- *knowledge of the causes of defects and suitable testing methods to identify, confirm or investigate these; and*
- *ability to record defects accurately, clearly and consistently."*

7.1.3 All the inspectors in a team should be in sound health and have a realistic appreciation of their own limits of experience and ability. Inspectors with limited experience should work under the supervision of experienced staff.

7.1.4 The inspection regime established should enable any defects, which may cause an unacceptable safety or serviceability risk, to be detected in good time in order to safeguard the public and the asset [2].

7.2 BCA Historic Practices

7.2.1 Historically inspections by the BCA were conducted on an informal basis. Not all inspections were recorded. This increases the liability of potential claims if an accident were to occur due to unsafe asset condition. Those that were recorded were reported in a variety of manners including paper records, Microsoft Excel and Microsoft Word documents. The previous systems made historic inspection data difficult to locate and interpret.

7.2.2 In January 2008, as part of the creation of the Asset Management Database, consultants PCD Systems Ltd commented [25] "*following initial investigation it*

became apparent that there was very little electronic data available, principally because there has never been a statutory requirement for such data but also due to resource limitations within BCA. Large quantities of paper records are available but they are not sufficiently categorised or comprehensive enough to be useful in the context of this project. It was also apparent that a large amount of local and historic knowledge was available through the Canal Rangers, although this was primarily in their heads". Further details of historic practices have been included (see Appendix 5).

7.2.3 In April 2008 the BCA proposed an inspection regime for the different primary and secondary assets (see Appendix 6). This regime was based upon 'detailed' and 'cursory' inspections at set frequencies. Within a BCA progress report [17] it was indicated that all inspection data would be entered directly into the Asset Management Geodatabase, to ensure it was easily accessible in the future. When documents were produced by third parties, which could not be directly entered into the database, an electronic copy would either be hyperlinked or referenced within the database. Currently the BCA have not adopted the inspection regime to the extent suggested in Appendix 6. However, work has been undertaken to ensure the Asset Management Geodatabase has the capability to store inspection data when it is adopted.

7.2.4 Whilst creating the Asset Management Geodatabase it was noted "*considerable time has been spent designing the core data and inspection tables, to ensure that as much useful detail as possible has been included. The method of data entry was also a major design consideration with regards to the inspection tables. It was decided to have as many selectable choice fields as possible, for ease of use and to maintain uniform data. In the field, the data is expected to be recorded either directly onto a Tablet PC, Laptop or Pocket PC. However if this is not possible, pre-print forms with pre-dominantly multiple choice input could be used"* [17].

7.2.5 In order for the BCA rangers to complete the inspections using mobile devices such as the Tablet PC, Laptop or Pocket PC there will need to be a capital injection to purchase these devices. The initial costs of these devices should prove to be a wise investment in the long term, as they would allow the Rangers to work more efficiently. In addition, the devices would ensure the system is constantly up to date, and help avoid the possibility of duplication of inspections.

7.2.6 The mobile devices could also contain GPS software so that the position of any identified defects can be referenced geographically. This insures that the defect can be re-located easily for repair, which is often a difficulty on the Canal. Another option to overcome this issue would be to introduce an accurate and regular chainage marker system. This option would be particularly beneficial whilst undertaking length inspections (see Section 7.3), and may also be helpful to the users of the canal whilst partaking in recreational activities. The BCA have undertaken research into available chainage markers that would be in keeping with the heritage of the Canal. It is recommended that the chainage markers should be implemented as soon as possible for effective management of the Canal.

7.3 Proposed Inspection Regime

7.3.1 British Waterways published an Asset Inspection Procedure (AIP) for canal assets in 2008 [26]. The regime included four types of inspection; reservoir surveillance inspection, length inspections, annual inspections, and principal inspections. The frequencies of each inspection type is summarised in Table 1. Details of the purpose, content, and cycle of each inspection type can be found in Appendix 7. A brief explanation of each inspection type is given below:

Reservoir Surveillance Inspection (RSI) – These are weekly inspections of reservoirs, as classified under the Reservoirs Act.

Length Inspection (LI) – Length inspections are monthly on-foot inspections used to make notes of change in condition of the asset by walking along the canal.

Annual Inspection (AI) – These are yearly inspections intended to record defects and any changes in site condition.

Principal Inspection (PI) – Principal inspections are in depth qualitative assessments of all the aspects of the site to ensure that the assets are maintained to a standard of acceptable risk. The frequency of the principal inspection should be determined from a risk assessment.

Inspection type	Inspection frequency
Reservoir Surveillance Inspection (RSI)	Weekly (or sometimes twice weekly) for Reservoirs under the Reservoirs Act (see Section 4.3).
Length Inspection (LI)	Monthly or three monthly (see Section 4.4).
Annual Inspection (AI)	Yearly (see Section 4.5).
Principal Inspection (PI)	3 to 20 years based on risk (see Section 4.6). Low risk cuttings 50 years

Table 1 – BW AIP 2008 Inspection Regime Overview
(Source [26])

7.3.2 The BCA should adopt the regime recommended by the BW AIP 2008 as it represents best practice for this type of transportation asset. This document should therefore supersede the BCA proposed inspection regime as detailed in Appendix 6 as there is no evidence to suggest that there is a lower level of risk on the Basignstoke Canal that would justify an increased period of time between inspections (see also 7.3.7). However, at present the AIP, and therefore this Plan, does not consider all the secondary assets the BCA have identified as existing on the Basingstoke Canal. Where this is the case secondary assets can continue to be assessed using the BCA proposals as shown in Appendix 6.

7.3.3 For full details of how to conduct and record the inspection regime reference should be made to the BW AIP 2008 report [26]. As such, all senior BCA managers and Rangers who are to undertake inspections should become familiar with the content of the report. It is intended that a separate inspection manual for the BCA may be produced.

7.3.4 As the BCA is not a large organisation like BW it does not contain all the necessary expertise to undertake all inspection types on all assets. As such Table 2 sets out the party responsible for undertaking each inspection type, for each of the principal assets currently considered within this Plan.

7.3.5 The frequencies of several inspections have been amended from those proposed by BW. This relates to inspections on bridge, aqueducts, tunnel and tree assets, which are conducted by SCC or HCC inspectors, in their respective areas. In these cases the inspection frequency and procedures have been modified from the proposals of the BW to the current best practice employed by each County Council. These frequencies tend to be longer than those suggested by BW. As such the term 'annul inspection' (AI) will be replaced with the term 'general inspection' (GI), as not all asset inspections will be undertaken yearly.

7.3.6 In addition, the Basingstoke Canal does not accommodate the same high level of boat navigation as many of the BW canals. As such the general 'wear and tear' on the Canal is likely to be reduced. For instance, lock gates are not used regularly enough by users of the canal to become worn out, and often fail by slower processes such as rot. Due to this consideration the BCA can adopt the highest interval of inspection frequency for the RSI and LI inspection types recommended by the BW. This maximum inspection cycle is every week for the RSIs, and every month for the LIs of the principal assets.

7.3.7 It should be noted that the inspection frequencies for the PIs are currently based on the lowest interval of inspection frequency recommended by BW. This is because sufficient condition data and risk analysis does not exist to safely enable the inspection frequencies to be increased. The only exception is the embankment asset (see Section 7.4). The necessary information for this asset has been collected allowing PIs to be undertaken at various intervals based on the risk posed by each individual embankment. As additional principal inspection data is collected, and the risks associated with each asset are assessed, there is the potential to extend the inspection frequencies for other assets.

7.3.8 Based on the inspection frequencies proposed in Table 2 an inspection timetable has been produced for the next 25 years detailing the current PI inspection requirements. This is shown in Table 3. This timetable assumes that PIs will be conducted for the cuttings, culverts, and weirs/sluices in July 2010, and the Canal channel in November 2010, as suggested in Section 8. Where previous principal inspections have been conducted, the inspection cycle has begun from that year.

7.3.9 The Inspection timetable presents an initial guide to adopting the new regime. It is appreciated that the timetable may not be followed precisely due to operational and financial constraints. None the less, the inspection frequencies proposed in Table 2 should be adhered to. In contrast to Table 3, it is also possible to spread the inspection of individual asset types over several years, rather than completing all the P.Is for one particular asset in one particular year. This may prove to be more practical, however it requires more detailed planning

on an operational level, as opposed to the tactical level currently being considered.

7.3.10 It should be noted that any updates to the 2008 AIP should be adopted by the BCA as soon as the document is made available.

Table 2 – BCA Inspection Regime Frequencies and Party Responsible

Asset Type	RSI Frequency (Weeks)	RSI Inspector	LI Frequency (Months)	LI Inspector	GI Frequency (Years)	GI Inspector	P.I Frequency (Years)	PI Inspector
Canal Channel	N/A	N/A	1	BCA Ranger	1	BCA Ranger	10	BCA Ranger
Towpath	N/A	N/A	1	BCA Ranger	1	BCA Ranger	10	BCA Ranger
Embankments	N/A	N/A	1	BCA Ranger	1	BCA Ranger	10 – 20 (See Section 7.4)	External Consultant
Cuttings	N/A	N/A	1	BCA Ranger	1	BCA Ranger	10	External Consultant
Sluices / Weirs	N/A	N/A	1	BCA Ranger	1	BCA Ranger	10	External Consultant
Lock Chambers	N/A	N/A	1	BCA Ranger	1	BCA Ranger	5	External Consultant
Lock Gates	N/A	N/A	1	BCA Ranger	1	BCA Ranger	5	BCA Ranger
Lock Footbridges	N/A	N/A	1	BCA Ranger	1	BCA Ranger	10	BCA Ranger
Reservoirs	1	BCA Ranger	1	BCA Ranger	1	BCA Ranger	5	Supervising and Inspection Engineer
Culverts	N/A	N/A	1	BCA Ranger	1	BCA Ranger	10	SCC / HCC Bridge Inspector
Pumping System	N/A	N/A	1	BCA Ranger	1	External Consultant	5	External Consultant

Bridges	N/A	N/A	1	BCA Ranger	2	SCC / HCC Bridge Inspector	6	SCC / HCC Bridge Inspector
Aqueducts	N/A	N/A	1	BCA Ranger	2	SCC / HCC Bridge Inspector	6	SCC / HCC Bridge Inspector
Tunnel	N/A	N/A	1	BCA Ranger	2	HCC Bridge Inspector	6	HCC Bridge Inspector
Trees	N/A	N/A	1	BCA Ranger	2	BCA Ranger	4	SCC / HCC Arboculturist

N.B The BW AIP 2008 [26] inspection type ‘annual inspection’ (A.I) has been replaced by the term ‘general inspection’ (G.I) as not all assets will be inspected on a yearly basis. However, the purpose and content of the inspection remains the same.

Table 3 - Principal Inspection Regime Timetable, 25-Year Look Ahead

Asset Type	Year																										
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Canal Channel																											
Towpath																											
Embankments*																											
Cuttings																											
Sluices/Weirs																											
Lock Chamber																											
Lock Gates																											
Lock Footbridges																											
Reservoirs																											
Culverts																											
Pumping Systems																											
Bridges	Continuous based upon the SCC and HCC Structures Group Bridge Inspection Regimes																										
Aqueducts																											
Tunnel																											
Trees																											

KEY

Principal Inspection Due
Principal Inspection Undertaken

* Principal inspections for some embankments can receive a greater inspection interval than shown in Table 3, based on each assets individual risk (see Section 7.4).

7.4 Embankment Principal Inspections

7.4.1 Following the Basingstoke Canal Embankment Survey, Dec 2009 [27] a hierarchy of principal embankment inspection cycles has been developed based upon the British Waterways AIP 2008 methodology [26]. Note, definitions of 'Condition Grade' and 'Consequences of Failure' levels can be found in Appendix 8 and 9 respectively. As detailed in Table 4 below, the PIs inspection frequency varies from 10 to 20 years based upon the assessed level of risk for each specific embankment.

Principal inspection cycles (years)		Condition Grade				
		A Very Good	B Good	C Fair	D Poor	E Bad
Consequence of failure (5 being the worst)	1	20	20	15	10	10
	2	20	20	15	10	10
	3	20	15	10	10	10
	4	15	10	10	10	10
	5	15	10	10	10	10

Table 4 – Embankment Principal Inspection Cycles
(Source [38])

7.4.2 These specific frequencies are detailed for every embankment within the Hampshire and Surrey stretch of the Canal in Appendix 10 and Appendix 11 respectively. Initial BCA proposed inspection schedules suggested detailed embankment inspections were to be conducted every 6 months by BCA Rangers (see Appendix 6). However, as detailed in Section 7.3, the BW inspection regime should now be followed as best practice.

7.4.3 As shown in Table 2; the LIs and AIs of the embankments can be completed by the BCA Rangers at monthly and yearly intervals respectively. PIs will need to be completed by a competent geotechnical engineer, and hence expertise will have to be sought outside of the BCA, and financed as necessary. The next PI review will be required between 10-20 years from now (2020-2030), and should be considered in future budget proposals.

7.4.4 It should be noted that this level of inspection planning is exemplar. The same level of detail at this operational level should be conducted for the other principal assets in order to have a comprehensive and up to date understanding of the condition of all the Canal elements. With this in place the longer inspection frequencies can be safely established relieving the resource and financial pressures this new inspection regime incurs.

7.5 Inspection Procedure

7.5.1 Guidance on how to conduct the proposed inspection regime is contained within the BW AIP 2008 [26]. Particular reference should be made to Appendix 10, which contains a prompt list for performing inspections on the various canal assets. Comprehensive procedural information also exists within the BW AIP 2008 [26] for the lock gate structures in Chapter 5.

7.5.2 Appendix 13, 14 and 15 of the AIP 2008 [26] give details to determine the relevant 'condition' grades, 'consequence of failure' grades and 'serviceability' grades for the various assets on the Canal. These grades conform to a standard system where the 'condition' grade and 'consequence of failure' are rated on five levels, and 'serviceability' grade is rated on three levels. It can be noted that 'consequence of failure' should not change over time unless there is change within the environment.

7.5.3 With this system established it is possible to produce a comparable 'risk' rating for all asset types. Where 'risk' is the product of an assets 'condition grade' and 'consequence of failure'. This risk score will allow the priority of maintenance work to be assessed across different assets. For example, the risk of a footpath defect is unlikely to be high even when the condition is poor, as the 'consequence of failure' will always be relatively low. However, the risk from an embankment breach may be high even though the condition is relatively good, as the consequence of failure may be severe. The risk assessment methodology introduces a system that will determine which defect should be resolved first to maximise the potential safety of the Canal. This is particularly useful when limited funding is available.

7.5.4 It is suggested that implementation of the inspection procedures could be assisted by direct consultation with BW to ensure the information is interpreted correctly. The BW inspection procedure for embankments has already been achieved successfully as part of the principal inspections conducted in 2009 (see Section 7.4). As these inspection procedures are established for each asset it should be followed indefinitely, and only altered with sufficient reasoning. Otherwise comparisons between past and present data become problematic, as demonstrated in Section 12.

7.5.5 It should be remembered that this inspection methodology is used to provide the basic data to assist the maintenance of the Canal. However, engineering judgements will still need to be factored into the decision making processes, as there may be external factors which the methodology can not accommodate.

7.6 BCA Resource Implications

7.6.1 As with any procedural change in any organisation, there will be resource implications resulting from the proposed inspection regime as set out in Section 7.3. As such the BCA rangers will require additional staff time to formally conduct inspections, and record their findings within the Asset Management Geodatabase. There may also need to be a change of job role for the existing

Rangers, and possibly an appointment of a new 'inspector' position within the BCA organisation structure. An attempt has been made to quantify the extent of these resource implications for each inspection type:

RSIs **-** it is estimated that a single BCA ranger could undertake and record the weekly RSI in three hours, given the proximity of the Mytchett reservoir to the Canal centre. Assuming a 6-hour working day this equates to half a Ranger day a week, or 2 Ranger days per month.

LIs **-** It is estimated that a single BCA ranger could undertake and record a mile of LI in one hour. Given there are 32 miles of Canal, on both the towpath side and offside of the Canal, this equates to a workload of 64 hours a month. Again, assuming a 6-hour working day this equates to approximately 10.5 Ranger days per month.

GIs & PIs **-** The extent of time required to complete the general inspections, and where applicable to BCA the principal inspections, is currently not know. Through the adoption of the regime and feedback from the BCA it will be possible to determine the Ranger days required for each asset.

7.6.2 Hence, it has currently been estimated that 12.5 Ranger days per month are required to complete both the RSIs and LIs. For simplicity it will also be assumed that, on average, it will require 12.5 Ranger days per month to complete both the GI's and PI's. Given that there are 8 Rangers in the current BCA organisational structure (see Appendix 1) this could necessitate each Ranger being able to conduct 3 days of inspections per month. However, with planning this could be reduced, as it is also possible to incorporate LIs with existing duties Rangers have on the Canal.

7.6.3 The new inspection regime will also require up-skilling of the Rangers in order to meet the new inspection demands. It is recommended that the BCA directly seek advice and training from the BW while implementing the regime. This will ensure that the necessary inspection competency standards are met, and the BCA can be confident in the results of the inspection reports made by its staff.

7.6.4 For the more demanding principal inspections, for which the Rangers will not have the technical understanding or necessary qualifications to undertake, the newly proposed regime will also produce greater yearly consultant costs. Hence, additional finances will need to be sought to ensure the proposed frequencies can be met and the new regime achieved.

7.6.5 At present, it is recognised that the proposed inspection regime (see Section 7.3) is more rigorous than the one BCA currently adopts (see Section 7.2). As such significant changes in working practices will need to be made in the short term. In order for the regime to be realistically achieved it is feasible that the BCA may wish to phase the adoption of the L.I inspection frequency, as suggested by BW.

7.6.6 For instance, in the first year (2010/11) the LIs could be adopted on a three-month cycle. Then in year two (2011/12) the frequency could be increased to every 2-months. Finally, in the third year (2012/13) the BCA could achieve the industry best practice of LIs each month. This phased approach should afford sufficient time for the upskilling and training of staff. To ensure the safety of the Canal it is not advisable that the BCA attempt to phase the adoption of the RSIs, G.Is or PIs.

7.6.7 At this point it should be stressed that the success of this Plan relies upon obtaining a series of condition data, in a consistent format. This requires BCA to conduct planned inspections and record the findings in a formal manner that can be easily interpreted at a later date. This will ultimately allow identification of defects, deterioration rates, and lifecycle plans. With this information a holistic view can be taken, and the long-term maintenance plans developed for the Canal.

8. CURRENT PERFORMANCE

8.1 Introduction

8.1.1 Good data underpins successful asset management. Section 6 set out the basic asset inventory on the Canal. This section summarises the current condition of each of these assets. This information is based upon recently collected data and a review of historic records, where available.

8.2 Canal Navigation Channel and Towpath

8.2.1 Canal Channel

8.2.1.1 Currently no formal condition data for the Canal channel is avaliable. It is known that little major maintenance has been conducted since the Canal was restored. As restoration occurred in the mid 1970s to early 1990s this means that the last major maintenance actions occurred between 20 to 35 years ago. This is largely due to a lack of suitable machinery and equipment.

8.2.1.2 From BCA Ranger accounts it is known that spot dredging has been conducted at certain locations since restoration. On the Surrey section the Woking area between St John's and Lock 1, and the Wey Navigation, was dredged in the late 1990s. During this period a small amount of dredging was also conducted at Sheerwater. BCA also dredged the Brookwood section in 2002, and the Deepcut Cutting in 2007.

8.2.1.3 On the Hampshire section it is believed that several areas were dredged by contract during the 1990s. The areas thought to be included were Barley Mow, Winchfield and Greywell.

8.2.1.4 At present BCA rangers informally assess the Canal channel to contain wood, mud, and debris along much of its length, particularly at locations where smaller streams enter the canal. The Woking area is also known to be heavily weeded.

8.2.1.5 In order to obtain formal condition data there are currently plans to undertake a depth survey of the Canal channel in November 2010. This is to be organized and undertaken by the Surrey and Hampshire Canal Society. The data is to be provided to BCA, and should be incorporated into the Plan. To ensure the information is useful it must be compatible with the Asset Management Database developed by the BCA. Therefore, consultation is required between the BCA and the Surrey and Hampshire Canal Society before the survey is undertaken.

8.2.2 Canal Towpath

8.2.2.1 Currently no formal condition data for the Canal towpath is available. Informal inspections are conducted with reactive maintenance being undertaken following any serious defects that are detected. Significant lengths of the Canal

towpath have been resurfaced by the BCA in the past, both within the Hampshire and Surrey sections, however due to limited maintenance records the exact extent of this is not known.

8.2.2.2 In addition, SCC, Sustrans and Cycle Woking has recently invested in the Canal towpath within the Borough of Woking. A fibre deck surface has been laid with an expected life-span of 10-15 years. It is hoped that there will be a similar capital injection in the rest of the Surrey stretch by the other riparian boroughs.

8.2.2.3 The BCA rangers informally assess the towpaths to be in fair condition, except certain locations within Deepcut. Overall, it is felt that the towpath is in a similar order to most rural rights of way. However, concerns have been raised that the towpath width is being reduced. Work is therefore required to re-instate and protect the embankment edge. Vegetation should also be cut back to keep the towpath clear. It has also been suggested that the footpath should be upgraded to withstand vehicle use, without rutting and damage to the footpath. This would improve access for maintenance works, and mobility and efficiency of the BCA Rangers.

8.3 Embankments and Cuttings

8.3.1 Embankments

8.3.1.1 In July 2001, British Waterways carried out a detailed inspection of 15 earth structures on the Canal [28]. A summary of the condition assessment from the report is given in Table 5 overleaf. Explanations of the 'Condition Grade' and 'Consequence of Failure Grade' used in the table are given in the British Waterways document 'Mandatory Procedures for the Inspection of Operational Assets' 2001 [7] and are summarised in Appendices 8 and 9.

8.3.1.2 The overall findings of the 2001 inspections are that the average (mean) condition of the embankments inspected is fair with a medium consequence of failure. Along with the condition data, remedial maintenance work was also identified. The estimate of this maintenance work in the short term (under 3 years) and medium term (3-10 years) show a backlog of work totalling £666,000 at the time of the inspections. The breakdown of this estimate is given in Table 5.

