SURREY
COUNTY COUNCIL
Transportation

BASINGSTOKE CANAL OPTIONS APPRAISAL

PROJECT TEAM 3

Engineering Review

Final Report

EXECUTIVE SUMMARY

Project Title: Basingstoke Canal Options Appraisal
Project Team 3

Document Title: Engineering Review -
Final Report

EXECUTIVE SUMMARY

Client Reference:

Date: 12 October 2006

Prepared By: Print Graham Cole

Sign .....

Authorised By: Print Stephen Child

Sign .....

THIS REPORT IS DRAFT UNLESS SIGNED

Amendment List

Iss. / Rev.	Iss. / Rev. Date	Remove		Insert	
		Page	Iss. / Rev.	Page	Iss. / Rev.

INTRODUCTION

The Basingstoke Canal runs for 32 miles from Greywell in Hampshire to a junction with the Wey Navigation in Byfleet, Surrey. The Basingstoke Canal Authority (BCA) manages the operation of the Canal from its headquarters at Mytchett, Surrey. The County Councils of Hampshire and Surrey own the Canal within their respective areas.

This Report considers the engineering and economic aspects of closing parts of the Canal to navigation. This Report will also have relevance to the working groups considering Options 1 and 2. Irrespective of the outcome of these deliberations there will still be an asset to be managed. This Executive Summary should be read in conjunction with the Final Report (doc.no. 3608/04).

ASSET MANAGEMENT

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. The development of an asset management plan can help identify the most effective way of determining and then dealing with any backlog of maintenance

The World Bank recommends that 1% of the reconstruction cost of an asset is spent on annual maintenance to keep it in a satisfactory condition. 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 £76,001 that is currently being spent on lock maintenance. The recommended maintenance figure assumes that the asset started life in a reasonable condition. The work carried out during this Study suggests that the restoration of the Canal was under – capitalised and that the maintenance of the canal now suffers as a result.

British Waterways recommend a regime of inspections for canal assets that include length inspections, intermediate inspections and principal inspections. The BCA follow many of these recommendations but improvements could still be made. It is important that inspections are planned, carried out and recorded because this is the basis for any asset management plan, risk register and limitation of liability for claims. The inspection process also provides the data necessary to implement an optimised maintenance regime. The BCA has started to determine the performance of its assets.

ASSET INVENTORY AND CURRENT CONDITION

Embankments and Channel

The basic structure of any canal is the water channel and towpath. The channel itself is formed in cutting or embankment depending on the localised topography. Unusually, the channel of the Canal was not lined with clay at the time of construction. Generally, the absence of clay did lead to seepage problems in places when the Canal was refilled following restoration. 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.

A deep saucer shape was opted for the channel at the time of restoration. 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 which affects the integrity of the embankments. This is most noticeable in the most intensively navigated areas of the canal. However, because the movement in the banks is a natural process, this process will continue whether the Canal remains open to navigation or not. Hence measures must be taken to maintain and protect the banks even if the Canal is closed.

Another 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 are 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. There are also problems caused by crayfish and mammals that borrow into the embankment creating voids.

Reports prepared by British Waterways and Surrey County Council conclude that the biggest threat to the embankments is that of over topping, leading to catastrophic erosion and failure. This is a key consideration for the future management of embankments along the Canal. If the Canal were to be closed to navigation then the embankments would still need to be maintained to prevent failures and resulting water loss, which may cause flooding, and to comply with the SSSI regulations.

Dredging provides the necessary draught for boats to navigate safely. It also improves the condition of the canal bed which benefits aquatic life. Therefore, dredging would need to continue even if the Canal were partially closed to navigation if the conditions appropriate to the SSSI status are to be maintained, although the frequency could be reduced. Partial closure would also require investment in a second dredging facility.

Sluices and Weirs

There are 7 sluices and 3 weirs on the canal. The BCA has water management 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.

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. For this reason, the sluices and weirs would all need to be maintained in full working order even if the Canal were to close to navigation. 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.

Additionally, there are restrictions from the SSSI status, on reducing the water level in the Canal. Therefore, there would be very little difference in costs regarding these structures if the canal were to be partially closed to navigation.

Locks

There are 29 locks on the Canal and 28 of these occur in the Surrey section. 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. There is a continuing problem with towpath voids caused by the by-wash culverts.

The main framework of the lock gates and the secondary planking should have design lives of 30 and 10 years respectively. However, these lives do not 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 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. There is a backlog of repairs to the lock gates that would probably not have occurred if the desired design life had been achieved. The gates appear to be currently deteriorating quicker than they are being replaced. A limited increase in investment would be required to arrest this decline.

Reservoirs

The requirements of the Reservoirs Act do not apply to canals. However, if the Canal were to be closed to navigation, most of the pounds are likely to be reclassified as reservoirs. The Environment Agency is the enforcement authority for the Reservoirs Act. It has recently determined that the Mytchett Lake pound is a

reservoir under the terms of the Act. Therefore, Surrey County Council has now employed an inspecting and supervising engineer. Other pounds might need to be added to this list of the Canal were to be closed to navigation.

EXTERNAL INFLUENCES

There are a significant number of stakeholders besides the users of powered pleasure craft (both resident and visitors). These include commercial boat operators, house boat owners, canoeists, anglers, walkers, cyclists and ecologists. There are also a large number of organisations involved with the BCA as well as the owning County Councils including riparian local authorities, English Nature (part of Natural England from October 2006), the Environment Agency, the Surrey and Hampshire Canal Society and the Inland Waterways Association.

There are a number of other key influences. A total of 28 miles out of the overall 32 miles of Canal have been designated as a Site of Special Scientific Interest (SSSI). A significant length of the Canal is included in a Conservation Area and a number of the structures are Listed Buildings or have been scheduled as Ancient Monuments. These influences significantly effect how the Canal is currently managed and how it might be managed in the future.

The terms of abstraction licences and the SSSI limit the amount of water that can be recycled and the number of boat movements that can be made. 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 1200 per year (i.e. 600 round trips). 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 self sufficient given this restriction on boat movements.

The SSSI designation places restrictions on the activities that may be performed in that area. In simple terms, consent must be sought from English Nature if an organization or