Table 5 – Embankment and Cutting Condition Data, 2001
(Source [28])

Section Number	Section Name	Condition Grade	Consequence of Failure	Current Risk Rating	Recommended Inspection Details	Recommended Works Details	Cost of Works Identified (£)
1.	Wey Junction to Lock 1	**C**	**5**	**High**	None	Short Term – Remove leaning trees, Vegetation management Med. Term – Install 400m of 1.8m trench sheets and backfill	46,500
2.	Lock 2 to Lock 6	**C**	**4**	**High**	Large trees in particular	Short Term – Vegetation management plan Med. Term – 60 lin.m of 2.5m trench sheet piles	12,000
3.	Lock 6 to Sheerwater	**C**	**4**	**High**	Monitor towpath crest for subsidence	Short Term – Vegetation Management	2,000
4.	Arthur's Bridge to Skew Bridge	**C**	**4**	**High**	Monitor seepage and tree stability	Short Term – Vegetation management Med. Term – Piling of 250m section of LHS	29,000
5.	Goldsworth Bridge to Kiln Bridge	**C**	**4**	**High**	Monitor any movement or seepage between locks 10 and 11	Short Term – Vegetation Management on embankment face. Install soak drain on embankment toe	2,900
6.	Frimley to Ash Vale	**C**	**5**	**Unacceptable**	Monitor all identified risk areas	Short Term – Install 190m of 8m heavy sheet piles, Install land drain, Vegetation management, Reinstate eroded bank Medium Term –Install 350m of 2.5m sheet piles, install scour protection for bank, Install total of 80m of 1.8m sheet piles at two locations	424,500
7.	Ash	**C**	**4**	**High**	Monitor crest subsidence and seepage points	Short Term – Install toe drain, infill bank erosion, infill tree bowl at ch. 47 Med. Term – Vegetation management, install trench sheet piles	47,500
8.	Reading Road to Pondtail Bridge	**D**	**4**	**Unacceptable**	Monitor any changes to embankment and any trees identified as high risk	Short Term – Vegetation management	2,500

9.	Dinorben	**B**	**4**	**High**	Regular checks of privately owned retaining walls	Short Term – Vegetation management, culvert inspection	5,500
10.	Zephon Common	**C**	**4**	**High**	None	Short Term – Vegetation management, CCTV inspection of culvert Med. Term – Add coir rolls to both banks	15,000
11.	East Hart	**D**	**2**	**High**	Monitor movement and seepage in LHS	Short Term – Fill bank embayments with clay, install 2.5m trench sheet piles, vegetation management plan, Reinstate or install drainage measures as required	38,200
12.	West Hart	**C**	**2**	**Medium**	Monitor V-notches and crest condition during LI	Short term – Puddling of embayments and erosions, vegetation management of RHS, repuddle bank as necessary, provide coir roll protection to both banks	19,000
13.	Tundry Pond	**C**	**2**	**Medium**	RHS – Monitor seepage into toe ditch LHS – Monitor seepage points, clear rubbish grill to overflow weir	Short Term – Coir roll protection for banks Med. Term - vegetation management.	5,500
14.	Pillars Bridge	**D**	**1**	**Medium**	Monitor during inspections	Short Term – Trimming and benching, Installation of gabion wall and regarding	2,100
15.	Broad Oak Bridge	**E**	**2**	**High**	Window sample and slip indicator	Short Term – Remove vegetation and survey area, Install buttress drains and trimming, Install lime piling, Install gabion basket at toe, Drain discharge	13,800

Total Cost of Works Identified = £666,00

N.B Section Numbers 1-13 represent embankments and Section Numbers 14-15 represent cuttings.

8.3.1.3 In December 2009 an updated review was made on the Canal's embankments under the same British Waterways assessment system. This review considered shorter lengths of embankment than in 2001, and in all 142 principal inspections were conducted by HCC [27]. The report noted that "inspection, maintenance and remediation has been minimal since 2001" despite the £666,000 backlog of work that was identified to be undertaken over the following 10 years.

8.3.1.4 HCC also considered a 'Serviceability Grade' for the embankments, based on BW recommendations [26]. The 'Serviceability Grade' indicates the assets' ability to meet service requirements. It reflects performance to required design capacity, or under-performance due to the dilapidation or imposition of increased service standards. It is based on three levels as given below:

Grade 1: Fit For Purpose - Not known to overtop or min freeboard >300mm.

Grade 2: Restricted Use - Would overtop without mitigating measures or minimum freeboard 150-300mm.

Grade 3: Unfit For Purpose - Overtops regularly or min freeboard ≤ 150mm.

8.3.1.5 The findings of the Dec 2009 inspections are summarised in Table 6 and Table 7 below. Full details of the individual scores for each embankment can be found in Appendix 10 for the Hampshire stretch of canal and Appendix 11 for the Surrey stretch of the Canal.

No. of sites	Condition Grade					
	A Very Good	B Good	C Fair	D Poor	E Bad	Unknown *
Hampshire	9	46	7	3	0	0
Surrey	13	46	17	0	0	1
Total	*22*	*92*	*24*	*3*	*0*	*1*

*one site has not been graded as access to the slope via a private property was not possible

Table 6 – Embankment 'Condition Grade' Summary, 2009
(Source [27])

No. of sites	Consequence of Failure *				
	5	4	3	2	1
Hampshire	15	12	23	14	1
Surrey	25	7	7	13	25
Total	*40*	*19*	*30*	*27*	*26*

(* 5 being the worst)

Table 7 – Embankment 'Consequence of Failure Grade' Summary, 2009
(Source [27])

8.3.1.6 For ease of interpretation Table 6 and Table 7 have been represented graphically as shown in Figure 10 and Figure 11 respectively.

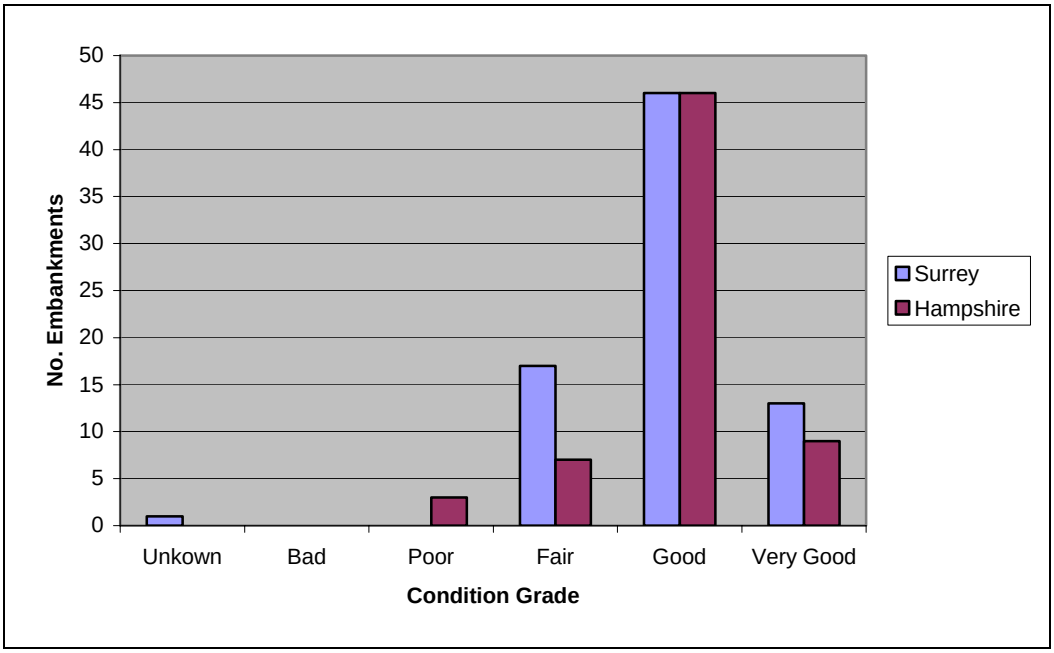

Figure 10 - Embankment 'Condition Grade' Summary, Dec 2009 (Source [27])

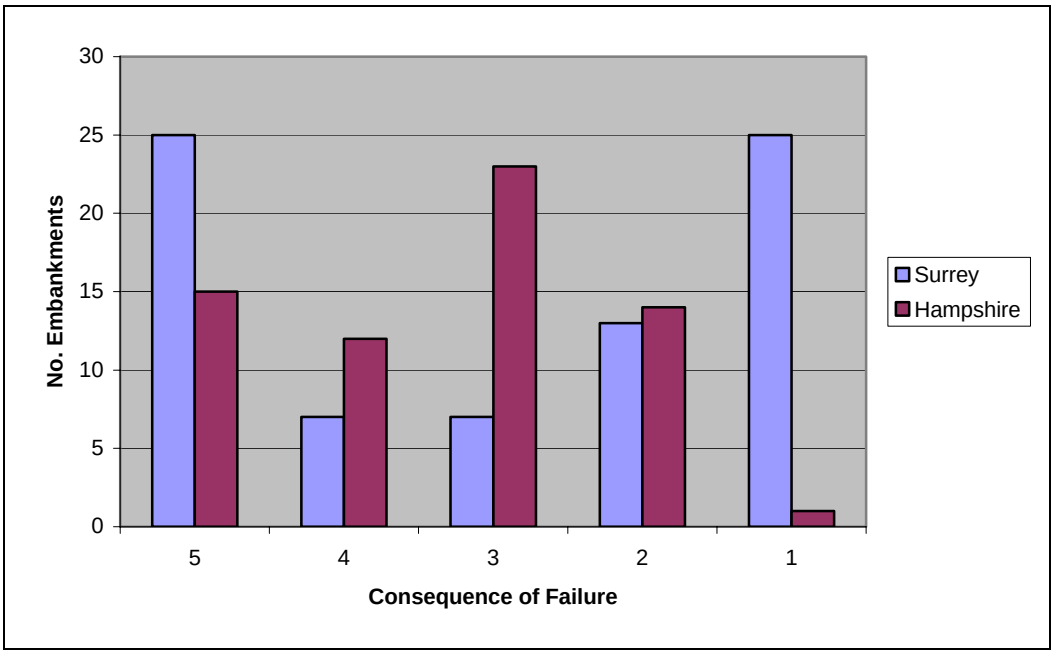

Figure 11 - Embankment 'Consequence of Failure' Summary, 2009 (Source [27])

8.3.1.7 The additional 'Serviceability Grade' is summarised below in Table 8. Again full details of the individual 'Serviceability Grade' scores for each embankment can be found in Appendix 10 for the Hampshire stretch of canal and Appendix 11 for the Surrey stretch of the Canal.

Serviceability Grade	Hampshire			Surrey*		
	1 Fit for purpose	2 Restricted use	3 Unfit for purpose	1 Fit for purpose	2 Restricted use	3 Unfit for purpose
No. sites	50	13	2	56	16	3
Site ID	1-19,21, 23,25,26, 28,29,31, 32,33,34, 36,39,40, 41,44,46, 47,49-57, 59,60,62, 63,65	22,24,27, 30,35,37, 38,42,43, 45,48,58, 64	20,61	66,68,69, 71-78,80, 81,83-100, 103,104,107, 108,109,110, 112,114,115, 116,118,119, 120,121,122, 123,124,125, 127,129,130, 131,133,135, 136	67,70,79, 105,106, 111,113, 117,126, 128,134, 137-140, 142	82,102, 141

*excluding sites 101 and 132 where it was not possible to measure the freeboard

Table 8 – Embankment 'Serviceability Grade' Summary, 2009 (Source [27])

8.3.1.8 Recommendations were made within the report [27] for remedial measures to address the defects within the high risk and moderate risk embankments (see Section 13.2.2). These recommendations were listed in order of priority. These recommendations are currently forming the basis of the HCC 2009/10 to 2012/13 three-year work programme (see Section 15.3).

8.3.1.9 It should also be noted that the two sets of condition data provide the opportunity to compare the embankments deterioration over a known time period. This was attempted in Section 12.3.

8.3.2 Cuttings

8.3.2.1 Limited formal condition data currently exists for the cuttings. In August 2008 SCC formally requested a report into the landslip area in Deepcut, and a stability risk assessment for the whole of Deepcut, from consultants Jacobs. Deepcut is the largest cutting on the Canal, and is located within the SCC owned section of the Canal.

8.3.2.2 The Deepcut landslip occurred on the southern face of the Canal, approximately 300m west of Lock No. 28 (OS Grid Reference: SU 909 565), after a period of heavy rain in Autumn 2006. In order to protect the surface of the landslip SCC arranged for plastic sheeting to be placed over the area to limit the erosion effects of rainfall runoff. No further physical work was been done on the landslip area for some time, although remedial works have now been completed.

8.3.2.3 The initial inspection report on the landslip [29] concluded that generally the overall stability of the cutting appeared to be sound, and that there was no underlying potential for a large slip of the fine sandy material in which the Canal cutting was formed. Recommendations for the repair of the cutting were

therefore based around reinstatement of the topsoil and vegetation, prevention of erosion on the slope, and measures to collect and divert rainfall runoff from the crest of the cutting.

8.3.2.4 The subsequent stability risk assessment report [30] covered the rest of the Deepcut stretch of the Canal, between Lock No. 28 and approximately 300m west of Deepcut Road Bridge. The conclusions drawn were that a total of twenty-five stability features were identified along the 1.4km length of Canal surveyed. Twelve features were recorded along the south bank and thirteen along the north bank. These features primarily consisted of shallow translation slip failure, deep seated slip failures, and erosion failures.

8.3.2.5 The majority of instability features identified were classed as low or very low risk to Canal users, as they are considered to be historical or inactive features. Five instability features identified were considered to be active with four being classified as medium risk and one as low risk to Canal users.

8.3.2.6 In order to establish formal condition data for the remaining sections of the Canal a principal inspection survey is planned to begin from July 2010. This is to be managed by HCC.

8.4 Sluices and Weirs

8.4.1.1 Currently no formal condition data for the sluices and weirs is available. Historically inspections were conducted informally with reactive maintenance undertaken as required. In order to establish formal condition data for the sluices and weirs a principal inspection survey is planned to begin from July 2010. This is to be managed by HCC.

8.5 Locks

8.5.1 Lock Chamber

8.5.1.1 The lock chambers themselves, and associated approach wing walls, are difficult to inspect when the Canal is in water. An opportunity was taken to inspect the Deepcut flight whilst the Canal was out of water in early 2005. The final inspection report [31] revealed a significant amount of outstanding work, largely associated with the need to underpin or reconstruct the approach wing walls.

8.5.1.2 Jacobs conducted principal inspections of the locks on the Canal, and the single dry dock, in 2009 [32]. The findings of these reports have been summarised in Table 9. These inspections suggest that the overall average condition of all the Canal locks is fair to poor. High priority maintenance work was identified for ten of the twenty-nine locks. These recommendations currently form the basis of the SCC 2009/10 to 2012/13 three-year work programme (see Section 15).

Table 9 - Lock Condition Data, 2009
(Source [32])

Flight	Lock No.	Structure Name	O.S Grid Reference	Current Condition							High Priority Remedial Works
				Gates - Upper	Gates – Lower	Leaks	Bypass Culvert	Chamber Wall	Bridge	Overall Condition	
Woodham Flight Locks	1.	Bottom Lock	505101E 161846N	Fair	Fair	Fair	Serious	Poor	Good	Fair	Replace culvert, repair headwall.
	2.	Scotland Lock	504546E 161542N	Fair - Good	Good	Fair	Poor	Poor	Fair	Fair	None
	3.	Woodham Lock	504033E 161342N	Good	Good	Good	Good	Good - Fair	N/A	Fair	None
	4.	Lock 4	503840E 162238N	Poor	Good	Good	Poor	Fair	Poor	Poor	None
	5.	Lock 5	503481E 161077N	Poor	Poor	Good	-	-	Fair	Poor	None
	6.	Sheerwater Lock	503325E 160981N	Poor	Poor	Good	Poor	-	Good	Fair	None
St John's Flight Locks	7.	Godsworth Bridge Lock	498635E 158231N	Poor	Poor	Poor	Good	Poor	Good	Fair	None
	8.	Lock 8	498520E 158236N	Poor	Poor	Poor	Fair	Fair	Fair	Fair	None
	9.	Lock 9	498300E 158145N	Poor	Good	Fair	Fair	Fair	Fair	Fair	None
	10.	Lock 10	498137E 158117N	Good	Poor	Good	Good	Poor	Good	Fair	None
	11.	Lock 11	497989E 158032N	Good	Poor	Good	Poor	-	Poor	Fair	None
Brookwood Flight Locks	12.	Lock 12	495826E 157193N	Poor	Poor	Poor	Serious	Poor - Serious	Fair	Poor	Replace culvert, remove vegetation, re-point chamber wall.
	13.	Lock 13	495704E 157161N	Poor	Poor	Poor	Poor	Poor	Fair	Poor	None
	14.	Lock 14	495581E 157182N	Fair	Fair	Fair	Poor	Poor	Good	Poor	

Deepcut Flight Locks	15.	Lock 15	494350E 156907N	Poor	Poor	Poor	Good	Poor	Poor	Poor	Remove organic material, seal void under wing wall.
	16.	Lock 16	493945E 156831N	Poor	Good	Poor	Good	Poor - Serious	Poor	Poor	None
	17.	Cowshot Lock	493638E 156794N	Poor	Fair	Poor	Good	Poor	N/A	Poor	Replace timber planks in upper towpath. Replace upper wing walls.
	18.	Lock 18	493393E 156764N	Fair	Fair	Fair	Good	Poor	Fair	Fair	None
	19.	Lock 19	493071E 156669N	Poor	Poor	Poor	Good	Poor	Poor	Poor	Re-point wing wall and repair damaged sections.
	20.	Lock 20	492885E 156635N	Poor	Fair	Poor	Good	Poor	Poor	Poor	Reconstruct wing wall, extend concrete apron.
	21.	Lock 21	492727E 156672N	Poor	Good	Poor	Good	Poor	Fair	Fair	None
	22.	The Bathing Lock	492523E 156672N	Fair	Fair	Fair	Good	Poor	Fair	Poor	None
	23.	Lock 23	492362E 156594N	Serious	Fair	Fair	Fair	Poor	Fair	Poor	None
	24.	Washerwomans Lock	492224E 156490N	Poor	Good	Fair	Fair	Poor	Fair	Poor	None
	25.	Curzon Lock	492042E 156402N	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Replace lower towpath paddle and winding gear.
	26.	Lock 26	491736E 156465N	Serious	Poor	Poor	Poor	Poor	Poor	Poor	Strengthen towpath flank wall. Replace or refurbish upper gates.
	27.	Lock 27	491561E 156454N	Poor	Poor	Poor	Serious	Fair	Poor	Poor	Replace missing lower towpath paddle. Reconstruct damaged bypass spillway. Reconstruct or refurbish towpath flank wall.

	28.	Frimley Lock	491134E 156465N	Serious	Poor	Good	Poor	Fair	Good	Poor	Replace upper gates. Replace lower towpath paddle. Reconstruct collapsed wing wall and provide suitable anti-scour bank protection.
		Frimley Dry Dock	491078E 156570N	Poor	Poor	Good	Poor	Fair	-	Fair	None
Ash Lock Lock	29.	Ash Lock	488091E 151775N	Good	Good	Fair	Poor	Poor	Good	Fair	None

8.5.2 Lock Gates

8.5.2.1 Historic data concerning the condition of the lock gates was produced by the BCA in 2006, as shown in Table 10.

8.5.2.2 An assessment of the condition of the lock gates was incorporated within the Jacobs 2009 lock inspection [32], as shown in Table 11. In April 2010 BCA raised concern regarding the validity of these lock gate inspection results. Concern was particularly raised that lock gates would be replaced unnecessarily in the proposed three-year SCC work programme, although some of these issues were created because the BCA had already replaced some of the lock gates highlighted by Jacobs as in poor condition whilst the capital programme was being prepared. To address these concerns a review was held in May 2010. Inspection data concerning the lock gates were produced by BCA, as shown in Table 12. The review compared and contrasted the two sets of inspection data.

8.5.2.3 Following the review the work programme is to be altered to take account of the recommendations of the BCA. Additional issues related to lock gates were also discussed as part of the review. This included the need to increase the safety of lock gate operation, the specification for replacement lock gates as part of the SCC capital investment, and the proposal to adopt the BW AIP 2008 [40] lock gate inspection procedure.

Table 10 - BCA Lock Gate Condition Data, 2006

Lock No.	Upper (tp)	Upper (non tp)	Lower (tp)	Lower (non tp)
1	672	768	1296	972
2	108	72	3125	3125
3	243	243	243	168
4	243	243	202	202
5	108	243	330	90
6	108	48	3125	3125
7	504	504	896	896
8	243	243	202	168
9	243	243	1024	1024
10	896	896	243	243
11	72	36	90	93
12	60	75	202	135
13	78	93	27	135
14	16	8	262	218
15	202	243	202	202
16	140	300	3125	3125
17	3125	3125	168	117
18	75	112	3125	2500
19	2500	2500	3125	3125
20	157	157	60	81
21	27	108	243	168
22	3125	3125	3125	3125
23	108	108	3125	3125
24	93	93	3125	3125
25	1024	1024	168	46
26	60	48	93	93
27	3125	3125	306	202
28	225	135	1024	1024
29	3125	3125	576	576
Dry Dock	1024	1024	N/a	N/a

	Below 110	Gates need immediate attention
	Below 210	Gates need urgent attention
		Gates built, awaiting installation

Table 11 – Jacobs Lock Gate Condition Data, 2009
(Source [32])

	Condition					Recommendation			
Lock Number	**Element**	**UTP**	**UOS**	**LTP**	**LOS**	**Element**	**Results/Defect**	**Recommended Action**	**Priority**
Lock 1	Gate Condition	3	3	3	3	UTP Gate	Balance beam and gate planks in fair condition but gate frame contains cracks and rots.	Replace Gate	L
	Planks	2	2	2	2	UOS Gate	Balance beam and gate planks in fair condition but gate frame contains cracks and rots.	Replace Gate	L
	Frame	3	3	3	3	LTP Gate	Balance beam and gate planks in fair condition but gate frame contains cracks and rots.	Replace Gate	L
	Leaks (Gates)	6		6		LOS Gate	Balance beam and gate planks in fair condition but gate frame contains cracks and rots.	Replace Gate	L
	Leak Flow (Gates)	2		4		Leak Flows (Gates)	Small Leaks observed through upper gates, major leaks through lower gates.	Replace Gates	L
Lock 2	Gate Condition	2	2	1	1	UTP Gate	Balance beam contains deep cracks but gate frame and planks in fair condition	Replace Balance Beam	L
	Planks	2	2	1	1	UOS Gate	Balance beam in fair condition, gate frame and planks in good condition	Review at next inspection	N
	Frame	1	1	1	1	LTP Gate	Balance beam in fair condition, gate frame and planks in good condition	Review at next inspection	N
	Leaks (Gates)	5		6		LOS Gate	Balance beam in fair condition, gate frame and planks in good condition	Review at next inspection	N
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Minor leak observed through upper gates, major leak through lower gates.	Repair Gates	L
Lock 3	Gate Condition	1	1	1	1	UTP Gate	Superficial inspection showed that the gate was in fair condition.	Review at next inspection	N
	Planks	1	1	1	1	UOS Gate	Superficial inspection showed that the gate was in fair condition.	Review at next inspection	N
	Frame	1	1	1	1	LTP Gate	Superficial inspection showed that the gate was in fair condition.	Review at next inspection	N
	Leaks (Gates)	6		6		LOS Gate	Balance beam in fair condition, gate frame and planks in good condition	Review at next inspection	N
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak through upper gates, large leak through lower gates.	Seal gaps in gates	N

Lock 4	Gate Condition	1	1	1	1	UTP Gate	Gate frame decayed and contains several splits but balance beam and planks in fair condition.	Replace Gate Frame	M
	Planks	1	1	1	1	UOS Gate	Gate frame decayed and contains several splits but balance beam and planks in fair condition.	Replace Gate Frame	M
	Frame	1	1	1	1	LTP Gate	Gate and balance beam in fair condition from superficial inspection.	Review at next inspection	N
	Leaks (Gates)	6		6		LOS Gate	Gate and balance beam in fair condition from superficial inspection.	Review at next inspection	N
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak observed through upper gates, large leak through lower gates.	Repair upper gates and seal gaps in lower gates	N
Lock 5	Gate Condition	3	3	2	2	UTP Gate	Gate frame severely decayed and contains several splits, gate planks appear weathered but balance beam in fair condition.	Replace Gate	M
	Planks	3	3	2	2	UOS Gate	Gate frame severely decayed and contains several splits, gate planks appear weathered but balance beam in fair condition.	Replace Gate	M
	Frame	4	4	3	3	LTP Gate	Gate frame decayed and contains several splits, gate planks and balance beam in fair condition.	Replace or refurbish gate frame	M
	Leaks (Gates)	5		6		LOS Gate	Gate frame decayed and contains several splits, gate planks and balance beam in fair condition.	Replace or refurbish gate frame	M
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak through upper gates, large leak through lower gates.	Seal gaps in gates	N
Lock 6	Gate Condition	3	3	2	2	UTP Gate	Gate frame decayed and contains several splits, gate planks appear weathered but balance beam in fair condition.	Replace or refurbish gate	M
	Planks	3	3	1	1	UOS Gate	Gate frame decayed and contains several splits, gate planks appear weathered but balance beam in fair condition.	Replace or refurbish gate	M
	Frame	3	3	2	2	LTP Gate	Balance beam contains several splits but gate frame and planks in fair condition.	Replace or refurbish balance beam	M
	Leaks (Gates)	6		6		LOS Gate	Balance beam contains several splits but gate frame and planks in fair condition.	Replace or refurbish balance beam	M

	Leak Flow (Gates)	2		4		Leak Flows (Gates)	Minor leak observed through upper gates, major leak through lower gates.	Seal gaps in gates	N
Lock 7	Gate Condition	2	2	3	3	UTP Gate	Balance beam and planks in fair condition but gate frame weathered and contains several cracks.	Replace gate frame	M
	Planks	2	2	3	3	UOS Gate	Balance beam and planks in fair condition but gate frame weathered and contains several cracks.	Replace gate frame	M
	Frame	3	3	3	3	LTP Gate	Balance beam in fair condition but gate frame and planks weathered and contain some cracks and rots.	Replace gate	M
	Leaks (Gates)	6		6		LOS Gate	Balance beam in fair condition but gate frame and planks weathered and contain some cracks and rots.	Replace gate	M
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak observed in upper gates, large leak in lower gates.	Repair/ replace gates	M
Lock 8	Gate Condition	3	3	3	3	UTP Gate	Balance beam in good condition but gate frame and planks are heavily weathered and contain several cracks.	Replace gate	M
	Planks	2	2	2	2	UOS Gate	Balance beam in good condition but gate frame and planks are heavily weathered and contain several cracks.	Replace gate	M
	Frame	3	3	3	3	LTP Gate	Balance beam in good condition, frame is heavily weathered and contain several cracks, planks are in fair condition.	Replace gate frame	M
	Leaks (Gates)	6		6		LOS Gate	Balance beam in good condition, frame is heavily weathered and contain several cracks, planks are in fair condition	Replace gate frame	M
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak observed through upper gates and between lower gates. Large leak observed through planks of lower gates.	Repair gates	M
Lock 9	Gate Condition	3	3	2	2	UTP Gate	Balance beam in good condition but gate frame and planks are heavily weathered and contain several cracks	Replace gate	M
	Planks	3	3	2	2	UOS Gate	Balance beam in good condition but gate frame and planks are heavily weathered and contain several cracks	Replace gate	M
	Frame	3	3	2	3	LTP Gate	Balance beam in good condition, gate frame and planks in fair condition.	Review at next inspection	N

	Leaks (Gates)	6		6		LOS Gate	Balance beam in good condition, gate frame and planks in fair condition.	Review at next inspection	N
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak observed through upper gates, large leak through lower gates.	Seal gaps around frames and between planks	L
Lock 10	Gate Condition	2	2	3	3	UTP Gate	Balance beam in good condition, gate frame and planks in fair condition.	Review at next inspection	N
	Planks	2	2	2	2	UOS Gate	Balance beam in good condition, gate frame and planks in fair condition.	Review at next inspection	N
	Frame	2	2	3	3	LTP Gate	Gate frame decayed and contains several splits but balance beam and planks in fair condition	Replace or refurbish gate frame	M
	Leaks (Gates)	6		6		LOS Gate	Gate frame decayed and contains several splits but balance beam and planks in fair condition.	Replace or refurbish gate frame	M
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak observed through upper gates, large leak through lower gates.	Seal gaps around frames and between planks	N
Lock 11	Gate Condition	2	2	3	3	UTP Gate	Superficial inspection showed balance beam, gate frame and planks in fair condition.	Review at next inspection	N
	Planks	1	1	3	3	UOS Gate	Superficial inspection showed balance beam, gate frame and planks in fair condition	Review at next inspection	N
	Frame	2	2	3	3	LTP Gate	Gate frame decayed and contains several splits, gate planks appear weathered but balance beam in fair condition	Replace or refurbish gate	M
	Leaks (Gates)	5		2		LOS Gate	Gate frame decayed and contains several splits, gate planks appear weathered but balance beam in fair condition.	Replace or refurbish gate	M
	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Large leak observed through upper gates, major leak through lower gates	Replace Gate	M
Lock 12	Gate Condition	4	4	3	3	UTP Gate	Balance beam in good condition but gate frame and planks are heavily weathered and contain several cracks.	Replace Gate	M
	Planks	3	3	2	2	UOS Gate	Balance beam in good condition but gate frame and planks are heavily weathered and contain several cracks.	Replace Gate	M

	Frame	4	4	3	3	LTP Gate	Balance beam and gate planks in fair condition, gate frame significantly weathered	Replace Frame	M
	Leaks (Gates)	5		6		LOS Gate	Balance beam and gate planks in fair condition, gate frame significantly weathered	Replace Frame	M
	Leak Flow (Gates)	3		4		Leak Flows (Gates)	Large leak observed through upper gates, major leak through lower gates	Repair Gates	M
Lock 13	Gate Condition	3	3	3	3	UTP Gate	Balance beam and gate planks in fair condition but gate frame is heavily weathered and contain several cracks, plywood fixed to frame to improve gate stability	Replace Gate Frame	M
	Planks	2	2	2	2	UOS Gate	Balance beam and gate planks in fair condition but gate frame is heavily weathered and contain several cracks, plywood fixed to frame to improve gate stability	Replace Gate Frame	M
	Frame	4	4	4	4	LTP Gate	Balance beam and gate frame heavily weathered and contain several cracks, gate planks in fair condition	Replace gate frame and balance beam	M
	Leaks (Gates)	5		6		LOS Gate	Balance beam and gate frame heavily weathered and contain several cracks, gate planks in fair condition.	Replace gate frame and balance beam	M
	Leak Flow (Gates)	2		4		Leak Flows (Gates)	Minor leak observed through upper gates, major leak through lower gates	Repair Gates	M
Lock 14	Gate Condition	2	2	3	3	UTP Gate	Balance beam and gate planks in fair condition but gate frame looks weathered	Replace Gate Frame	L
	Planks	2	2	2	2	UOS Gate	Balance beam and gate planks in fair condition but gate frame looks weathered	Replace Gate Frame	L
	Frame	3	3	3	3	LTP Gate	Balance beam and gate planks in fair condition but gate frame looks weathered	Replace gate Frame	L
	Leaks (Gates)	5		6		LOS Gate	Balance beam and gate planks in fair condition but gate frame looks weathered	Replace gate Frame	L
	Leak Flow (Gates)	2		4		Leak Flows (Gates)	Small leak observed through upper gates, major leak through lower gates	Repair Gates	L
Lock 15	Gate Condition	3	3	3	3	UTP Gate	Balance beam and gate planks in fair condition but gate frame weathered and containing several splits and fissures	Replace Gate Frame	M
	Planks	2	2	1	1	UOS Gate	Balance beam and gate planks in fair condition but gate frame weathered and containing several splits and fissures	Replace Gate Frame	M

	Frame	3	3	3	3	LTP Gate	Balance beam and gate planks in fair condition but gate frame weathered and containing several splits and fissures	Replace gate Frame	M
	Leaks (Gates)	5		2		LOS Gate	Balance beam and gate planks in fair condition but gate frame weathered and containing several splits and fissures	Replace gate Frame	M
	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Large leak observed through upper and lower gates	Repair Gates	M
Lock 16	Gate Condition	2	2	1	1	UTP Gate	Balance beams and gate planks in fair condition but frame looked heavily weathered with cracks	Replace Gate Frame	M
	Planks	2	2	1	1	UOS Gate	Balance beams and gate planks in fair condition but frame looked heavily weathered with cracks	Replace Gate Frame	M
	Frame	3	3	2	2	LTP Gate	Fair Condition.	No Immediate Action	N
	Leaks (Gates)	6		6		LOS Gate	Fair Condition.	No Immediate Action	N
	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Large leak observed through planks and around frames of upper and lower gates	Repair Gates	M
Lock 17	Gate Condition	3	3	3	3	UTP Gate	Minor cracks in balance beam and gate frame, large holes and cracks in planks	Replace Balance Beam	H
	Planks	4	2	3	3	UOS Gate	Balance beam distressed with deep rots but frame and planks of gate in fair condition	Replace Gate	L
	Frame	2	2	3	3	LTP Gate	Balance beam, gate frame and planks contain several cracks and rots.	Replace Gate	L
	Leaks (Gates)	6		6		LOS Gate	Balance beam in fair condition but gate frame and planks appear weathered with several cracks	Replace Gate	L
	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Large leak observed through planks and around frames of upper and lower gates	Repair Gates	M
Lock 18	Gate Condition	2	2	2	2	UTP Gate	Deep cracks in balance beam but gate frame and planks are in good condition	Replace Balance Beam	L
	Planks	1	1	3	3	UOS Gate	Deep cracks in balance beam but gate frame and planks are in good condition	Replace Balance Beam	L
	Frame	1	1	2	3	LTP Gate	Balance beam and gate frame in fair condition, significant rot on planks	Replace Planks	L
	Leaks (Gates)	5		6		LOS Gate	Balance beam in fair condition but gate frame and planks appear weathered with significant rot and cracks	Replace Gate	L

	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Large leak observed through planks and around frames of upper and lower gates	Repair Gates	L
Lock 19	Gate Condition	3	3	3	3	UTP Gate	Replace balance beam and gate frame	Replace Balance Beam and Gate Frame	M
	Planks	2	2	3	3	UOS Gate	Replace balance beam and gate frame	Replace Balance Beam and Gate Frame	M
	Frame	3	3	3	3	LTP Gate	Balance beam in fair condition, gate frame and planks significantly weathered	Replace Gate	M
	Leaks (Gates)	5		6		LOS Gate	Balance beam in fair condition, gate frame and planks significantly weathered	Replace Gate	M
	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Large leak observed through upper and lower gates	Repair Gates	M
Lock 20	Gate Condition	3	3	2	2	UTP Gate	Balance beam weathered with some rots and cracks, gate frame heavily weathered, planks in fair condition	Replace Balance Beam and Gate Frame	M
	Planks	2	2	1	1	UOS Gate	Balance beam and gate planks in fair condition but gate frame heavily weathered	Replace Gate Frame	M
	Frame	4	4	3	3	LTP Gate	Balance beam and gate planks in fair condition but gate frame weathered	Replace Gate Frame	L
	Leaks (Gates)	5		6		LOS Gate	Balance beam and gate planks in fair condition but gate frame weathered	Replace Gate Frame	L
	Leak Flow (Gates)	2		4		Leak Flows (Gates)	Small leak observed through upper gates, large leak observed through lower gates	Repair Gates	M
Lock 21	Gate Condition	4	4	1	1	UTP Gate	Balance beam in fair condition but gate frame and planks contain several cracks and rots	Replace Gate	M
	Planks	3	3	1	1	UOS Gate	Balance beam in fair condition but gate frame and planks contain several cracks and rots	Replace Gate	M
	Frame	4	4	1	1	LTP Gate	Balance beam, gate frame and planks in good condition	Review at next inspection	N
	Leaks (Gates)	5		6		LOS Gate	Balance beam, gate frame and planks in good condition	Review at next inspection	N
	Leak Flow (Gates)	2		4		Leak Flows (Gates)	Major leak observed through planks of lower gates	Replace Gates	M
Lock 22	Gate Condition	2	2	2	2	UTP Gate	Balance beam in fair condition with minor cracks, gate planks in fair condition but gate frame contain several cracks and rots	Replace gate frame when funds are available	L

	Planks	2	2	2	2	UOS Gate	Balance beam in fair condition with minor cracks, gate planks in fair condition but gate frame contain several cracks and rots	Replace gate frame when funds are available	L
	Frame	3	3	3	3	LTP Gate	Balance beam and gate planks in fair condition but gate frame contain several cracks and rots	Replace gate frame when funds are available	L
	Leaks (Gates)	5		6		LOS Gate	Balance beam and gate planks in fair condition but gate frame contain several cracks and rots	Replace gate frame when funds are available	L
	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Major leak observed through planks and around gate frames at upper and lower ends of lock	Repair Gates	L
Lock 23	Gate Condition	4	4	2	2	UTP Gate	Balance beam in fair condition with minor cracks, gate planks and frame contain extensive cracks and rots	Replace gate	H
	Planks	3	3	2	2	UOS Gate	Balance beam contain several cracks, gate planks and frame contain extensive cracks and rots	Replace gate and balance beam	H
	Frame	4	4	3	3	LTP Gate	Balance beam contains minor cracks, gate planks in fair condition but frame contains several cracks and rots	Replace gate frame when funds are available	L
	Leaks (Gates)	5		6		LOS Gate	Balance beam contains minor cracks, gate planks in fair condition but frame contains several cracks and rots	Replace gate frame when funds are available	L
	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Major leak observed through planks and around gate frames at upper and lower ends of lock	Repair Gates	L
Lock 24	Gate Condition	3	3	2	2	UTP Gate	Balance beam in fair condition with minor cracks, gate planks and frame appear heavily weathered	Replace gate	M
	Planks	3	3	2	2	UOS Gate	Balance beam in fair condition with minor cracks, gate planks and frame appear heavily weathered	Replace gate	M
	Frame	3	3	2	2	LTP Gate	Balance beam, gate frame and planks in fair condition	Review at next inspection	N
	Leaks (Gates)	6		6		LOS Gate	Balance beam, gate frame and planks in fair condition	Review at next inspection	N

	Leak Flow (Gates)	3		3		Leak Flows (Gates)	Major leak observed through planks and around gate frames at upper and lower ends of lock	Repair Gates	L
Lock 25	Gate Condition	3	3	2	2	UTP Gate	Balance beam in fair condition but gate frame and planks appear weathered and contain cracks	Replace gate	L
	Planks			2	2	UOS Gate	Balance beam in fair condition but gate frame and planks appear weathered and contain cracks	Replace gate	L
	Frame	3	3	3	3	LTP Gate	Balance beam in fair condition but gate frame and planks appear weathered and contain cracks	Replace gate	L
	Leaks (Gates)	6		6		LOS Gate	Balance beam in fair condition but gate frame and planks appear weathered and contain cracks	Replace gate	L
	Leak Flow (Gates)	2		4		Leak Flows (Gates)	Minor leak observed through upper gates, major leak through lower gates	Repair Gates	M
Lock 26	Gate Condition	3	3	3	3	UTP Gate	Gate frame and planks significantly weathered, balance beam in fair condition	Replace or refurbish gate	M
	Planks	3	3	2	2	UOS Gate	Balance beam split extensively, gate frame heavily weathered, planks significantly weathered	Replace or refurbish balance beam and gate	H
	Frame	3	4	3	3	LTP Gate	Balance beam contain several splits, gate frame weathered but planks in fair condition	Replace or refurbish balance beam and gate frame	M
	Leaks (Gates)	6				LOS Gate	Balance beam contain several splits, gate frame weathered but planks in fair condition	Replace or refurbish balance beam and gate frame	M
	Leak Flow (Gates)	4				Leak Flows (Gates)	Major leak observed through upper gates, extent of leak through lower gates unknown	Seal gaps around upper gate	M
Lock 27	Gate Condition	3	3	4	4	UTP Gate	Balance beam in fair condition with minor cracks, large cracks and weathering to gate frame and planks	Replace or refurbish gate	M
	Planks	3	3	2	2	UOS Gate	Balance beam in fair condition with minor cracks, large cracks and weathering to gate frame and planks	Replace or refurbish balance beam and gate	M
	Frame	3	3	4	4	LTP Gate	Balance beam and gate planks in fair condition, gate frame heavily weathered and contain extensive splitting and decay	Replace or refurbish gate frame	M

	Leaks (Gates)	5				LOS Gate	Balance beam, gate frame has major splits, decay and weathering. Planks are in fair condition.	Replace or refurbish gate frame	M
	Leak Flow (Gates)	3				Leak Flows (Gates)	Large leak observed through upper gates, leak flow through lower gates unknown	Repair gates	M
Lock 28	Gate Condition	4	4	3	3	UTP Gate	Gate contains many splits and is excessively decayed, balance beam significantly weathered	Replace gate and refurbish balance beam	H
	Planks	3	3	3	3	UOS Gate	Gate contains many splits and is excessively decayed, balance beam significantly weathered	Replace gate and refurbish balance beam	H
	Frame	4	4	3	3	LTP Gate	Gate frame and balance beam significantly weathered and contain some large splits	Replace or refurbish gate frame and balance beam	M
	Leaks (Gates)	6				LOS Gate	Gate frame and balance beam significantly weathered and contain some large splits	Replace or refurbish gate frame and balance beam	M
	Leak Flow (Gates)	3				Leak Flows (Gates)	Large leak observed through upper gates, extent of leak through lower gates unknown	Review after replacing/repairing gates	N
Lock 29	Gate Condition	2	2	1	1	UTP Gate	Balance beam, gate frame and planks in fair condition	Review at next inspection	N
	Planks	1	1	1	1	UOS Gate	Balance beam, gate frame and planks in fair condition	Review at next inspection	N
	Frame	2	2	1	1	LTP Gate	Balance beam, gate frame and planks in fair condition	Review at next inspection	N
	Leaks (Gates)	5		6		LOS Gate	Balance beam, gate frame and planks in fair condition	Review at next inspection	N
	Leak Flow (Gates)	2		3		Leak Flows (Gates)	Small leak observed through upper gates, large leak through lower gates	Seal gaps between gate frames	L
Dry Dock	Gate Condition	3	3			Gates	Balance beams and gate frames disintegrated, gate planks in fair condition	Replace or refurbish gate frames and balance beams	M
	Planks	2	2						
	Frame	3	3						
	Leaks (Gates)	5							
	Leak Flow (Gates)	4				Leak Flows (Gates)	Minor leak observed through gates	Review at next inspection	N

N.B. An overview of the inspections scoring methodology is given below…

Condition:

Gate Condition	(1) Good	(2) Reasonable	(3) Poor	(4) Very Poor	(5) Dangerous
Planks	(1) Good	(2) Reasonable	(3) Poor	(4) Very Poor	
Frame	(1) Good	(2) Reasonable	(3) Poor	(4) Very Poor	(5) Dangerous

Leaks (Gates)	(1) No Leakage	(2) Planks	(3) Cills	(4) Heads	(5) Cills & Heads	(6) Planks, Cills & Heads
Leak Flow (Gates)	(1) No Leakage	(2) Small Leaks	(3) Large Leaks	(4) Major Leaks		

Priority:

N (No Action Required)	-	No remedial work required within the next two years
L (Low)	-	Work should be done within the next two financial years
M (Medium)	-	Work should be done within the next financial year
H (High)	-	Immediate remedial Action required

Table 12 – BCA Lock Gate Condition Data, 2010

	UPPERS			LOWERS		
Lock No.	**Condition**	**Est Life**	**Comments**	**Condition**	**Est Life**	**Comments**
1		3/4 yrs			3/4 yrs	
2		25 yrs	New		25 yrs	New
3		25 yrs	New		25 yrs	New
4		0 yrs	Replace		25 yrs	New
5		0 yrs	Replace		3 yrs	
6		0 yrs	Replanking possible 2/3 yrs		25 yrs	New
7		10+ yrs			10+yrs	
8		5 yrs			3+ yrs	Needs irons
9		2 yrs			10 yrs	
10		15 yrs			2 yrs	
11		25 yrs	New		2 yrs	
12		0 yrs	Replace		2 yrs	
13		0 yrs	Replace		0 yrs	Replace
14		20 yrs			4 yrs	
15		3 yrs			3 yrs	
16		3 yrs			15+ yrs	
17		15 yrs	Need new beams		0 yrs	Replace
18		20 yrs			20 yrs	
19		10 yrs			10 yrs	
20		0 yrs	replacement scheduled		3 yrs	
21		25 yrs	New		25 yrs	New
22		10 yrs			10 yrs	New, lowers for 25 onsite
23		0 yrs	Replace		15+ yrs	
24		0 yrs	Replace		10 yrs	
25		2 yrs	Replace		0 yrs	replacements available
26		0 yrs	Replace		25 yrs	
27		15 yrs			3/4 yrs	
28		25 yrs	New		5 yrs	
29		20 yrs			25 yrs	fitted 2008

8.6 Reservoirs

8.6.1 The only pound to be currently classified as a reservoir is Mytchett Lake. The condition of Mytchett Lake reservoir has been assessed by 'Black & Veach Inspecting and Panel Engineering Consultants' in a report prepared for SCC in April 2007 [33], under the Reservoirs Act 1975. The report assessed the condition as follows:

"The dam is in fair condition with no indications of instability, settlement or movement. The upstream face is adequately protected against erosion. Much of the downstream slope is covered by trees and bushes, and clearance of some of these is essential to enable thorough inspection of the slope to be undertaken.

The area at the toe of the dam is very wet with standing water for much of the year. There are also wet spots in both mitres, but a drain has been observed in the right mitre. Improvements of the drainage in the mitres and from the area at the toe of the dam is required. This will require liaison with Network Rail due to proximity of their track."

8.6.2 Black & Veach assessed the condition of the reservoir again in May and November 2008, and reported on their findings in December 2008 [34]. Generally, the reservoir was found to be in the same condition. However, it was noted that material was being washed out causing local sinkholes to form in the towpath, which required repair.

8.6.3 In April 2010 SCC commissioned a hydrological and hydraulic assessment to be undertaken to determine the combined performance of the Mychett Lake and the Basingstoke Canal in extreme floods. This work was undertaken by consultants Jacobs and reported in draft in May 2010 [35]. This work was required to address the requirements of the Supervising Engineer for the reservoir. Within the draft report it was recommend that the Supervising Engineer responsible for Mytchett Lake reviews the spill results presented and considers [35]:

- *"The implication of the results of this hydraulic modelling in relation to the Mytchett Lake and Basingstoke Canal and the requirements of the Reservoirs Act;*
- *The implications of the flood risk downstream of the spills;*
- *Raising the canal embankment;*
- *Providing appropriate erosion protection measures to the canal embankment for the magnitude of spills envisaged."*

It was also suggested that the construction of an additional spillway is considered, for use in flood conditions.

8.7 Culverts

8.7.1 Currently no formal condition data for the culverts is available. A principal inspection survey is planned to begin from July 2010. This is to be managed by HCC. It should be noted that some of these assets are on land owned by third parties; hence permission to inspect these features will need to be obtained.

8.8 Pumping Systems

8.8.1 Currently no formal condition data for the pumping systems exists. However, it is known that maintenance of the pumping systems is run under a commercial contract, let out by BCA, to Aish Electro-Mechanical Services. Under this contract the pumping systems receive two annual service visits. At the present time all pumps are considered to be in good working order.

8.9 Bridges

8.9.1 The majority of Canal bridges have their condition monitored through general and principal inspections (as set out in Appendix 12) by SCC and HCC highways departments. The exceptions to this include the lock footbridges, and bridges owned by third parties such as Network Rail.

8.9.2 A review of the Basingstoke Canal bridges was made in 2009 as part of the first edition of the Plan. This was conducted independently by SCC and HCC, as the respective owners of the majority of the bridges in their areas. The raw data concerning this review can be seen in Tables 13 and 14 respectively. Both SCC and HCC were found to be responsible for 30 bridges over the Canal.

8.9.3 The overall findings of this review were that the SCC owned bridges were estimated to have an average (mean) score of 81 on the CSS Bridge Condition Index (BCI). This relates to a 'fair' condition for the bridge stock. (For further details of the BCI scoring system see Appendix 13). From the identified maintenance work there is currently a backlog estimated at £226,600. This work will be carried out as part of the SCC prioritised bridge maintenance programme. However, the BCA will need to be aware of any works that could impact on the use of the Canal.

8.9.4 Likewise, the findings of the HCC review were that the bridge stock had an average (mean) score of 83 on the CSS bridge condition index. Again this relates to a 'fair' condition according to the BCI indicators. The identified maintenance work is currently showing a backlog estimated at £41,730.

8.9.5 The difference in identified maintenance costs may seem surprising given that both the SCC and HCC bridge stock contain the same number of bridges, and are approximately in the same condition according to the BCI scoring system. It was believed this is due to HCC basing their estimates on maintaining the safety of the bridge rather than bringing it back into 'good as new' (A1) condition, whereas the reverse was true in SCC. It was also felt that the bridges in

Hampshire were generally of a shorter span and more basic structural form, making them cheaper to maintain.

8.9.6 As part of the 2009 lock principal inspections [32] the condition of the lock footbridges were reviewed. The results of which are given in Table 15. Of the 27 lock bridges present on the Canal nine were assessed as being in good condition, twelve were assessed as being in fair condition, and six were assessed as being in poor condition.

Table 13 – SCC Bridge Stock Condition Data, 2009
(Source [36])

ID NO.	STRUCTURE NAME	STRUCTURE NO.	BCI INDEX SCORE	BCI CONDITION	INSPECTION DATE	MAINTEANCE WORK IDENTIFIED	ESTIMATED COST (£)
1.	Scotland Bridge	C130/542	75	Poor	13/08/08	Wing wall, Concrete Slab, Surfacing, Parapets	7,500
2.	Scotland Footbridge	C130/1788	72	Poor	13/08/08	Service duct, Parapet, Painting	40,300
3.	Faris Barne	04026134	DATA REQUIRED				
4.	Sheerwater Bridge	A245/8	57	Very Poor	09/06/2009	Painting, Signage	1,500
5.	Monuments Bridge	C144/551	92	Good	17/07/08	None	0
6.	Wheatsheaf Bridge	A3046/1	DATA REQUIRED				
7.	Chertsey Road Bridge	A320/7	73	Poor	05/01/06	Wing Wall, Parapets, Troughing, Edge Beam, Painting	56,000
8.	Victoria Bridge	00455901	98	Very Good	16/10/98	None	0
9.	Goldsworth Relief Road Canal Bridge	A324/15	86	Fair	29/01/01	None	0
10.	Horsell Moor Footbridge	A324/14	73	Poor	12/03/02	None	0
11.	Arthurs Bridge	D3637/561	69	Poor	07/07/09	Painting	1,500
12.	Goldsworth Park Bridge	C142/1834	80	Fair	17/07/08	Approach Embankments, Drainage Systems, Surfacing, Expansion Joint	24,000
13.	Langmans Lane Woodend	98665824	90	Good	21/10/97	None	0
14.	Woodend Bridge	98225812	DATA REQUIRED				
15.	Kiln Bridge	C141/2401	64	Very Poor	17/07/08	Waterproofing, Expansion Joints, Parapets	33,000
16.	ST Johns Lye Canal Footbridge	97615757	85	Fair	29/02/00	None	0
17.	Hermitage Bridge	A324/2	82	Fair	11/06/09	None	0
18.	Brookwood Bridge	A322/2	95	Very Good	29/06/09	None	0
19.	Sheets Heath	49515716	DATA REQUIRED				
20.	Pirbright Bridge	D44/590	94	Good	24/07/08	Vegetation	250
21.	Curzon Bridge	92045639	82	Fair	30/06/2009	None	0
22.	Deepcut	B3015/2	83	Fair	19/03/09	Expansion Joints, Primary	25,000

						Deck Element, Painting	
23.	Guildford Road Canal	B3012/2	91	Good	19/03/09	None	0
24.	Mytchett Place Canal Bridge	D3455/505	87	Fair	13/08/08	Graffiti Removal, Footway Surfacing	1,600
25.	Mytchett Lake Canal Bridge	D3458/507	83	Fair	13/08/08	Graffiti Removal, Vegetation Removal	950
26.	Valley View (Deedsmans) Footbridge	89135410	100	Very Good	07/07/08	None	0
27.	Ash Vale Junction Bridge	89325347	82	Fair	03/12/99	None	0
28.	Heathvale Bridge	D898/2242	61	Very Poor	24/07/08	Painting	5,000
29.	Ash Vale Canal Footbridge	A321/17	97	Very Good	22/01/01	None	0
30.	Ash Vale Canal Bridge	A321/16	60	Very Poor	04/07/07	Abutment, Wing Wall, Waterproofing	30,000
AVERAGE:			**81**	**FAIR**	**TOTAL:**		**226,600**

BCI SCORE	BCI CONDITION	COLOUR CODE
100 - 95	VERY GOOD	
94 - 90	GOOD	
89 - 80	FAIR	
79 - 65	POOR	
64 - 40	VERY POOR	
39 - 0	SEVERE	

Table 14 – HCC Bridge Stock Condition Data, 2009
(Source [37])

ID No.	Structure Name	Structure No.	BCI_{AVE} Index Score	BCI_{AVE} Condition	Inspection Date	Identified Maintenance Work	Estimated Cost (£)	Comments
1.	Wharf New	B234a	87.32	Fair	25-07-2008	Parapets, Vegetation, Reinforcement bars, Railing,	5950	
2.	Wharf	B234	84.51	Fair	25-07-2008	Brick Repair, Pointing	800	Bridge has been saddled so no major repairs to the brickwork required
3.	Norris – Pyestock	B236a	95.26	Very Good	11-07-2008	None	0	
4.	Norris	B2193		DATA REQUIRED				
5.	Pondtail New	B791	87.71	Fair	20-06-2007	Safety fence foundation, repainting	500	
6.	Pondtail	B244a	57.00	Very Poor	20-06-2007	Clean and paint beams and jack arches, Paint parapets	12000	
7.	Reading Road	B245	89.27	Fair	28-08-2007	Vegetation, Investigate services	200	
8.	Coxheath Fleet Footbridge	FB 874	83.90	Fair	25-07-2008	Clear leaves, Blast clean steelwork, apply protective, surfcing	5600	
9.	Coxheath Fleet	B908	92.88	Good	25-07-2008	Repair NE training wall, Pointing, Vegetation	1025	
10.	Malthouse	B318a	73.85	Poor	10-09-2008	None	0	Bridge is in poor condition but major scheme is being investigated and hance no work is recommended at present

11.	Malthouse Footbridge	FB 873	100	Very Good	10-09-2008	Replace shaped end brick of coping	50	
12.	Zephon Common Swing	FB 150	86.32	Fair	06-09-2006	None	0	
13.	Poulters	B745	84.51	Fair	16-10-2008	Replace bricks to SE abutment	250	
14.	Chequers	B293	93.62	Good	16-10-2008	Parapet spall, replace bricks to training wall	430	
15.	Dogmersfield	B302	89.47	Fair	07-05-2008	None	0	
16.	Blacksmiths	FB 787	81.84	Fair	07-05-2008	Rake out joints, repair spalled and missing brickwork to arch barrel, Repair training wall, Vegetation	2500	
17.	Barley Mow	B287	85.12	Fair	07-05-2008	Repair training wall, Replace bricks from toe path	1200	
18.	Staceys	FB 788	70.92	Poor	07-05-2008	None	0	No Vehicular traffic, hence no work
19.	Baseleys	FB 789	72.96	Poor	07-05-2008	None	0	No Vehicular traffic, hence no work
20.	Sprats Hatch	FB 790	73.63	Poor	15-09-2008	Vegetation, Replace spalled bricks to barrel	725	No Vehicular traffic, hence no major work
21.	Sandy Hill	FB 791	75.84	Poor	15-09-2008	Vegetation	225	No Vehicular traffic, hence no major work
22.	Broad Oak	FB 792	80.79	Fair	15-09-2008	Vegetation	250	No Vehicular traffic, hence no major work
23.	Canal Bridge	B1498	91.95	Good	15-09-2008	Replace polysulphide sealant to parapet joints, Vegetation	1200	
24.	Colt Hill Canal	B294	84.51	Fair	15-09-2008	Vegetation	200	

25.	Lodge Farm	FB 130	83.90	Fair	14-11-2008	Build up corner of wall (underwater mix), Clean parapet nuts and bolts, paint and galvanise	3200	
26.	Swan	B331	88.30	Fair	22-02-2009	Install posts and birdlip top rail, Vegetation	1350	
27.	North Warnborough Lift	B333	87.91	Fair	22-02-2009	Clean, Paint, Tighten Kee Klamp posts	1300	
28.	Eastrop	B2027	61.95	Very Poor	30-10-2007	Vegetation, Provide rejects behind and under timber sleepers	600	
29.	Slades	FB 103	79.73	Poor	06-08-2008	Repair bricks and open joints, Paint handrails	1100	
30.	Brick Kiln	B251	77.59	Poor	30-10-2007	Paint NW approach fence, Replace approach steps	1075	
AVERAGE:			**83**	**FAIR**	**TOTAL:**		**41,730**	

BCI SCORE	BCI CONDITION	COLOUR CODE
100 - 95	VERY GOOD	
94 - 90	GOOD	
89 - 80	FAIR	
79 - 65	POOR	
64 - 40	VERY POOR	
39 - 0	SEVERE	

Table 15 – Lock Footbridge Condition Data, 2009
(Source [32])

Lock Bridge Number	Span (m)	Width (m)	Area (m^2)	Deck Material	Parapet Material	Condition
1	4.43	0.77	3.41	Open Mesh Grated GRP	Steel Posts with Timber Rails	Good
2	4.41	0.77	3.40	Open Mesh Grated GRP	Steel Posts with Timber Rails	Fair
3	N/A					
4	4.54	0.77	3.50	Open Mesh Grated GRP	Steel Posts with Timber Rails	Poor
5	4.52	0.77	3.48	Open Mesh Grated GRP	Steel Posts with Timber Rails	Fair
6	4.42	0.77	3.40	Open Mesh Grated GRP	Steel Posts with Timber Rails	Good
7	4.50	0.77	3.47	Open Mesh Grated GRP	Steel Posts with Timber Rails	Good
8	4.44	0.77	3.42	'Marine Standard' Decking	Steel Posts with Timber Rails	Fair
9	4.44	0.77	3.42	'Marine Standard' Decking	Steel Posts with Timber Rails	Fair
10	4.50	0.77	3.47	Open Mesh Grated GRP	Steel Posts with Timber Rails	Good
11	4.43	0.77	3.41	Open Mesh Grated GRP	Steel Posts with Timber Rails	Poor
12	4.48	0.91	4.08	Timber	Timber	Fair
13	4.43	0.77	3.41	Open Mesh Grated GRP	Steel Posts with Timber Rails	Fair
14	4.53	0.77	3.49	Open Mesh Grated GRP	Steel Posts with Timber Rails	Good
15	4.53	0.77	3.49	Open Mesh Grated GRP	Steel Posts with Timber Rails	Poor
16	4.45	0.77	3.43	'Marine Standard' Decking	Steel Posts with Timber Rails	Poor
17	N/A					
18	4.54	0.77	3.50	'Marine Standard' Decking	Steel Posts with Timber Rails	Fair
19	4.46	0.77	3.43	Open Mesh Grated GRP	Steel Posts with Timber Rails	Poor
20	4.50	0.77	3.47	Open Mesh Grated GRP	Steel Posts with Timber Rails	Poor
21	4.48	0.77	3.45	'Marine Standard' Decking	Steel Posts with Timber Rails	Fair
22	4.37	0.77	3.36	'Marine Standard' Decking	Steel Posts with Timber Rails	Fair
23	4.51	0.77	3.47	'Marine Standard' Decking	Steel Posts with Timber Rails	Fair
24	4.46	0.77	3.43	'Marine Standard' Decking	Steel Posts with Timber Rails	Fair
25	4.36	0.77	3.36	Open Mesh Grated GRP	Steel Posts with Timber Rails	Fair
26	4.51	0.77	3.47	Open Mesh Grated GRP	Steel Posts with Timber Rails	Poor
27	4.53	0.77	3.48	Open Mesh Grated GRP	Steel Posts with Timber Rails	Poor
28	4.45	Not Known	Not Known	Open Mesh Grated GRP	Steel Posts with Timber Rails	Good
Dry Dock	N/A					
29	4.5	0.33-0.6	2.10 approx	Concrete	Steel Posts with Timber Rails	Good

8.10 Aqueducts

8.10.1 At the time of this Plan there was limited data concerning the condition of the aqueducts assets. A detailed assessment was only available on Ash Embankment Aqueduct (known as Canal Aqueduct in the SCC inventory register). From an inspection conducted by the Surrey Highways Structures Group in August 2005 it was found that the aqueduct had a score of 84 on the CSS bridge condition index. This relates to a 'fair' condition rating. The inspection identified £9,000 of outstanding maintenance work required to improve the condition of the fenders, piers and abutments.

8.11 Tunnel

8.11.1 The single tunnel on the Canal, Greywell Tunnel, was partially inspected in February 2009 by the HCC Structures Department. The structure was assessed to have a condition score of 86 on the CSS bridge condition index. This relates to a 'fair' condition rating. Identified maintenance work included vegetation removal and replacement of railings. These maintenance actions had an estimated cost of £750.

8.12 Trees

8.12.1 Limited formal condition data exists for the Canal tree asset. This is obtained from the SCC Surrey Tree Survey, completed in 2006 in the Surrey stretch only. In total the survey identified 324 trees for remedial actions. In September 2009 64 of these trees were recorded to have either had their issues resolved or to be put forward for further monitoring by BCA. 189 trees were outstanding, awaiting maintenance actions. However, of these 189 trees 50 are privately owned and require further arrangements to be made. In addition, 71 trees were never positively identified by the BCA Rangers after the survey work was completed. No formal condition data is held for the trees in Hampshire stretch of the Canal.

8.12.2 In May 2010 BCA suggested that further maintenance actions had been undertaken on the tree asset but had not been formally recorded. As such it is impossible to monitor progress, and identify the remaining outstanding work. It was therefore suggested by BCA that the tree inspections are repeated in Surrey and undertaken in Hampshire to obtain up-to-date condition data. Once completed, the BCA should ensure any remedial actions following the survey are recorded in the Asset Management Geodatabase, so that it is kept up to date in future.

8.13 Canal Centre and Workshops

8.13.1 Currently no formal condition data for the Canal centre and workshop is available. From informal assessments it was found that these assets were in a serviceable condition. However, the computers available for the BCA staff in the Canal Centre require updating, especially given plans for additional usage to log inspection data electronically within the Asset Management Geodatabase.

9. FUTURE DEMAND

9.1 Introduction

9.1.1 The strategic objectives for the Canal include a requirement to maintain an ecological balance and recreational facility, as well as a heritage transportation infrastructure. In this section each of these objectives will be investigated in order to attempt to develop an understanding of the future demand. The predictions of future demand will inevitably affect the amount of investment in the Canal, and may also focus funds on particular assets in order to ensure that a particular demand can be met.

9.1.2 It should be noted that future demand is difficult to predict, and can also vary over time. Another issue is that the objectives of the Canal do not necessarily work in harmony. For instance, demands for navigation and recreation can lead to compromises in conservation. It is important the correct balance is sought to enable success in each objective. Further work is required to ensure this is achieved.

9.2 Navigation

9.2.1 Navigation along the Canal at present is largely for recreational use. It is anticipated that there will be little or no future demand for commercial traffic transporting goods or services. Commercial boat hire operations run from the Canal centre, and other locations along the Canal, during certain times of the year.

9.2.2 The permissible navigation for the Canal is limited by the SSSI status it has been awarded. The Conservation Management Plan [13] identifies a limit of 780 - 1300 movements per year, as derived from national research. BCA have set the limit at the upper end of the range (i.e. at 1300 movements/year) in order to give greatest possible accommodation for boat users. In order to protect the SSSI conservation operational boat speeds have been restricted to 6.4km/h.

9.2.3 At present recent records of boat use on the Canal are not available, as no boat counting measures are currently in place. Historic data taken at Dogmersfield between 1992-1999 showed that the average (mean) number of boat movements per year was 918. The Conservation Management Plan, 2008 [13] states, "*electronic boat counters will be re-instated at Dogmersfield and Deepcut. A means of counting passages at Lock 1 will be developed and implemented (electronic counter and lockage records). Traffic data will be compiled monthly from these locations and assessed against the target*".

9.2.4 It is suggested that as this traffic data is collected it should be analysed with any established trends used to predict future demand. The results of this analysis should be detailed in future editions of this Plan.

9.3 Recreation

9.3.1 The Conservation Management Plan [13] recognises that "*the canal is greatly used as a recreational resource. It forms a linear country park in which the towpath is much frequented by walkers and provides a traffic-free 'green corridor' in urban, suburban and rural areas*." Many other recreational users capitalise on the Canals facilities such as boaters, cyclists and anglers to name but a few. The Conservation Management Plan goes on to say: "*The canal's easy public accessibility is particularly valuable because it runs through areas in which other accessible green spaces are limited and decreasing*".

9.3.2 The way in which the Canal is used and accessed makes it very difficult to gain accurate estimates of the number of users, and hence predict future growth. Nationally the trend is upwards with estimates of 130 million towpath visits in 1995, growing to 268 million in 2006 [13]. This limited information makes managing the Canal with respect to this demand difficult. However, it is anticipated that there is sufficient spare capacity to cope with recreational growth for the immediate future. This should be continually re-addressed within future editions of this Plan.

9.4 Conservation

9.4.1 The nature conservation value of the Canal should not be underestimated (see Section 3 for further details). The future demands for the conservation of the Canal relates to the preservation measures that are required. It should be noted that the condition of the SSSI in 2008 was mostly declining unfavourably. The aim of the Conservation Management Plan [13] was to reverse this decline and progress towards favourable conditions. Aims and objectives to achieve this were established, with a programme of review formulated to ensure success. It is suggested that these reviews are used in future editions of this Plan in order to comment on the present conservation demands.

10. PERFORMANCE TARGETS AND LEVELS OF SERVICE

10.1 It will be essential to determine Performance Targets and Levels of Service for the users of the Canal. This will include consideration of Economy, Safety, Integration and Accessibility. This exercise will allow a future gap analysis to be carried out to determine the maintenance work required to move from the current condition to the desired condition.

10.2 To facilitate gap analysis and desired performance targets could be set relating to each of the three key demands; navigation, recreation, conservation, as measured by Key Performance Indicators (KPIs). For example, these KPI's could include:

- Navigation P.I. – the number of miles, and number of locks, open for navigation over each year (in lock months)

- Recreation P.I. – the condition rating of the towpath over each year (performance targets may be different in urban and rural areas)

- Conservation P.I. – the PH of the canal water (further details are given in the Conservation Management Plan [13])

Further work is required to establish the details of these performance targets and levels of service. This will require consultation with various owners, stakeholders, and other related organisations.

11. PERFORMANCE GAPS AND IDENTIFICATION OF NEEDS

11.1 As suggested previously, good asset data underpins the creation of a reliable asset management plan. Although much progress has been made in establishing the asset inventory and current asset condition during the initial development of the Plan some work still remains.

11.2 In order to progress with further developments of this Plan, such as lifecycle plans and long-term maintenance plans, this missing data must be collected. The bullet points below summarise the 'performance gaps' and 'identification of needs' that should be addressed in order to achieve this:

- Obtain formal condition data for the Canal channel
- Obtain formal condition data for the towpath
- Obtain formal condition data for the remaining cuttings
- Obtain formal condition data for the sluices and weirs
- Obtain formal condition data for the culverts
- Obtain formal condition data for the pumping systems
- Complete formal condition data for the remaining aqueducts
- Complete a formal tree survey within the Hampshire section of the Canal
- Repeat a formal tree survey within the Surrey section of the Canal
- Obtain formal condition data for the canal centre and workshops
- Continually re-assess condition data as it becomes out dated
- Adopt the proposed inspection regime based upon industry best practice
- Establish chainage markers at regular intervals along the Canal to aid inspection and maintenance
- Record all maintenance work in detail within the Asset Management Database
- Establish an electronic system to share information held by the BCA with the Canal's owning authorities (SCC and HCC)
- Establish the locations of access points and access routes which could facilitate maintenance works on the Canal

- Determine specifications for upcoming lock and embankment maintenance work based on BCA past experience and best practice

- Determine the asset value of the Canal in financial terms

12. LIFECYCLE PLANS

12.1 Introduction

12.1.1 A lifecycle plan can be described as follows [2]:

"A Lifecycle Plan describes the long term strategy for managing a group of similar structures with a view to minimising whole life costs while providing the required levels of performance. Lifecycle Plans are used to identify maintenance cycles and intervention thresholds."

"The same lifecycle plans should be used to identify needs for individual structures and elements. The cyclic / intervention rules established in the lifecycle plans are compared against the current conditions and performance of a structure / element and the specific characteristics of a structure are assessed to determine if the lifecycle plan activity is appropriate i.e. the lifecycle plans should be used as general guidance when identifying specific maintenance needs."

12.1.2 The purpose of this section will ultimately be to develop lifecycle plans for each individual asset on the Canal. These should identify the optimal investment profile required to deliver a specified level of service, and the cost effectiveness of varied levels of service.

12.1.3 A significant amount of work is now required to develop these lifecycle plans. Each lifecycle plan should include a complete acquisition to disposal cycle (see Figure 12). It will be necessary to determine routine maintenance activities and maintenance standards. The objective will then be to keep the assets in a serviceable state by carrying out the inspection process and then applying the stated maintenance standards.

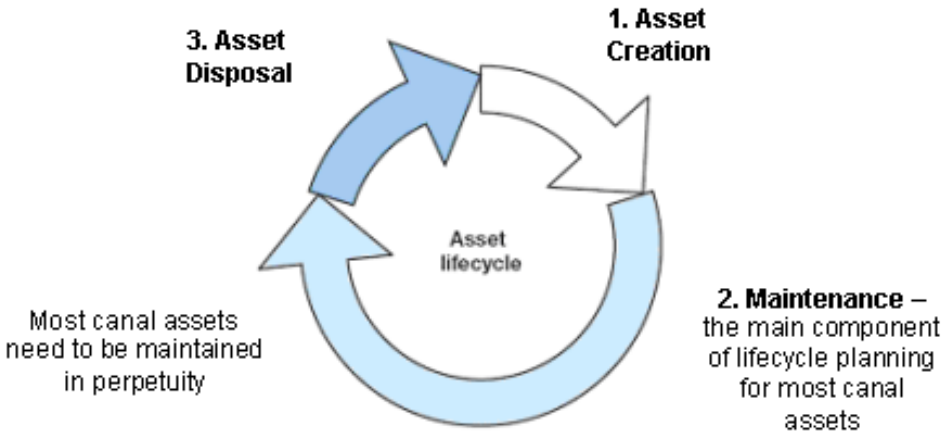

Fig. 12 – Lifecycle Phases of a Highway Structure
(Based on Fig. 3.8 [2])

12.1.4 At this initial stage of the Plan it is not possible to provide comprehensive lifecycle plans for all the assets, as the necessary background data does not exist. However, where multiple sets of condition data exist lifecycle plans have been attempted, as detailed in Section 12.2 and 12.3. Through continued monitoring and reporting of asset condition, deterioration rates will be able to be established for the remaining assets.

12.2 Illustrative Lock Gate Lifecycle Plan

12.2.1 The lock gates have been selected for development of a lifecycle plan as several sets of historic inspection data exist for this asset. The lifecycle plan intends to use this historic data to determine deterioration rates for the asset. This historic data includes:

- BCA survey undertaken in 2006, as shown in Table 10
- Jacobs survey undertaken in 2009, as shown in Table 11
- BCA survey undertaken in 2010, as shown in Table 12

12.2.2 In order to determine the deterioration rates the historic data was compared as follows:

- BCA 2006 inspection data was compared to Jacobs 2009 inspection data, as shown in Table 16
- Jacobs 2009 inspection data was compared to BCA 2010 inspection data, as shown in Table 17

12.2.3 However, in attempting the comparison problems were encountered. Firstly, the various sets of inspection data were prepared under different inspection methodologies. For this reason a detailed comparison could not be conducted as the systems did not correlate. For example, although a set of lock gates may be classified under the same priority rating in 2009 and 2010, this does not necessarily indicate that the condition had remained constant.

12.2.4 In addition, formal maintenance records did not exist. This made it difficult to correlate improvement in condition with performed maintenance actions. In order to gain an informal maintenance history a review was conducted with the BCA Rangers. This established the year of installation, manufacture and any specific notes for each lock gate from the Rangers memory (see Appendix 14).

12.2.5 Lastly, there was disagreement concerning the Jacobs 2009 and BCA 2010 inspection data. In brief, the data showed several discrepancies between the assessment made by the BCA and Jacobs. BCA believed certain lock gates had received condition ratings that did not reflect the true condition of the gates. These issues were openly discussed at a review with the BCA in May 2010. Due to these discrepancies it was not valid to try and established trends based on comparison between these data sets.

Table 16 – Lock Gate Condition Data Comparison, BCA 2006 and Jacobs 2009

Lock Number	BCA 2006 Inspections		Jacobs 2009 Inspections	
	Upper Gates	Lower Gates	Upper Gates	Lower Gates
Lock 1	Low	Low	Low	Low
Lock 2	Immediate	Low	Low	None
Lock 3	Low	Urgent	None	None
Lock 4	Low	Urgent	Medium	None
Lock 5	Urgent	Low	Medium	Medium
Lock 6	Immediate	Low	Medium	Medium
Lock 7	Low	Low	Medium	Medium
Lock 8	Low	Urgent	Medium	Medium
Lock 9	Low	Low	Medium	None
Lock 10	Low	Low	None	Medium
Lock 11	None	Immediate	None	Medium
Lock 12	Immediate	Urgent	Medium	Medium
Lock 13	Immediate	Immediate	Medium	Medium
Lock 14	None	Low	Low	Low
Lock 15	Low	Low	Medium	Medium
Lock 16	Low	Low	Medium	None
Lock 17	Low	Urgent	Medium	Low
Lock 18	Immediate	Low	Low	Low
Lock 19	Low	Low	Medium	Medium
Lock 20	Urgent	Immediate	Medium	Low
Lock 21	Immediate	Low	Medium	None
Lock 22	Low	Low	Low	Low
Lock 23	Immediate	Low	High	Low
Lock 24	Immediate	Low	Medium	None
Lock 25	Low	Urgent	Low	Low
Lock 26	Immediate	Immediate	High	Medium
Lock 27	Low	Low	Medium	Medium
Lock 28	Low	Low	High	Medium
Dry Dock	Low	Low	Medium	Medium
Lock 29	Low	Low	None	None

N.B Similar colour ‘Priority Rating’ does not necessarily indicate agreement in the timescale maintenance work should be conducted (see Paragraph 12.2.3).

Table 17 - Lock Gate Condition Data Comparison, Jacob's (2009) and BCA (2010)

Lock Number	BCA 2010 Inspection Data		Jacobs 2009 Inspection Data	
	Upper Gates	Lower Gates	Upper Gates	Lower Gates
Lock 1	3/4 yrs	3/4 yrs	Low	Low
Lock 2	25 yrs	25 yrs	Low	None
Lock 3	25 yrs	25 yrs	None	None
Lock 4	0 yrs	25 yrs	Medium	None
Lock 5	0 yrs	3 yrs	Medium	Medium
Lock 6	0 yrs	25 yrs	Medium	Medium
Lock 7	10+ yrs	10+yrs	Medium	Medium
Lock 8	5 yrs	3+ yrs	Medium	Medium
Lock 9	2 yrs	10 yrs	Medium	None
Lock 10	15 yrs	2 yrs	None	Medium
Lock 11	25 yrs	2 yrs	None	Medium
Lock 12	0 yrs	2 yrs	Medium	Medium
Lock 13	0 yrs	0 yrs	Medium	Medium
Lock 14	20 yrs	4 yrs	Low	Low
Lock 15	3 yrs	3 yrs	Medium	Medium
Lock 16	3 yrs	15+ yrs	Medium	None
Lock 17	15 yrs	0 yrs	Medium	Low
Lock 18	20 yrs	20 yrs	Low	Low
Lock 19	10 yrs	10 yrs	Medium	Medium
Lock 20	0 yrs	3 yrs	Medium	Low
Lock 21	25 yrs	25 yrs	Medium	None
Lock 22	10 yrs	10 yrs	Low	Low
Lock 23	0 yrs	15+ yrs	High	Low
Lock 24	0 yrs	10 yrs	Medium	None
Lock 25	2 yrs	0 yrs	Low	Low
Lock 26	0 yrs	25 yrs	High	Medium
Lock 27	15 yrs	3/4 yrs	Medium	Medium
Lock 28	25 yrs*	5 yrs	High	Medium
Dry Dock	No Inspection Data		Medium	Medium
Lock 29	20 yrs	25 yrs	None	None

*Lock 28 upper gates have been replaced following the Jacobs inspections 2009. See Appendix 16 for further details.

BCA Priority Rating

Rating	Estimated Life
Green	25-10 yrs
Orange	10-5 yrs
Red	5-0 yrs

Jacobs Priority Rating

Rating	*Estimated Life*
N (No Action Required)	No remedial work required within the next two years
L (Low)	Work should be done within the next two financial years
M (Medium)	Work should be done within the next financial year
H (High)	Immediate remedial action required

N.B Similar colour 'Priority Rating' does not necessarily indicate agreement in the timescale maintenance work should be conducted (see Paragraph 12.2.3).

12.2.6 The issues above highlight the need to adopt a comprehensive and consistent inspection methodology, undertaken by competent inspectors, and the need to formally record the details of all maintenance actions undertaken on the Canal. These issues are fundamental performance gaps, which need to be addressed.

12.2.7 Due to these difficulties it was decided to create a simplistic lifecycle plan based on informal BCA ranger experience. This does not present best practice, as lifecycle plans should be validated by inspection data. As such the lifecycle plan is purely illustrative at present.

12.2.8 Following discussions, BCA proposed that on average the lock gates required their secondary planking to be replaced every 10 years (minor maintenance) and the main framework to be replaced every 30 years (major maintenance). This simplistic lifecycle plan could thus be represented diagrammatically (see Fig. 13). It was suggested that the main framework for a pair of lock gates costs approximately £16,000, where re-planking a pair of lock gates costs approximately £3,000.

12.2.9 This knowledge has been used to predict when each individual lock gate will fall below the desired level of service (as suggested by the lifecycle plan in Fig. 13), based on its year of manufacture (as shown in Appendix 14) and current condition (as shown in Table 12), and hence require major maintenance. This process has been undertaken as shown in Table 18 for a 30-year period. Note, lock gates recorded as original structures since restoration (i.e. pre 1992) are conservatively assumed to begin their first lifecycle in 1985, as it is known manufacture and installation was conducted before the Canal was re-opened.

12.2.10 With this pre-planning in place it is possible to predict the future workload and the funding requirements for the lock gates. This also allows long-term work programmes to be established and co-ordinated so that the necessary resources are in place to deliver the maintenance work.

12.2.11 Table 18 indicates that at least 26 pairs of lock gates currently require major maintenance over the next 5 years (2010-2015). This represents almost half the total stock, and will require an investment of approximately £416,000 to renew the stock. With prior planning this demand could have been phased to ensure the workload could be met more easily with a more manageable financial investment required, and hence guaranteeing the safe operation of the asset. Fortunately, recent capital injection from the Canal's owners will be able to reverse some of this backlog of work (see Section 15). It is recommended that the work is prioritised and phased as appropriate, so that this same peak in workload is not experienced at the next lock gate life cycle.

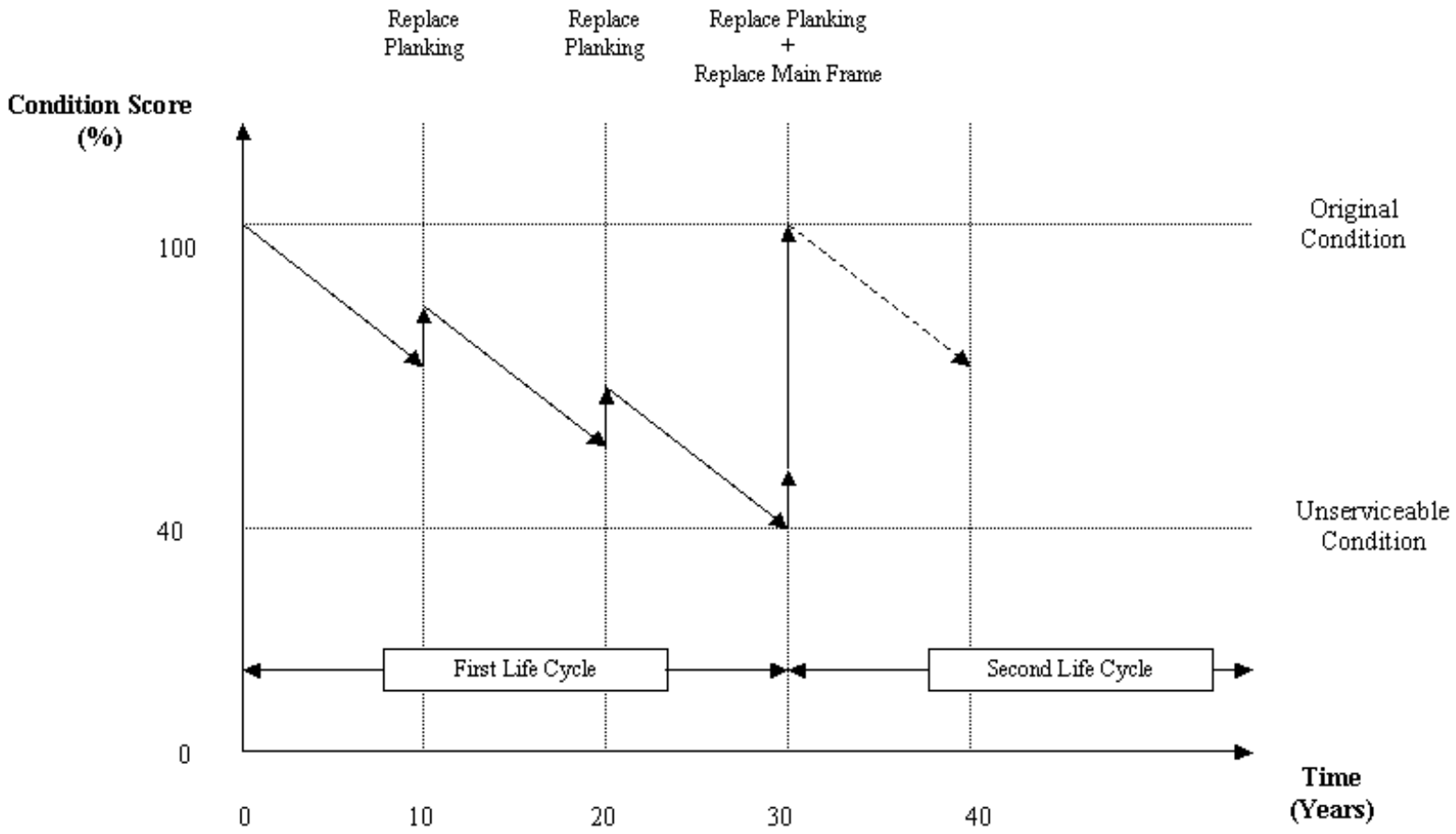

Fig. 13 – Lock Gate Illustrative Lifecycle Plan

N.B Replacing the planking represents minor maintenance, whereas replacing the main frame and planking represents major maintenance.

Table 18 – Lock Gate Major Maintenance Predications, 30-Year Look Ahead:

	Year																														
Lock Gate	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1 Uppers																															
1 Lowers																															
2 Upper																															
2 Lowers																															
3 Uppers																															
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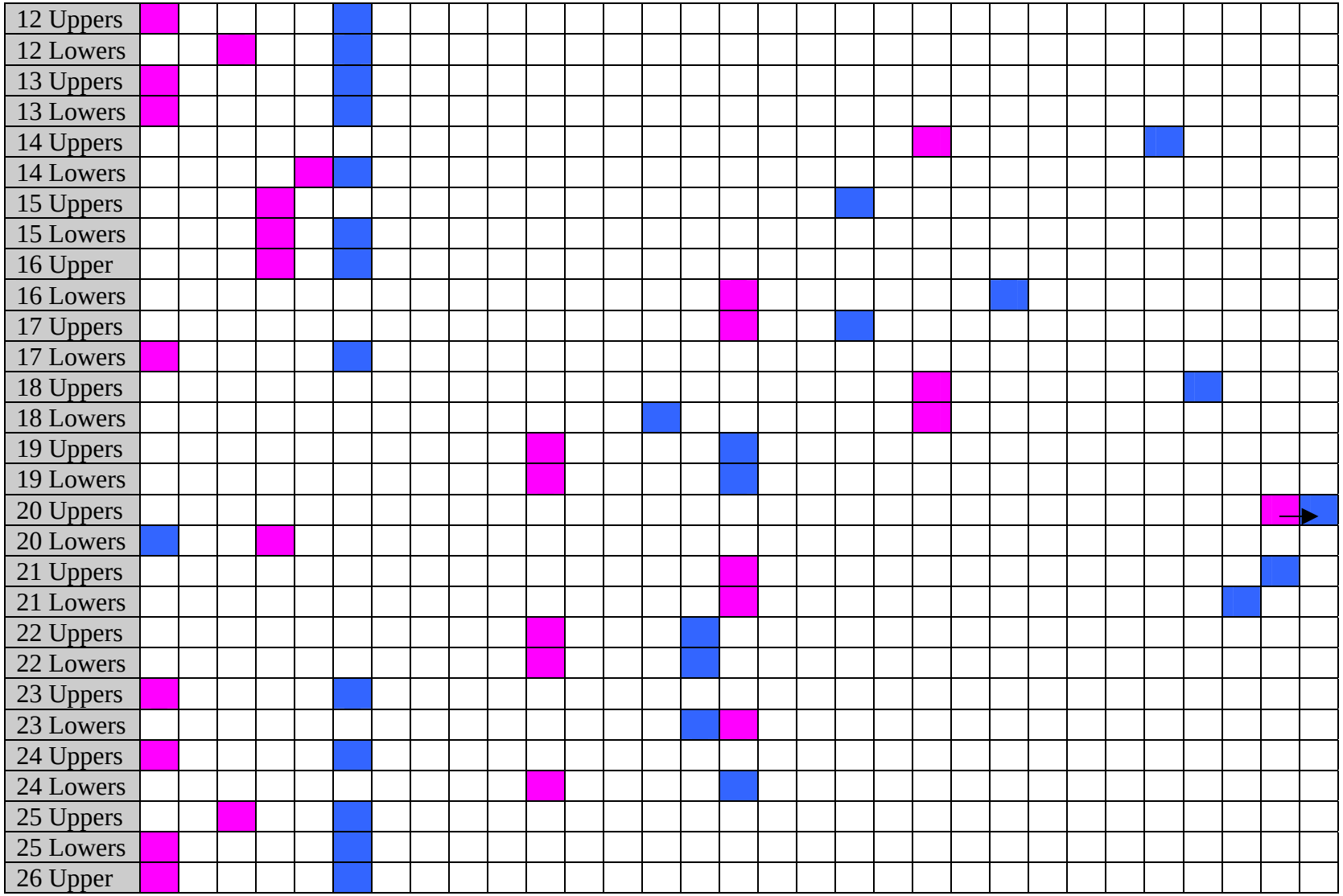
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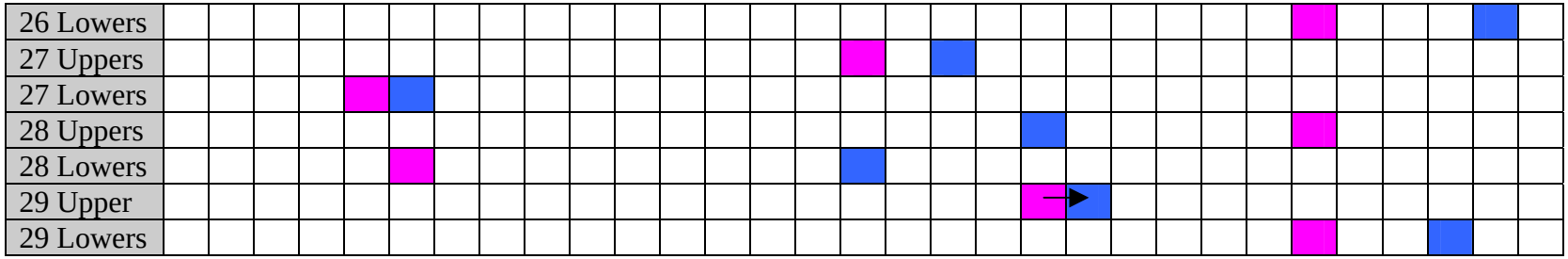

KEY

Lifecycle Plan Prediction of Major Maintenance
BCA Estimated Life Prediction of Major Maintenance

→ The arrow symbol indicates that the lifecycle plan prediction and the BCA estimated life assessment both fall on the same year, as shaded blue.

N.B. These lifecycle plan predictions require validation, as they are based on informal information.

12.3 Illustrative Embankment Lifecycle Plan

12.3.1 Work to develop an embankment lifecycle plan has been attempted as two sets of condition data are held for the embankment asset (see Section 8.3). The condition data is scored using the same BW methodology in both cases. This should make comparing the past and current condition simple, and therefore allow deteriorate to be realised simply.

12.3.2 However, the comparison is complicated as in 2001 long stretches of earth structures were classified together, leading to there being 15 condition assessments for the Canal [28]. More recently smaller sections have been considered, leading to 142 condition assessments made along the Canal [27]. In addition, deterioration of an embankment is particularly dependent on external factors, and in some cases condition main remain constant for long periods of time. This makes accurate lifecycle plans difficult to establish.

12.3.3 None the less, considering the above, the comparison was undertaken as shown in Table 19. The relative sections of embankments were matched to each other, given location data, and the most severe 2009 embankment result was compared to the 2001 assessments.

Table 19 – Embankment Condition Data Comparison, British Waterways 2001 and HCC 2009

2001 Section Name	Condition Grade	Consequence of Failure	2001 Risk Rating	Corresponding 2009 Section ID's	Condition Grade	Consequence of Failure	2009 Risk Rating	Most Severe 2009 Risk Ranking	Change in Assessed Risk
Wey Junction to Lock 1	C	5	High	142 141	C C	5 5	High High	High	0
Lock 2 to Lock 6	C	4	High	138 137 136 135	B B C C	2 2 3 1	Low Low Moderate Low	Moderate	+1
Lock 6 to Sheerwater	C	4	High	133	B	5	Moderate	Moderate	+1
Arthur's Bridge to Skew Bridge	C	4	High	126 125 124	B C B	5 5 5	Moderate High Moderate	High	0
Goldsworth Bridge to Kiln Bridge	C	4	High	121 120 119 118	A A A A	4 2 4 5	Low Very low Low Low	Low	+2
Frimley to Ash Vale	C	5	Unacceptable	77 76 75 74	C C B B	5 5 5 5	High High Moderate Moderate	High	+1
Ash	C	4	High	69 68 67 66 65 64 63 62 61 60	B B C C C B B C A B	5 5 5 5 5 4 1 4 4 5	Moderate Moderate High High High Low Very low High Low Moderate	High	0

Reading Road to Pondtail Bridge	D	4	Unacceptable	52 51 50 49	A B B B	2 5 5 5	Very low Moderate Moderate Moderate	Moderate	+2
Dinorben	B	4	High	48 47 46 45	B B B B	5 4 5 5	Moderate Moderate Moderate Moderate	Moderate	+1
Zephon Common	C	4	High	42 41	B B	2 3	Low Low	Low	+2
East Hart	D	2	High	38 37	B B	3 3	Low	Low	+2
West Hart	C	2	Medium	36 35	D B	4 3	High Low	High	-1
Tundry Pond	C	2	Medium	27 26	C B	3 3	Moderate Low	Moderate	0
Pillars Bridge	D	1	Medium	Comparison not applicable as 'Pillars Bridge' 2001 Earth Structure Inspection is of a cutting not embankment.					
Broad Oak Bridge	E	2	High	Comparison not applicable as 'Pillars Bridge' 2001 Earth Structure Inspection is of a cutting not embankment.					

12.3.4 Given the comparison made in Table 19 it can be seen that the embankments have largely remained in the same condition, or in a few cases apparently improved in condition. This seems unlikely given that the 2009 embankment report [27] noted that “inspection, maintenance and remediation has been minimal since 2001”. Further work is now required in order to determine the cause of these discrepancies, and which condition score is in fact most accurate.

12.3.5 The assessed improvement in condition could be attributed to a different interpretation of the scoring system between the 2001 inspector and the 2009 inspector. As inspection is a subjective assessment there will always be some variation. However, this variation should be minimised as far as possible, otherwise information can be misleading or incorrect. This can only be achieved by adequate training.

12.3.6 In addition, there are variations in the consequence of failure score between the 2001 and 2009 data. Again this is largely attributed to differences in interpretation, but also possibly some changes in the environment.

12.3.7 Considering the uncertainties expressed above no attempts have been made to establish embankment lifecycle plans from the above comparison. The comparison demonstrates the need for consistent inspections by competent inspection staff, and the need to record maintenance actions as they are performed.

13. VALUE MANAGEMENT AND RISK MANAGEMENT

13.1 Value Management

13.1.1 Value management is used to prioritise needs. It has been recommended [2] that:

"Value Management should be used because it provides a formalised approach for assessing the benefits of undertaking maintenance and the associated risks of not undertaking maintenance. The risks and benefits should cover hard issues e.g. condition and assessed capacity that can be assessed objectively and soft issues such as local importance and synergies with other work that may need to be assessed subjectively."

An important part of Value Management is Risk Management. Generally, Value Management cannot be undertaken until the Risk Management procedures have been established.

13.2 Risk Management

13.2.1 Introduction

13.2.1.1 The general procedure for carrying out a risk assessment is to divide it into two levels. These are Strategic, concerning the asset as a whole (in this case, the entire canal) and Tactical, which concentrates on individual problem assets, for instance an individual lock or pound.

13.2.1.2 The Strategic level procedure can be summarised as follows:

- Identify risk objectives and hazards
- Inspection and asset register compilation – Identify risks, probabilities of risks occurring and consequences if risks occur
- Risk Analysis – many methods available, the chosen method usually depends on the level of data available for assessment
- Creation of a risk register – Containing all hazards and risks (with probabilities and consequences) and their mitigation options (costs/benefits and any residual risk)
- Prioritisation and budgeting for work
- Monitoring asset condition to ensure risk register is up to date

13.2.1.3 Similarly for Tactical Risk Assessment:

- Used for assets that fail to meet some or all of the risk objectives identified in the Strategic Assessment

- Collect detailed data of the site for use in a detailed risk analysis

- A risk register for the problem asset is created and mitigation options for each risk identified

- The most appropriate (usually those with the highest cost-to-benefit ratio) mitigation measures are then chosen for implementation

13.2.1.4 The ALARP (As Low as Reasonably Practicable) principle dictates that safety improvements should not be pursued at any cost. If the cost of preventing the risk is grossly disproportionate to the probability of the risk occurring then the risk should be noted, and tolerated. Therefore, once all risks are identified in a strategic level risk register, funds can be allocated accordingly. It is clear that the risk assessment process is a key part of the production of an asset management plan and this topic has significant relevance to the future of the Basingstoke Canal.

13.2.1.5 It should be noted that at the present time the relative importance of each of the asset types has not been considered. Similarly, the importance of each element within a particular asset type has also not been considered. The relative merits of asset types can be compared using a technique know as Multi Criteria Decision Analysis. The use of this technique is beyond the scope of the present Plan. However, in order to establish risk for the Canal it is recommended that industry best practice (as set out in the BW AIP 2008 [26]) is followed during inspections, and reported within future editions of this Plan.

13.2.1.6 Although the relative importance of each asset has not been established formally, the Plan has attempted to consider some perceived higher risk assets as a priority. The risk of the remaining principal assets that have not been considered within this edition of the Plan should be included in subsequent editions.

13.2.2 Embankments

13.2.2.1 The 2009 P.I survey report [27] assesses the risk of every embankment using a strategic level risk matrix, as shown in Table 20. (Note; details of 'Condition Grade' and 'Consequence of Failure Grade' can be found in Appendix 8 and Appendix 9 respectively).

13.2.2.2 A summary of the risk assessment results for the Hampshire and Surrey stretch of the Canal can be seen in Table 21 and Table 22 respectively. Recommendations are also given within the report to resolve the specific issues of the high-risk sites and moderate risk sites, listed in order of priority. This level of risk assessment and management is exemplar, and should be undertaken in a similar manner for the remaining principal assets.

Relative Risk Ranking		Condition Grade				
		A Very Good	B Good	C Fair	D Poor	E Bad
Consequence of failure (5 being the worst)	1	Very low	Very low	Low	Moderate	Moderate
	2	Very low	Low	Moderate	Moderate	High
	3	Low	Low	Moderate	High	High
	4	Low	Moderate	High	High	Very high
	5	Low	Moderate	High	Very high	Very high

Table 20 - Relative Risk Ranking Matrix, 2009
(Source [27])

No. of sites Table shading key: Very High Risk High Risk Moderate Risk Low Risk Very Low Risk		Condition Grade				
		A Very Good	B Good	C Fair	D Poor	E Bad
Consequence of failure	1	-	1	-	-	-
	2	6	8	-	-	-
	3	2	15	4	2	-
	4	1	8	2	1	-
	5	-	14	1	-	-
	Total	*9*	*46*	*7*	*3*	-

Table 21 - Hampshire Embankments Proposed Risk Rating, 2009
(Source [27])

No. of sites Table shading key: Very High Risk High Risk Moderate Risk Low Risk Very Low Risk		Condition Grade*				
		A Very Good	B Good	C Fair	D Poor	E Bad
Consequence of failure (5 being the worst)	1	6	14	5	-	-
	2	4	8	1	-	-
	3	-	3	4	-	-
	4	2	4	-	-	-
	5	1	17	7	-	-
	Total	*13*	*46*	*17*	-	-

* one site has not been graded as access to the slope is via a private property

Table 22 - Surrey Embankments Proposed Risk Rating, 2009
(Source [27])

13.2.2.3 It should be noted that a significant investment is required to eliminate the high-risk sites. The recommendations within the survey report [27] are currently forming the basis of a HCC work programme over a three-year period (see Section 15.3).

13.2.3 Locks

13.2.3.1 The condition of the locks was assessed in 2009 through principal inspections by consultants Jacobs [32]. An overview of the lock condition is given in Table 9. Work is still required to establish the 'consequence of failure' and therefore 'risk' associated with each lock. This is complicated as the inspection procedure did not follow the BW procedures, as set out in the AIP 2008 [26]. Hence, the Jacobs 'condition' rating is not easily compatible with the BW 'consequence of failure' rating adopted for the Canal.

13.2.3.2 Nonetheless, the locks have been considered a potentially high-risk structure. They are also critical to the navigation on the canal and as such should be in appropriate condition to preserve an adequate level of service. As such the lock, and lock gate, work recommendations made by Jacobs are being addressed in a SCC work programme, over a three-year period (see Section 15.3). Recommendations from the BCA are also to be incorporated to establish the high priority lock gate maintenance work.

13.2.4 Reservoirs

13.2.4.1 The risk from the reservoir on the Canal was informally assessed as high. A hydrological report was undertaken by consultants Jacobs in May 2010 [35] to determine the likelihood of flooding for this asset. A model of the reservoir was created and the hydrological inputs were amended to simulate 100, 1000 and 10,000 year flood events, and the Probable Maximum Flood. The findings of the report were that [35]:

- *"The canal generally contains the peak water levels during the 100 year flood, although the freeboard between the resultant canal water level peaks and the canal bank crest is very limited (ranging from 10 to 230mm);*

- *For more extreme events the peak water levels experienced in the canal are controlled by informal spills from the canal;*

- *The hydraulic modeling assumes the canal embankments remain intact during the floods simulated; however, flows from some of these informal spills have the potential to cause failure of the embankments."*

14. ASSET VALUATION

14.1 It is possible to establish the ‘asset value’ for the various assets on the Canal by assuming an ‘as new’ cost for each asset. Where condition data is known it is also possible to establish a ‘deprecated value’ for each asset. The deficit between the ‘deprecated value’ and the ‘asset value’ therefore represents the backlog. The backlog indicates the investment required in order to renew the asset to ‘as good as new condition’ or a condition as agreed in the ‘desired levels of service’ (see Section 10). This knowledge is useful for the financial management of the Canal. Work is still required to determine the asset value and depreciated value of the Canal. This will be considered in future editions of the Plan.

15. WORK PLAN AND FINANCIAL PLAN

15.1 Introduction

15.1.1 The Canal was originally completed in 1794. The economic conditions during most of its working life meant that minimal maintenance would have been carried out. Indeed the condition of the original timber highway bridges became so bad that the local authority had to take these over and totally reconstruct them in the early 1920s. At the end of its commercial life the Canal declined into a dangerously derelict condition. Substantial reconstruction of lock chambers and other assets took place before the Canal was reopened on 10th June 1991.

15.1.2 The World Bank [38] recommends that 1% of the reconstruction cost of an asset is spent on annual maintenance to keep it in a satisfactory condition. For example; if the cost of reconstruction of a lock chamber is conservatively estimated at £500,000 then the asset value of the locks alone is approximately £15m, and an annual maintenance charge of £150,000 would be reasonable. This figure should be compared with the amount that is currently being spent on lock maintenance.

15.1.3 The recommended maintenance figure assumes that the asset started life in a reasonable condition. The work carried out to prepare this Plan suggests that the restoration of the Canal was under – capitalised and that the condition of the Canal now suffers as a result. Further work will be required to determine the critical areas for future development.

15.2 Maintenance Strategies

15.2.1 When considering work plans, thought should be given to the type of maintenance being undertaken. Routine maintenance is the regular ongoing day-to-day work that is necessary to keep assets operating. Steady State maintenance can be split into Preventative and Essential maintenance. The former covers work to repair defects and replace components. The latter heading covers rehabilitation work undertaken when part (or whole) of a structure is considered to be (or about to become) structurally inadequate.

15.2.2 Routine maintenance should be applied at regular intervals as required, however a choice exists whether to apply a system of preventative or essential maintenance. In general, essential maintenance tends to be reactive whereas preventative maintenance tends to be planned. There is growing support for the theory that regular preventative maintenance can reduce lifecycle costs, and disruption to the user. At present the Canal is largely preserved by a system of essential maintenance. Lifecycle plans and forward works plans will enable a preventative approach to be developed which should yield long term financial benefits for the Canal.

15.3 Work Plan

15.3.1 Until condition data and lifecycle plans have been established for all the Canals assets it is difficult to develop optimal work plans, as a holistic view cannot be taken. Likewise, long-term financial plans cannot be developed if there is not a full concept of the future work required. Therefore, it is not possible to provide these details in this edition of the Plan.

15.3.2 The (2009/2010) revenue plan has been included in Appendix 15. This demonstrates that the Canal does not generate sufficient funds to support itself. Hence, additional funding is required in order to maintain the Canal, and to reverse the decline of the asset caused by previous under funding. In recognition of this fact the joint owners, SCC and HCC, have invested a significant capital injection for maintenance of the Canal. SCC and HCC have committed £729,000 and £758,000 respectively over a three-year period from 2010/11 to 2013/14.

15.3.3 At present work plans must be considered in the short term, based on the limited condition data available. This represents essential reactive maintenance as detailed in Section 15.2. SCC has based its work plan on the 2009 lock principal inspections, which is to be aided by recent recommendations relating to the lock gates from BCA. Details of which can be found in Appendix 16 for 2009/10 and 2010/11. The work plan for 2011/12 is yet to be confirmed. HCC has based its work plan on the 2010 embankment principal inspection. Details of which can be found in Appendix 17 for 2010/11 to 2012/13. These work programmes are currently being implemented.

15.3.4 Discussions are currently taking place with the aim to form a partnership contract between SCC, HCC, and a Contractor to deliver the remainder of the three-year programmes. It is hoped that through such a contract better value for money would be achieved for the Canal. To assist the planning of the upcoming works it is suggested that BCA document the access points and routes, including what traffic these routes are suitable for (i.e. boat, vehicle, quad bike). This information can be passed to the Contractor during the tender process. It should be noted that BCA should to be consulted regarding future work plans to ensure they do not conflict with BCA planned activities.

15.3.5 It is strongly recommended that only the high priority and high-risk maintenance work should be undertaken at present. Only, when the condition data has been collected for all the assets and the associated risks with each are assessed will a long-term holistic view be able to be taken, hence ensuring the optimal allocation of funds and the safety of the Canal.

15.3.6 Whilst conducting the three-year work programmes it is vitally important that all maintenance work should be recorded in detail within the Asset Management Geodatabase (AMG). When maintenance work has been undertaken the condition rating of the asset should also be updated in the AMG to reflect its new state. This will ensure the data remains up to date and valid. Otherwise output of the AMG in the future may be misleading and could lead to ineffective

management and maintenance. Consultation should also be sought with BCA to ensure that the specification of any maintenance work meets with BCA best practice.

16. IMPROVEMENT PLAN

16.1 It is recognised that the development of an asset management plan is a continuous improvement process. Broadly speaking; future versions of this Plan will cover, and be influenced by, the following advancements:

- Collection of the outstanding asset inventory data
- Adoption of a formal inspection programme
- Harmonisation of the inspection classifications
- Consider electronic data capture of inspection data
- Ongoing collection of asset condition data
- Ensure linkage with development of the Conservation Management Plan
- Quantify business and safety related risks
- Analyse serviceability and rates of deterioration of assets
- Ensure that appropriate and timely remedial works are carried out
- Prioritise arrears expenditure on the basis of need
- Report progress on targets
- Identify long-term investment needs
- Formation of asset lifecycle plans
- Formation of asset work plans
- Formation of financial plans
- Preparation of the forth edition of the BCA Asset Management Plan

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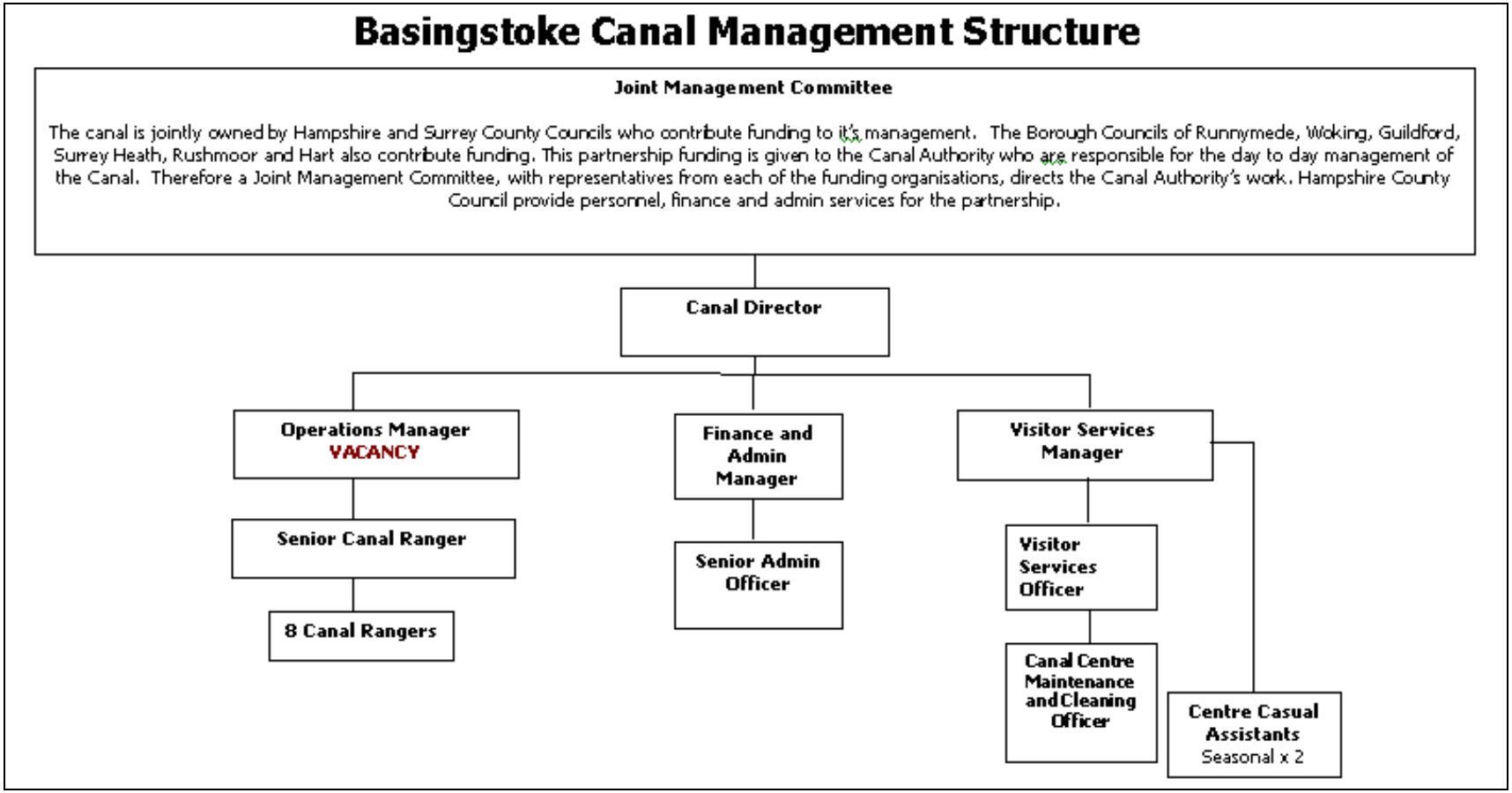
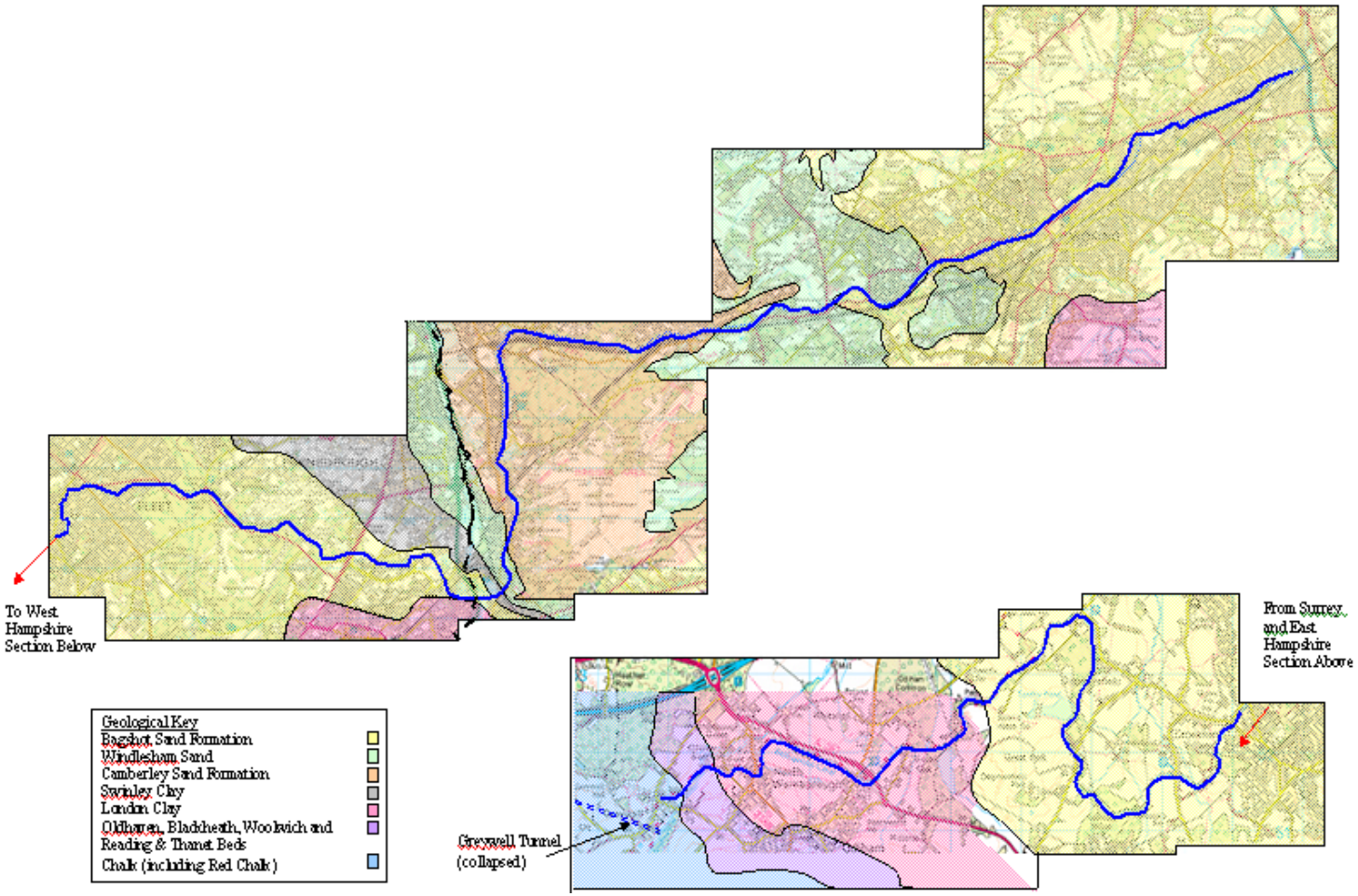
APPENDICES

Appendix One – BCA Organisational Structure, June 2010
(Source: BCA, June 2010)



Appendix Two - Bedrock Geology of the Basingstoke Canal
(Source [10])



Appendix Three – Example Definitions of Principal Assets
(Source: [7])

Asset Type	Principal Asset	Definition of the Principal Asset Type and the elements to be inspected as part of the Asset Inspection Procedure
1	Aqueduct	A structure owned by BCA and carrying a canal or feeder over an obstruction such as a river, road or valley and having a span of more than 1.83m (such assets with a span 1.83m or less are described as culverts) Aqueducts not in BCA ownership but carrying the Basingstoke Canal should be coded to Asset Type 101. Includes trough, approaches, river invert, river protection walls, cut waters, inspection paths, draw off sluices within the aqueduct.
2	Bridge, accommodation	A bridge owned by BCA and constructed to provide access across the canal, feeder or river for an adjacent landowner or to maintain a Right of Way. These bridges will not be carrying a public road or a towpath.
3	Public Road Bridge	A bridge owned by BCA carrying a public highway maintained by a highway authority. Includes approach walls, approach ramps, surfacing, canal invert, weight restriction signs, stop plank grooves and planks and mechanical and electrical equipment.
4	Bridge, towpath / turnover	A bridge owned by BCA carrying the towpath from one side of the canal or feeder to the other. May also carry the towpath over an obstruction, canal arm or junction. Includes features as asset type 3.
5	Culvert	A structure owned by BCA that carries a canal or feeder over an obstruction (typically a small watercourse) with a span of 1.83m or less. NB: the culvert may form part of a piped surface water drain that has not been adopted by a Water Company or Local Authority and therefore remains in BCA ownership. Separate asset types exist for water mains and public sewers, electricity cables and other utility crossings (150 to 157) Includes culvert structure, headwalls, catch pits, inspection accesses, stream upstream and downstream within sphere of influence.
6	Cutting	All cuttings owned by BCA where the canal water level is greater than 3m below surrounding ground level. Includes slope face, bank protection, towpath, surfacing, inspection accesses, drainage pipes, ditches, retaining walls and vegetation. NB: cuttings on each side of the canal to be treated separately.
7	Dry Dock	All dry docks (docks capable of being drained of water) owned and operated by BCA. Includes chamber, gates, work areas, sluices, electrical, mechanical or hydraulic equipment, safety equipment, accesses, pedestrian bridges or walkways, stop plank grooves and planks. Also any associated buildings
8	Dredging Tip	All dredging tips with a current operating licence. (NB: these may be on BCA land or on land in other ownership. They may be active or dormant but will be available for use if required) Includes fencing, drainage, monitoring equipment, accesses, run-off and leachate.

N.B These definitions have since been updated within the BW AIP 2008 [26].

Appendix Four – Example Definitions of Secondary Assets
(Source: [7])

Asset Type	Canal Side Assets	Definition (where necessary)
50	Stop Plank Grooves	A pair of grooves, one on each side of the canal designed to allow stop planks to be installed in an emergency or to allow remedial works to be undertaken. NB: stop plank grooves may be sited independently but they are usually built into other assets such as bridges or locks. In such cases they will be inspected as part of those assets, but should be recorded separately to provide a complete listing of the location of each pair of stop plank grooves. The text field should be used to record where the stop planks are kept.
51	Footbridge	Small footbridges not being a Principal Asset or forming part of a Principal Asset such as a lock or weir as defined above.
58	Towpath Barrier	A fixed or moveable structure designed to control or prevent access to, from or along the towpath.
59	Fence or Gate	
60	Sign	Mandatory, warning or information. Details of different types of sign may be recorded in the text field if required.
61	Winding Hole	A widening of the canal to allow boats to be turned around.
62	Slipway	A sloping ramp into the canal or river to allow boats to be launched from a trailer or cradle.
64	Pier / jetty	A stone, steel or timber structure with water on both sides designed primarily to allow freight or passengers to be transferred to and from vessels
69	Cascade	A structure designed to allow water to fall to a lower level safely over a series of steps

N.B These definitions have since been updated within the BW AIP 2008 [26].

Appendix Five – BCA Historic Inspection Practices (Source [25])

PCD Systems Ltd

Highway Information Systems Consultants

Current Inspection Regimes (Condition)

Aqueducts
Currently no formal inspection regime.

Bridges
Not currently the responsibility of BCA, structures are inspected by either the Local Authority or the structure owner (e.g. Network Rail).

Culverts, Sluices, Weirs
Currently no formal inspection regime for these asset classes, although previous informal inspections have been carried out and recorded.

Cuttings / Embankments
These are inspected on a regular basis as a consequence of ranger activity up and down the canal. There is currently no formal inspection regime in place although ranger knowledge exists to identify areas of high risk. Some recorded data exists in the form of noted text about previous and ongoing issues and this has been factored into routine work plans that instruct the rangers to keep a watching brief.

Towpaths
The towpath is inspected on a regular basis as a consequence of ranger activity up and down the canal. There is currently no formal inspection regime in place for this asset.

Pumping Stations
These are maintained under commercial contract and no inspection regime is deemed necessary by BCA.

Registered Office : 8 Kenilworth Avenue, Bracknell, Berkshire RG12 2JJ Director : P Davidson
info@www.pcdsystems.co.uk

Locks & Lock Gates

There are both paper and electronic Inspection Sheets (held in Excel format) the data is currently used to plan lock gate replacement over a five year period. Each lock gate is given a condition score from 1-5 based on the inspection criteria within the spreadsheets. There are paper inspection records for the lock flights but again the inspection regime is relatively informal.

Buildings

These are covered by County Estates Property Services Asset Management Practice at present. The Canal Centre Building is covered by a contract maintenance plan provided by Hampshire County Council Property Services.

Licensed Waste Sites

There exists one registered waste site under current legislation; Canal Centre at Mytchett, registered for hazardous waste registration number NKV814

Reservoirs

Reservoirs, including Mytchett Lake are inspected annually.

Registered Office : 8 Kenilworth Avenue, Bracknell, Berkshire RG12 2JJ Director : P Davidson
info@www.pcdsystems.co.uk

Appendix Six – BCA Proposed Inspection Schedules
(Source [17])

Primary Assets	**Detailed Inspections**	**Cursory Inspections**
Embankments	Every 6 months	Record notes etc. in "inspections" table
Cuttings	Every 12 months	Record notes etc. in "inspections" table
Culverts	Every 12 months	Record notes etc. in "inspections" table
Bridges - Roads & Rights of Way (BCA not responsible)	Responsibility of third party	Notify third party if problem occurs
Bridges - Railway (BCA not responsible)	Responsibility of third party	Notify third party if problem occurs
Bridges - Other Bridges (BCA responsible)	Every 6 months	Record notes etc. in "inspections" table
Aqueducts - BCA Responsible (White Water aqueduct)	Every 6 months	Record notes etc. in "inspections" table
Aqueducts - BCA not Responsible	Responsibility of third party	Notify third party if problem occurs
Weirs and Sluices	Every 12 months	Record notes etc. in "inspections" table
Tunnel	Responsibility of HCC Engineers	Notify third party if problem occurs
Locks	Every 12 months	Record notes etc. in "inspections" table
Towpath Lengths	Every 12 months	Record notes etc. in "inspections" table
Canal Lengths - Channel	Every 12 months	Record notes etc. in "inspections" table
Canal Lengths - Banks	Every 12 months	Record notes etc. in "inspections" table
Ecology - Trees	Every 6 or 18 months (with and without foliage)	Record notes etc. in "inspections" table
Canal Estate Boundary's & Holdings	Every 12 months	Record notes etc. in "inspections" table
Secondary Assets		
Feeders and Outfalls	Not recorded	Record problems in "works past & future" table
Stop Plank Facility's	Detailed - every 12 months	Record notes etc. in "inspections" table
Stop Gate facility's	Detailed - every 12 months	Record notes etc. in "inspections" table
Retaining Walls - BCA Responsible	Not recorded	Record notes etc. in "inspections" table
Retaining Walls - BCA not Responsible	Not recorded	Notify third party if problem occurs
Pumping Systems	Responsibility of third party	Notify third party if problem occurs
Manhole/Access Covers - BCA Responsible	Not recorded	Record notes etc. in "inspections" table

Manhole/Access Covers - BCA not Responsible	Responsibility of third party	Notify third party if problem occurs
Services - Electricity	Responsibility of third party	Not recorded
Services - Communication	Responsibility of third party	Not recorded
Services - Fiberway	Responsibility of third party	Not recorded
Services - Gas	Responsibility of third party	Not recorded
Services - Oil	Responsibility of third party	Not recorded
Services - Water	Responsibility of third party	Not recorded
Services - Sewer	Responsibility of third party	Not recorded
Services - Steam	Responsibility of third party	Not recorded
Services - Canal Related (pipes to water points etc.)	Not recorded	Record problems in "works past & future" table
Historical Features - Canal Artifacts (Cranes, winches etc.)	Not recorded	Record problems in "works past & future" table
Historical Features - WWII Defences	Not recorded	Notify third party if problem occurs
Historical Features - Military Training	Not recorded	Notify third party if problem occurs
Historical Features - Pre-Canal Archaeology	Responsibility of third party	Notify third party if problem occurs
Waste Sites	Not recorded	Record problems in "works past & future" table
Silt Deposits & Silt Traps - BCA Responsible	Not recorded	Record problems in "works past & future" table
Silt Deposits & Silt Traps - BCA not Responsible	Not recorded	Notify third party if problem occurs
Slipways	Not recorded	Record problems in "works past & future" table
Winding Holes	Not recorded	Record problems in "works past & future" table
Wharfs	Not recorded	Record problems in "works past & future" table
Fencing etc.	Not recorded	Record problems in "works past & future" table
Buildings	Responsibility of third party	Notify third party if problem occurs

Appendix Seven – BW AIP 2008 Inspection Classifications
(Source: [26])

Reservoir Surveillance Inspection (RSI)

Purpose

Reservoirs are high hazard assets, with potential for rapid deterioration. In line with UK practice, management of this risk will be demonstrated by Surveillance Inspections.

Content

The RSI consists of a competent employee carrying out a visual check on the dam structure(including mitres, toe, crest, pitching etc) and outlet arrangements.

Inspection Cycle

At least weekly for all reservoirs falling under the Reservoirs Act 1975, Some reservoirs will require twice weekly inspections to manage drawdown risk. Smaller reservoirs that do not fall under the Act will be managed by the Length Inspection process.

Length Inspection (LI)

Purpose

The primary purpose of the LI is to note changes in the condition of specific assets and waterway track, and to record data that increases BWs knowledge of its assets. The importance of LIs cannot be overstressed. Documentary evidence of LIs, and follow-up actions are vital in the event of complaints, enquiries, investigations or claims.

Content

LIs form a key part of the routine management of the waterway. They consist of walking the 'track', noting and reporting on a mobile device any change in the condition of specific assets, towing paths and bank protection, or to the network or waterway corridor itself as a result of wear and tear, accidental damage, natural occurrences, vandalism, third party works or other events that might affect BW property.

LIs will be extended beyond towpath or BW boundaries, for instance to the toe of embankments and beyond where leakage may be emerging, or where nearby excavation or abnormal loading may destabilise BW property.

Inspection Cycle

LIs will be carried out monthly for all towpath side and easily accessible offside elements, reservoirs and Waterway track buildings. Any element that has not been inspected will be noted as NOT SEEN. The Inspection Reviewer will identify the reasons for non-inspection and required actions to remedy this. Actions to improve access for inspection purposes to uninspected elements must be taken within 6 months. The APM will be notified of required actions and will monitor and ensure implementation. The APM will report compliance with this requirement to the GM at 3 monthly intervals.

Subject to the specific provisions below, where offside access cannot be easily achieved, a visual inspection will be carried out monthly from the nearest easily accessible point. Such inspection will be noted as REMOTE VISUAL ONLY

Annual Inspection (AI)

Purpose

AIs are carried out to record defects that are readily identifiable from an external inspection and operation of the asset and the track. They provide assurance that no significant deterioration is taking place between PIs and that the waterway as a whole is in a satisfactory working condition for the use of our customers.

Content

An AI is a more detailed inspection by a certificated AI inspector. It will be carried out annually together with the LI inspector dedicated to that length. A boat similar to that in normal use on the waterway (a deep-draughted boat if that is the norm - subject to logistical considerations) will be in attendance to allow access to all offside locations and to allow a full functional check to be carried out on all operable assets (these should mimic single user operation wherever possible).

Observations will take into account Minimum Safety Standards, and the requirements of all customers and will identify the need for any actions. They will report on any change in the condition, consequence of failure or serviceability of:
• Specific Assets, and components of assets (eg lock gates, paddles, M & E)
• Waterway Track (eg Towing Path, Bank Protection)

They should also note any changes due to:
• Wear and Tear
• Accidental Damage
• Vandalism
• Natural Occurrences
• Any other event that might affect BW property

AIs may need to be extended beyond BW boundaries, and particularly to the toe of embankments, or beyond, where such embankments are constructed on a natural slope and where leakage may manifest itself further down-slope.

The rate of change of the asset, if any, will be recorded through a thorough review of the Condition, Consequence of Failure, and Serviceability grades. The inspection will also focuson specific items (if any) highlighted in a PI report (Z2 notification) and associated Z4's.
• The Inspector will record any improvements that could be made to improve safety or improve the ease of use of the waterway by customers.
• Inspectors will be aware of assets with high heritage value (eg Listed Buildings and Scheduled Monuments, which may also be categorised as Buildings at Risk) and will understand and identify decay mechanisms affecting their historic fabric. In such cases it will be appropriate to include observations on heritage issues, references to BW Heritage Standards or to specialist heritage advice.

Inspection Cycle

AIs will be carried out annually, or more frequently if required by the APM.

Principal Inspection (PI)

Purpose

PIs ensure that we meet our safety and operational obligations and identify work necessary to meet those obligations. The PI provides a detailed record of each element of an asset and their condition, as well as the structure as a whole.

They are normally carried out on Principal Assets, and on Other Assets where the APM considers it necessary.

Content

The PI is a visual and tactile inspection of all accessible parts of the asset. It consists of a qualitative assessment of the whole asset, of each of its elements and with dimensional checks if necessary.

Inspectors will review previous AI and PI reports, notifications and recent repair history prior to inspection, and will apply engineering knowledge to assess the significance of structural defects and whether they indicate more complex failure modes than those noted by previous inspections.

Inspectors will be aware of structures with high heritage value (eg Listed Buildings and Scheduled Monuments, which may also be categorised as Buildings at Risk) and will understand and identify decay mechanisms affecting their historic fabric. In such cases it will be appropriate to include in the PI observations on heritage issues, references to BW Heritage Standards or to specialist heritage advice.

Inspection Cycle

Cycles will be determined using a risk-based approach (dependant on the asset type, its condition and consequence of failure grades). PIs may be carried out more frequently if recommended in the PI and agreed by the APM. This change in cycle will be recorded in the PI report. Inspection cycles will be managed using SAP Maintenance Plans.

Appendix Eight – BW Condition Grades for Cuttings and Embankments (Source: [7])

Grade	Description	Cuttings	Embankments
A	Very Good	Sound construction with well maintained slopes.	Sound construction with well maintained slopes and bank protection.
B	Good	Minor but not structurally significant deterioration. Minor localised face slips. Drainage systems functioning well.	Minor but not structurally significant deterioration. Minor localised face slips. No seepage. Minor deterioration of bank protection
C	Fair	Affected by minor deterioration which may develop into structurally significant defects in the long term. Drainage systems functioning adequately. Some evidence of minor movement. Old tree movement.	Affected by minor deterioration which may develop into structurally significant defects in the long term. Minor inactive face slips. Some irregularity of crest. Old tree movement. Isolated areas of significant deterioration or movement of bank protection.
D	Poor	Slips affecting face, slight bulging into channel. Drainage systems only partially functioning. Deformed fence lines and active tree movement.	Slips actively affecting face. Drainage systems only partially functioning. Deformed fence lines and active tree movement. Substantial crest subsidence and significant loss of freeboard. Active leakage at a number of points or standing water at toe of embankment (from canal or navigation).
E	Bad	Major slips affecting face and crest. Land and property at crest affected. Major bulging into canal preventing navigation. Drainage systems not functioning. Evidence of crest loading resulting in movement. Structure unstable with incipient failure.	Major active slips affecting face and crest. Tension cracks in crest Obvious toe bulging Risk of overtopping due to subsided crest. Drainage systems not functioning. Bank protection failed over large lengths. Major leakage carrying fines. Evidence of reduced toe support or crest loading resulting in movement.

N.B These tables have since been updated within the BW AIP 2008 [26].

Appendix Nine – BW Consequences of Failure for Cuttings and Embankments (Source: [7])

Category	Personal	Neighbours	Affected Property Values
5	Multiple Deaths	Widespread Urban Flooding (>0.5sg.km)	In excess of £5m
4	Multiple Serious Injuries Single Death	Flooding of small community	£2m to £5m
3	Serious Injury (1 to 2 no.)	Disruption of a major transport link Widespread flooding of agricultural land (>0.5sq.km)	£250k to £2m
2	Minor Injuries	Limited flooding to gardens Limited flooding to agricultural land (<0.5sq. km)	£25k to £250k
1	Single Minor Injury	Seepage to gardens / agricultural land No consequences	£1k to £25k

N.B These tables have since been updated within the BW AIP 2008 [26].

Appendix Ten – Hampshire Embankments Inspection - Summary Table, 2009
(Source [27])

Asset ID	Asset Name	Locality	Condition Grade	Condition Grade	Consequence of Failure	Serviceability Grade	Risk Score	Principal Inspection frequency	Additional remedial/maintenance suggestions	Priority ranking
1	Up Nateley (tp)	Up Nateley	Good	B	2	1	Low	20		
2	Brickworks Arm (tp)	Up Nateley	Good	B	2	1	Low	20		
3	Odiham Castle (os)	North Warnborough	Very good	A	3	1	Low	20		
4	Odiham Castle (tp)	North Warnborough	Good	B	4	1	Moderate	10	Monitor seepage	27
5	Champions (tp)	North Warnborough	Good	B	4	1	Moderate	10		28
6	Jolly miller (tp)	North Warnborough	Good	B	4	1	Moderate	10		29
7	Janaways (Lodge br to Colt Hill) (tp)	Odiham	Good	B	3	1	Low	15		
8	Odiham Common - West (tp)	Odiham	Good	B	2	1	Low	10		
9	Odiham Bypass (os)	Odiham	Good	B	3	1	Low	20		
10	Odiham Common - East (tp)	Odiham	Fair	C	3	1	Moderate	15	Clear debris, silt from toe ditch and regrade if the ditch cuts the slope toe at a steep angle	8
11	Broad Oak Silt Dump (tp)	Broad Oak	Good	B	3	1	Low	10		
12	Broad Oak (tp)	Broad Oak	Very good	A	3	1	Low	15		
13	Broad Oak (os)	Broad Oak	Good	B	2	1	Low	20		
14	Wilks Water (tp)	Broad Oak	Very good	A	2	1	Very low	20		
15	Lousey Moor (os)	Broad Oak	Very good	A	2	1	Very low	20		
16	Lousey Moor (tp)	Broad Oak	Very good	A	2	1	Very low	20		
17	Sandy Hill Silt Dump (tp)	Broad Oak	Very good	A	2	1	Very low	20		
18	Yew Tree Copse (tp)	Winchfield	Good	B	2	1	Low	20		
19	Yew Tree Copse (os)	Winchfield	Fair	C	3	1	Moderate	10	Monitor burrows	9
20	Thatched Cottage (tp)	Winchfield	Good	B	3	3	Low	15		

21	Thatched Cottage (os)	Winchfield	Very good	A	2	1	Very low	20		
22	Chawltons (tp)	Winchfield	Poor	D	3	2	High	10	This site will require further assessment and replacement of slipped material. This site should be monitored to ensure that overtopping does not occur during very wet weather.	3
23	Chawltons Culvert (os)	Winchfield	Good	B	2	1	Low	20		
24	Barley Mow - by road (tp)	Winchfield	Good	B	4	2	Moderate	10	Clear debris, silt from toe ditch and regrade if the ditch cuts the slope toe at a steep angle	25
25	Chatter Alley (tp)	Winchfield	Fair	C	4	1	High	10	It is suggested that the toe ditch is cleared and regraded so that the sides are less steep and provide more support for the embankment.	5
26	Tundry Pond (os)	Dogmersfield	Good	B	3	1	Low	15		
27	Tundry Pond (tp)	Dogmersfield	Fair	C	3	2	Moderate	10	Clear debris, silt from toe ditch and regrade if the ditch cuts the slope toe at a steep angle	7
28	Double Bridge Farm (os)	Dogmersfield	Good	B	3	1	Low	15		
29	Eastrop House (tp)	Dogmersfield	Fair	C	3	1	Moderate	10		10
30	Eastrop House (os)	Dogmersfield	Good	B	3	2	Low	15		
31	Dogmersfield Old Swingbridge (os)	Dogmersfield	Poor	D	3	1	High	10	Seepage issues should be addressed before loss of embankment material causes stability problems. The toe ditch should be cleared out so that water can drain away instead of ponding at the embankment toe.	4
32	Dogmersfield Old Swingbridge (tp)	Dogmersfield	Good	B	3	1	Low	15		
33	Coxmoor Wood -	Crookham	Good	B	3	1	Low	15		

	Upstream (tp)									
34	Coxmoor Wood - Downstream (tp)	Crookham	Good	B	3	1	Low	15		
35	West Hart (tp)	Crookham	Good	B	3	2	Low	15		
36	West hart (os)	Crookham	Poor	D	4	1	High	10	A remedial solution is being developed by HCC framework Consultant Mott Gifford	1
37	Crookham Deeps (tp)	Crookham	Good	B	3	2	Low	15		
38	Crookham Deeps (os)	Crookham	Good	B	3	2	Low	15		
39	Poulters Bridge - upstream (tp)	Crookham	Good	B	3	1	Low	15		
40	Poulters Bridge - upstream (os)	Crookham	Good	B	2	1	Low	20		
41	Poulters Bridge - downstream (tp)	Crookham	Good	B	3	1	Low	15		
42	Poulters Bridge - Downstream (os)	Crookham	Good	B	2	2	Low	20		
43	Crookham Road - Coal Pens (tp)	Fleet	Good	B	5	2	Moderate	10	Remediate embayments and undercutting at the canal edge	11
44	Crookham Road - Coal Pens (os)	Fleet	Good	B	5	1	Moderate	10	Clear debris, silt from toe ditch and regrade if the ditch cuts the slope toe at a steep angle. Remediate embayments and undercutting at the canal edge.	15
45	Dinorben (tp)	Fleet	Good	B	5	2	Moderate	10	Clear debris, silt from toe ditch and regrade if the ditch cuts the slope toe at a steep angle	12
46	Dinorben (os)	Fleet	Good	B	5	1	Moderate	10	Monitor burrows	16
47	Courtmoor School (os)	Fleet	Good	B	4	1	Moderate	10		30
48	Crookham Road - Cottages (tp)	Fleet	Good	B	5	2	Moderate	10	It is suggested access is agreed and the works	13

									inspected to ensure the embankment is sufficiently supported.	
49	Regent Close (tp)	Fleet	Good	B	5	1	Moderate	10	Clear debris, silt from toe ditch and regrade if the ditch cuts the slope toe at a steep angle	17
50	Regent Close (os)	Fleet	Good	B	5	1	Moderate	10		18
51	Pondtail - West (tp)	Fleet	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	19
52	Pondtail - West (os)	Fleet	Very good	A	2	1	Very low	20		
53	Pondtail to Gelvert (tp)	Fleet	Good	B	4	1	Moderate	10		31
54	Gelvert (os)	Fleet	Good	B	4	1	Moderate	10		32
55	Eelmoor (tp)	Aldershot	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	20
56	Puckridge (tp)	Aldershot	Good	B	5	1	Moderate	10		21
57	Claycart - Flash (tp)	Aldershot	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	22
58	Claycart - Golf Course (tp)	Aldershot	Good	B	5	2	Moderate	10		14
59	Rushmoor (tp)	Aldershot	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	23
60	Power Station (tp)	Aldershot	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	24
61	Ash Lock - Upstream (tp)	Aldershot	Very good	A	4	3	Low	15		
62	Ash Embankment - West of Railway (tp)	Aldershot	Fair	C	4	1	High	10	Monitor seepage.	6
63	Ash Embankment - West of Railway (os)	Aldershot	Good	B	1	1	Very low	20		
64	Ash Embankment West (tp)	Aldershot	Good	B	4	2	Low	10		26

65	Ash Embankment West (os)	Aldershot	Fair	C	5	1	High	10	Steps should be taken to stop the leaking by re-lining the canal. The embankment should be monitored and if necessary the burrows should be dealt with.	2

Appendix Eleven - Surrey Embankments Inspection - Summary Table, 2009
(Source [27])

Asset ID	Asset Name	Locality	Condition Grade	Condition Grade	Consequence of Failure	Serviceability Grade	Risk Score	Principal Inspection frequency	Additional remedial/maintenance suggestions	Priority ranking
66	Ash Embankment East (tp)	Ash	Fair	C	5	1	High	10	A winter inspection would be recommended with increased monitoring to ensure that the seepage does not worsen. Rootbowl removed soils should be replaced with similar embankment materials (eg. Clay on clay embankments and coarse soils where sand).	4
67	Ash Embankment East (os)	Ash	Fair	C	5	2	High	10	This site needs to be carefully monitored and should the seepage become any worse or begin to carry embankment material, steps should be taken to stem the leakage and reline this area of the canal and deal with the burrows.	3
68	Shawfield Road (os)	Ash	Good	B	5	1	Moderate	10		15
69	Shawfield Road (tp)	Ash	Good	B	5	1	Moderate	10		17
70	Vale Road - South of Orchard Close (tp)	Ash	Good	B	5	2	Moderate	10		14
71	Vale Road - North of Orchard Close (tp)	Ash	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	18
72	Greatbottom Flash (tp)	Ash	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	19
73	Ash Vale - North (tp)	Ash Vale	Good	B	5	1	Moderate	10	Remediate embayments and undercutting at the canal edge	20
74	Mytchett Lake	Mytchett	Good	B	5	1	Moderate	10	Monitor seepage	21

	(tp)									
75	Greyswood Drive (tp)	Ash Vale	Good	B	5	1	Moderate	10	Toe ditch maintenance required	22
76	Canal Centre (tp)	Mytchett	Fair	C	5	1	High	10	Embayments should be appropriately infilled.	5
77	Frimley Lodge Park (tp)	Frimley	Fair	C	5	1	High	10		6
78	Frimley Aquaduct (os)	Frimley	Good	B	5	1	Moderate	10		23
79	Lower Wilderness (tp)	Frimley	Fair	C	1	2	Low	15		
80	Old MOD Sewerage Works (os)	Deepcut	Good	B	1	1	Very low	20		
81	Lock 27 - Downstream	Deepcut	Fair	C	1	1	Low	15		
82	Lock 26 - Downstream (tp)	Deepcut	Good	B	5	3	Moderate	10		13
83	Lock 25 - Downstream (tp)	Deepcut	Good	B	5	1	Moderate	10		24
84	Lock 24 - Bypass (os)	Deepcut	Good	B	1	1	Very low	20		
85	Lock 23 - Upstream (tp)	Deepcut	Very good	A	1	1	Very low	20		
86	Lock 23 - Bypass (os)	Deepcut	Very good	A	1	1	Very low	20		
87	Lock 22 - Upstream (tp)	Deepcut	Very good	A	1	1	Very low	20		
88	Lock 22 - Bypass (os)	Deepcut	Very good	A	1	1	Very low	20		
89	Lock 22 - Downstream (tp)	Deepcut	Good	B	1	1	Very low	20		
90	Lock 21 - Bypass (os)	Deepcut	Good	B	1	1	Very low	20		
91	Lock 21 - Downstream (tp)	Deepcut	Good	B	1	1	Very low	20		
92	Lock 20 - Bypass (os)	Deepcut	Fair	C	1	1	Low	15		

93	Lock 19 - Bypass (os)	Deepcut	Very good	A	1	1	Very low	20		
94	Lock 19 - Downstream (tp)	Deepcut	Good	B	1	1	Very low	20		
95	Lock 18 - Bypass (os)	Deepcut	Fair	C	1	1	Low	15		
96	Lock 18 - Downstream (tp)	Deepcut	Good	B	1	1	Very low	20		
97	Lock 17 - Upstream (os)	Deepcut	Good	B	1	1	Very low	20		
98	Lock 17 - Downstream (os)	Deepcut	Good	B	1	1	Very low	20		
99	Lock 16 - Upstream (tp)	Deepcut	Good	B	1	1	Very low	20		
100	Lock 16 - Downstream (os)	Deepcut	Good	B	1	1	Very low	20		
101	Lock 15 - Winding Hole (os)	Deepcut	Good	B	1	?	Very low	20		
102	Lock 15 (tp)	Deepcut	Good	B	4	3	Moderate	10	Raise embankment to increase freeboard	30
103	Brookwood Reach (tp)	Brookwood	Very good	A	2	1	Very low	20		
104	Brookwood Allotments (tp)	Brookwood	Very good	A	2	1	Very low	20		
105	Lock 14 (tp)	Brookwood	Very good	A	2	2	Very low	20		
106	Lock 14 - (os)	Brookwood	Good	B	2	2	Low	20		
107	Lock 14 - Downstream (tp)	Brookwood	Good	B	2	1	Low	20		
108	Lock 13 (os)	Brookwood	Good	B	1	1	Very low	20		
109	Lock 13 - Downstream (tp)	Brookwood	Fair	C	2	1	Moderate	15		12
110	Brookwood Lye (tp)	Hermitage	Good	B	3	1	Low	15		
111	Brookwood Lye -	Hermitage	Good	B	2	2	Low	20		

	Upstream (os)									
112	Brookwood Lye - Downstream (os)	Hermitage	Good	B	2	1	Low	20		
113	Hermitage House Boats (tp)	Hermitage	Good	B	3	2	Low	15		
114	Hermitage Bridge - Downstream (tp)	Hermitage	Fair	C	3	1	Moderate	10	Monitor seepage	10
115	Hermitage Weir (tp)	Hermitage	Good	B	3	1	Low	15		
116	Redway Cottages (tp)	St John's	Good	B	4	1	Moderate	10		32
117	Redway Cottages (os)	St Johns	Fair	C	3	2	Moderate	10		8
118	Lock 11 (tp)	St. John's	Very good	A	5	1	Low	15		
119	Lock 11 - Downstream (tp)	St Johns	Very good	A	4	1	Low	15		
120	Lock 9 (os)	St. John's	Very good	A	2	1	Very low	20		
121	Lock 9 to Lock 7 (tp)	St Johns	Very good	A	4	1	Low	15		
122	Lock 7 (os)	St. John's	Good	B	2	1	Low	20		
123	Harelands Lane (tp)	Woking	Good	B	5	1	Moderate	10	Toe ditch maintenance required. Monitor apparent line of sewer	25
124	Step Bridge (tp)	Woking	Good	B	5	1	Moderate	10	Toe ditch maintenance required	26
125	Step Bridge - Upstream (os)	Woking	Fair	C	5	1	High	10	A winter inspection should be undertaken	7
126	Step Bridge - Downstream (os)	Woking	Good	B	5	2	Moderate	10		16
127	Chertsey Road - Upstream (os)	Woodham	Good	B	4	1	Moderate	10		33
128	Chertsey Road - Downstream	Woking	Good	B	4	2	Moderate	10		31

	(os)									
129	Britannia Wharf (os)	Sheerwater	Unknown	Unknown	4	1	Unknown	10		
130	Sheerwater West (tp)	Sheerwater	Good	B	5	1	Moderate	10	Winter inspection	27
131	Sheerwater School (tp)	Sheerwater	Good	B	5	1	Moderate	10	Winter inspection	28
132	Woodham Lane (os)	Sheerwater	Good	B	2	?	Low	20		
133	Sheerwater East (tp)	Sheerwater	Good	B	5	1	Moderate	10	Winter inspection	29
134	Lock 6 - Downstream (tp)	Woodham	Very good	A	1	2	Very low	20		
135	Lock 5 - Downstream (tp)	Woodham	Fair	C	1	1	Low	15		
136	Lock 4 - Downstream (tp)	Woodham	Fair	C	3	1	Moderate	10	Suitable natural material to infill areas where trees have fallen. Assessment of trees for felling	11
137	Lock 2 - Upstream (tp)	Woodham	Good	B	2	2	Low	20		
138	Lock 2 (os)	Woodham	Good	B	2	2	Low	20		
139	Lock 1 - Upstream (os)	Woodham	Fair	C	3	2	Moderate	10	Assessment of trees for felling	9
140	Lock 1 - Upstream (tp)	Woodham	Good	B	1	2	Very low	20		
141	River Wey Junction (os)	Woodham	Fair	C	5	3	High	10	Steps should be undertaken to increase the height of the embankment and improve the drainage detail	1
142	River Wey Junction (tp)	Woodham	Fair	C	5	2	High	10	Steps should be undertaken to increase the height of the embankment and improve the drainage detail	2

Appendix Twelve – County Council Bridge Inspection Regime
(Source [39])

County Roads (A, B, C & D Roads)**:**

Activity	**Period**	**Asset Type Covered**
Superficial Inspections	Every 2 years	On all privately owned structures
General Inspections	Every 2 years	On all structures
Principal Inspections	Every 6 to 12 years	On all structures – frequency determined by risk assessment
Close Monitor Inspections	1, 3, 6,12 monthly	On sub-standard (weak) structures – to monitor potential failure modes on unrestricted bridges
Special inspections	As required	For specific requirements
Post tensioned inspections	Once only	On PT bridges – unless condition determines otherwise
Diving inspections	Every 2 years	A scour assessment on vulnerable bridges

County Rights of Way:

Activity	**Period**	**Asset Type Covered**
General Inspections	Every 3 years	On all structures
Principal Inspections	Every 6 to 12 years	On specifically identified structures
Special inspections	As required	For specific requirements
Diving inspections	Every 2 years	A scour assessment on vulnerable bridges

Appendix Thirteen –Bridge Condition Index Value Descriptions
(Source [40])

BSCI Range	**BCS Range**	**Bridge Stock Condition based on $BSCI_{Av}$**	**Bridge Stock Condition based on $BSCI_{Crit}$**
100 → 95 Very Good	1.0 → 1.3	Bridge stock is in a **very good** condition. Very few bridges may be in a moderate to severe condition.	Very few critical load bearing elements may be in a moderate to severe condition. Represents **very low risk** to public safety.
94 → 85 Good	1.31 → 1.8	Bridge stock is in a **good** condition. A few bridges may be in a severe condition.	A few critical load bearing elements may be in a severe condition. Represents a **low risk** to public safety.
84 → 65 Fair	1.81 → 2.7	Bridge stock is in a **fair** condition. Some bridges may be in a severe condition. Potential for rapid decrease in condition if sufficient maintenance funding is not provided. Moderate backlog of maintenance work.	Wide variability of conditions for critical load bearing elements, some may be in a sever condition. Some bridges may represent a **moderate risk** to public safety unless mitigation measures are in place.
64 → 40 Poor	2.71 → 3.7	Bridge stock is in a **poor** condition. A significant number of bridges may be in a severe condition. Maintenance work historically under funded and there is a significant backlog of maintenance work.	A significant number of critical load bearing elements may be in a severe condition. Some bridges may represent a **significant risk** to public safety unless mitigation measures are in place.
39 → 0 Very Poor	3.71 → 5.0	Bridge stock is in a **very poor** condition. Many bridges may be unserviceable or close to it. Maintenance work historically under funded and there is a huge backlog of work.	Many critical load bearing elements may be unserviceable or close to it and are in a dangerous condition. Some bridges may represent a **high risk** to public safety unless mitigation measures are in place.

Appendix Fourteen – BCA Lock Gate Maintenance History
(Source: [41])

	Upper Gates			Lower Gates		
No. of Lock	**Year installed**	**Manufacturer**	**Notes**	**Year installed**	**Manufacturer**	**Notes**
Lock 1	Pre1992	Restoration	Re-braced/re-planked and ironed 1999. Heal rotting, immediate replacement	1984	Inland Waterways	Have been re-braced/re-planked and ironed. Could be imminent failure
Lock 2	2007	Green Oak Carpentry Ltd		2007	Rochdale Council (BW)	
Lock 3	2007	Green Oak Carpentry Ltd		2007	Green Oak Carpentry Ltd	
Lock 4	Pre1992	Restoration	Can make gate last until 11/12 programme	2007	Green Oak Carpentry Ltd	Re-planked in 1999/2000
Lock 5	Pre1992	Restoration	In 11/12 programme	Pre1992	Restoration	Were re-braced and re-planked in 2005
Lock 6	Pre1992	Restoration	Frames were made from unsustainable wood “green hart” Can get another 2/3 year life if replanked	2006	Rochdale Council (BW)	
Lock 7	1997	BCA	Wood from Sussex There is a plank patch repair due to vandalism. Needs ironed as seal up okay	1997	BCA	
Lock 8	Pre1992	Restoration	Not in programme but needs to be.	Pre1992	Restoration	There is iron on large split. Not in programme but needs to be.
Lock 9	Pre1992	Restoration	Have been ironed Needs replacing	2002	BCA	Can reuse all balance beams as all okay
Lock 10	2002	BCA		Pre1992	Restoration	Have been refurbished braced/re-planked
Lock 11	2006	BCA		Pre1992	Restoration	Braced 2009

Lock 12	Pre1992	Restoration		Pre1992	Restoration	Were re-planked in 2000. Have funds already for this lock
Lock 13	Pre1992	Restoration	Can brace/iron/steel head caps to preserve In 11/12 programme	Pre1992	Restoration	Can brace/iron/steel head caps to preserve. In 11/12 programme
Lock 14	Made 2000 Fitted 2006	BCA	In 11/12 programme	Pre1992	Restoration	AL noted tree shading affecting condition here. In 11/12 programme.
Lock 15	Late 1990s	BCA		Pre1992	Restoration	
Lock 16	Pre1992	Restoration	In 10/11 programme	2002	BCA	
Lock 17	1997/8	BCA	Requires re-planking In programme for 10/11 due to Jacobs – needs adjusting	Pre1992	Restoration	This needs to be adjusted in programme.
Lock 18	2007	Green Oak Carpentry Ltd		1992/3	BCA	In programme for 12/13 – needs to be adjusted in programme
Lock 19	1995/6	BCA	Was in programme for 10/11 so programme needs adjusting	1995/6	BCA	Was in programme for 10/11 so programme needs adjusting
Lock 20	May 2010	Green Oak Carpentry Ltd	Needs further work SM – Uppers need new balance beams	1980	Royal Aircraft Establishment	AL noted gates could be braced, capped/ironed to extend life by 3 more years
Lock 21	2009	Green Oak Carpentry Ltd		2008	Green Oak Carpentry Ltd	
Lock 22	1994/5	BCA	Have been re-planked Needs adjustment in programme	1994/5	BCA	Have been re-planked Needs adjustment in programme
Lock 23	Pre1992	Restoration		1994/5	BCA	
Lock 24	Pre1992	Restoration		1995/6	BCA	
Lock 25	Pre1992	Restoration	Have been re-planked	Pre1992	Restoration	BCA have replacements – needs adjustments JC noted keeping original apron (solid

						elm)
Lock 26	Pre1992	Restoration		2009	Green Oak Carpentry Ltd	Needs new balance beams & paddle frames
Lock 27	1997	BCA	Rangers say in good condition		Restoration	Have been replanked
Lock 28	2009	Green Oak Carpentry Ltd		1995	BCA	
Dry Dock	Late 1990s	BCA	SM said we could use old balance beams from lock 28			No Lower Gates
Lock 29	2000	BCA		2008	Green Oak Carpentry Ltd	

N.B. This information was recalled from BCA Rangers memory and therefore there may be some variations in the year of instillation and manufacturer suggested above.

Appendix Fifteen – BCA Financial Plan 2009/10
(Source [42])

	Original Budget 2009/10 £	Revised Budget 2009/10 £	Forward Budget 2010/11 £
Expenditure			
Employees	511,300	501,100	524,500
Premises	86,800	90,200	86,800
Transport	84,200	84,200	84,200
Supplies & Services	41,600	35,000	41,600
Dredging	10,000	10,000	10,000
Special Project Research	3,600	2,200	3,600
Total Revenue Expenditure	737,500	722,700	750,700
Income			
Boat Licences	19,500	17,000	19,500
Sales	3,700	4,000	4,000
Angling	10,900	11,000	11,000
Rents and Hire of Facilities	57,100	64,200	60,000
Group Activities	15,400	17,000	15,400
Fibre Optic Cable	54,400	49,300	49,300
Donations	10,600	11,400	10,600
Total Revenue Income	171,600	173,900	169,800
Contribution to/(from) Reserves	7,900	(9,892)	(7,101)
Net Revenue Expenditure	573,800	538,908	573,800

Appendix Sixteen – SCC Three Year Capital Works Programme
(Source [43])

Capital Works Programme 2009/10

No.	Brief description	Amount (£'000)	Estimated date when this spend will start	Estimated date when this spend will finish	Risk of cost slipping or being more than what is estimated here? (High, Medium or Low)	Revenue impact i.e. savings or cost
1	To carry out urgent repairs to Lock 12 as recommended in the principal lock inspection report: • Replace failed bywash pipe • Fill voids around lock chamber • Replace upper lock gates	£60	Sept 2009	March 2010	High	Collapsed bywash pipe is associated with a massive void extending under the towpath and adjacent garage forecourt – potential for collapse threatens public safety and/or substantial third party claim for damages. Lock inspection report suggests void on offside, requiring further geotechnical investigation. Failure of upper lock gates could result in localised flooding.
2	To carry out a study of flood inflows and the hydraulic performance of Mytchett Lake and its overflows to determine the actual overflow capacity in extreme events, as recommended in	£10	Sept 2009	March 2010	Low	Failure to complete the study by 31 December 2009 will result in the county council being in breach of its statutory duties under the Reservoirs Act 1975

	the 2007 inspection report under Section 12 Reservoirs Act 1975					
3	To carry out urgent repairs to Lock 1 as recommended in principal lock inspection report: • Replace bywash pipe	£20	Sept 2009	March 2010	Low	The existing bywash pipe is in imminent danger of collapse. Collapse could lead to water levels in the reach above rising with potential for significant damage to third party property
4	To carry out urgent repairs to Lock 17 as recommended in principal lock inspection report: • Rebuild upper wing walls • Repair upper lock gates	£40	Sept 2009	March 2010	Medium	The upper wing walls are in imminent danger of collapse. They are most likely to collapse if disturbed by someone standing on them or by a vehicle or a boat passing by. If they collapse in these circumstances, the potential for serious personal injury and third party damage is high
	Total Cost of Countryside Contracts Capital schemes is	£130				

Capital Works Programme 2010/11

These capital projects will deliver urgent improvements to lock structures and embankments on the Basingstoke Canal identified in the principal lock inspection reports; the embankments survey; and the draft asset management plan.

Permission is sought to carry forward the funds previously allocated for rebuilding Lock 17 upper wing walls, which it has not been possible to spend in the current financial year. It is proposed to appoint a principal contractor in 2010 to carry out the refurbishment works, which will speed up implementation and give much greater certainty as to costs.

No.	Brief description	Amount (£'000)	Estimated date when this spend will start	Estimated date when this spend will finish	Risk of cost slipping or being more than what is estimated here? (High, Medium or Low)	Revenue impact i.e. savings or cost
1	To carry out the following improvement works as recommended in the principal embankments survey: • Raise the level of the offside embankment below Lock 1 to increase freeboard • Install Nicospan soft bank protection, dredge, backfill and replant to prevent further bank erosion	40	April 2010	March 2011	Low	The existing embankments have a very low freeboard – 150mm or less – leading to a high risk of overtopping. The surrounding area is built up and the consequence of failure is very high. Soft bank protection has an expected life of up to 20 years
2	To modify winding gear and install safety barriers at lock bypass culverts to address identified drowning hazard – Locks 1/2/3/6/7/11/12/14 & 15	45	April 2010	March 2011	Medium	There was a drowning in 2007 which could have been prevented if safety barriers had been in place
2	To carry out the following critical maintenance/ restoration works to Lock 15 as recommended in the	40	April 2010	March 2011	Medium	The lower offside wing wall is undermined by up to 1.5m immediately downstream of a

	principal lock inspection report: • Seal and backfill voids under lower offside wing wall • Raise embankment to reduce risk of overtopping • Install anti-scour bank protection 15m upstream and 30m downstream of lock					bridge abutment, threatening collapse of the towpath. Suitable anti-scour bank protection is required to prevent further undermining of wing walls
3	To carry out the following critical maintenance/ restoration works to Lock 19 as recommended in the principal lock inspection report: • Repoint lower towpath side wing wall and repair damaged kingpost extension • Underpin or replace hanging lower offside wing wall • Extend bypass outfall to protect lower wing walls • Replace upper and lower lock gates • Install anti-scour bank protection 15m upstream and 30m downstream of lock	75	April 2010	March 2011	Medium	The lower offside wing wall is in imminent danger of collapse. If it collapses, the potential for serious personal injury and third party damage is high. The cost of rebuilding a wing wall would be considerably higher if it were allowed to collapse. It is essential to provide hard bank protection up and downstream of locks to prevent further undermining. The integrity of upper lock gates in the Deepcut flight is critical to ensuring that the canal remains in water throughout the year. Failure to maintain adequate water levels risks damaging the SSSI
4	To carry out the following critical maintenance/ restoration works to Lock 20 as recommended in the principal lock inspection report: • Replace lower offside wing wall	75	April 2010	March 2011	Medium	The lower offside wing wall is in imminent danger of collapse. If it collapses, the potential for serious personal injury and third party damage is high. The cost of rebuilding a wing wall would

	• Repair damaged king post extension in lower towpath wing wall • Extend bypass outfall to protect lower wing walls • Replace upper and lower lock gates • Install anti-scour bank protection 15m upstream and 30m downstream of lock					be considerably higher following a collapse
5	**To carry out the following critical maintenance/ restoration works as recommended in the principal lock inspection report:** • **Replace upper lock gates at Locks 13; 27 and 28**	17	April 2010	March 2011		The integrity of upper lock gates in the Deepcut flight is critical to ensuring that the canal remains in water throughout the year. The upper gates at Lock 28 retain a substantial quantity of water in the Mytchett Pound
	Total 2010/11	**292**				

Capital Works Programme 2011/12

TBC

Appendix Seventeen - HCC Three Year Capital Works Programme
(Source [44])

CCRA – Countryside Service

Basingstoke Canal

Three Year Capital Works Bid

1. These capital projects will deliver urgent priority repairs and improvements to earth bank structures on the Basingstoke Canal identified in the bank inspection reports carried out by White Young and Green in partnership with Hampshire County Council. Where possible both material and required engineering monitoring cost have been included.

2. Costs are best estimations based on current knowledge and known rates and charges. In most cases the Canal Authority have worked with Hampshire County Council structural and geotechnical engineers and in partnership with specialist consultancies;

No.	Brief description	Estimate	Timetabled Priority	Estimated Duration	Basis of Estimate	Notes
1	**West Hart Embankment**. Category D (Very High Risk of Failure) Land Slippage and Slope Slumping with multiple leakage from bed of canal. Tree and Vegetation Management with qualified engineering monitoring in place now and future.	150,000	ASAP	14 months	Evidence from most recent survey suggests a combination of remedies using specialist contractors in three stages so as not to impact on structural integrity.	Potential significant saving if work is done in order to manage risk of wide spread flooding. Sub Power Station and Village in close proximity. Extensive damage expected to surrounding property.
2	**Dogmersfield Old Swing Bridge**. Site off side embankment. Persistent seepage through bank with sheet piling and a clay backfill	15,000	Year 1	12 months	Sheet piling solution 5m pile length x 12m run x £200 per sq m + £3,000 for other work.	Impact from flooding to agricultural land.

	required.					
3	**Ash Embankment (West)**. Animal burrowing activity management required. Significant tree issues and vegetation clearance to gain access to bank for further monitoring. Soft Bank Protection requires upgrading	58,000	Year1	10 months	Evidence from most recent survey suggests using specialist contractors in three stages so as not to impact on structural integrity and ecological quality.	Impact from flooding to commercial and private land initially. Housing and substantial property not far away and potentially at risk.
4	**Chatter Alley Embankment.** Tow ditch in poor state, water edge fair. Evidence of third party interference. No access from private land owner, no tree threats but requires qualified engineering monitoring	5,000	Year 1	**Ongoing**	2hrs per week for 50 weeks x £50 per hr Monitoring only at present	If were to collapse would cause severe flooding to neighbouring property. Consultation with private land owner.
5	Installation of Emergency Stop Gates. **To reduce and control risk down from high to medium. Minimise damage from flooding and reduce ongoing maintenance cost.**	300,000	Year 1	Over 3 years	Gates made of high grade green oak fitted into Bridge Holes with required posts, metal work and security fixtures. 4 No sets of gates x £75,000	The case for this action is to immediately reduce the risk from flooding. Additionally more control over water flow is achievable during emergency conditions with the added benefit of reducing ongoing costs.

6	Culverts. **An Inspection of all culverts running under the canal now needs to take place. HCC Engineers are working on a schedule of rates at the moment. Access issues on remote parts of the canal will have effect on rates. There are approximately 40 culverts in Hampshire**	20,000	Year 1	6 months	40 no culverts x £500 per culvert	No allowance for repairs in 2010/11 as these are as yet unquantifiable
7	Swan Cutting. **Suspected Land Slip**	75,000	Year 1	3 months	Sheet piling solution 5m pile length x 40m run x £200 per sq m + £5,000 for other work	The towpath side bank is in imminent danger of collapse. If it collapses, the potential for serious personal injury and third party damage is high. The cost of rebuilding after collapse would be considerably higher
	Total For 2010/11	**£623,000**				
8	**Chawltons Embankment at Dogmersfield.** Category D (high risk of failure) Tree issues on banks, slumping with slope movement. Culvert within 10 metres. Requires repair and management with continual qualified engineering monitoring	20,000	Year 2	12 months	Sheet piling solution 5m pile length x 10m run x £200 per sq m + £5,000 for other work + £5,000 for monitoring	The towpath side bank is in imminent danger of collapse. If it collapses, the potential for serious personal injury and third party damage is high. The cost of rebuilding after collapse would be considerably higher

	put in place					
9	**Ash Embankment.** Down stream from Ask Lock – Sloping and slippage inherent. Slumping evident with significant vegetation management issues. Large trees need removing. Animal burrowing activity at the tow with seepage evident.	25,000	Year 2	12 months	Sheet piling solution 5m pile length x 20m ? run x £200 per sq m + £5,000 for other work.	The integrity of this steep embankment is important as this protects a large private housing development. Failure to maintain could cause loss of life, property and amenity value.
10	Odiham Common (East) **Towpath Leak through bank with critical voiding and potential for failure. Potential tree threats that require attention.**	40,000	Year 2	12 months	Fill voids and manage trees.	Large volume of water would be let loose in this area causing immediate loss of amenity value and damage to a neighbouring SSSI area.
	Total for 2011/12	**£85,000**				

11	Yew Tree Copse. **Private ownership is an issue. HCC responsible for bank. Undercutting leading to some instability. Tree and vegetation maintenance required. Animal activity. Requires qualified engineering monitoring.**	£5,000	Year 2	24 months	2hrs per week for 50 weeks x £50 per hr	Requires monitoring with some vegetation management put in place. Consultation with Land owner initiated.
12	Tundry Pond Embankment. **Animal activity in bank needs management. Old tree roots need removing and void filled. Coppice manage trees and vegetation. Improve free board.**	20,000	Year 2	24 months	Increase freeboard on tow path and some tree management	Loss of amenity value with expected flooding to rural area and woodland. Lower risk.
13	**Eastrop House Embankment. Past leakage with loss of free board. Require extending culvert pipe and put qualified engineering monitoring in place.** **Put in place qualified engineering monitoring.**	£25,000	Year 2	24 months	Increase freeboard on tow path and some tree management	Access issue, towpath requires attention, raising up to provide additional free board clearance.

14	**Repairs to Culverts**	£n/k	Dependent on survey outcome			Repairs are as yet unquantifiable
	Total 2012/13	**£50,000**				
	Grand Total	**£758,000**				
	Note Repairs to Culverts	**Suggested £100,000**				

Scheme Justification/Business Case

The Canal has suffered many years of under investment and now represents a significant risk to the County Council. The whole canal is designated a Site of Special Scientific Interest (SSSI) for the quality and diversity of its aquatic habitat, but the SSSI is currently in unfavourable declining condition, partly due to an inability to maintain adequate water levels. Hampshire County Council is potentially in breach of its statutory duty if it fails to take action to reverse the decline in the condition of the SSSI. The canal towpath represents a valuable recreational resource and a potential key sustainable cycle transport link. The canal has been closed to through boat navigation traffic for the past 4 years due to failing infrastructure and water supply issues and as a result income from boat licenses has declined significantly. Volunteers from the Surrey & Hampshire Canal Society carry out minor improvement works, contributing a minimum of £40,000 to the Canal each year by raising funds for materials and providing voluntary labour. Failure to respond to the urgent recommendations in the condition inspection reports risks serious reputational damage to the County Council. Surrey County Council face similar issues for the length of the Canal within their jurisdiction. Cabinet at Surrey

CC recently agreed to invest £900k over 3 years to respond to the matters identified in the survey, although this has yet to be approved by Full Council.

Subject to the capital investment programme being approved, a tender process will be undertaken with a view to appointing a principal contractor for all refurbishment works. This will ensure maximum value for money and consistency of workmanship and give much greater certainty of costs for future years.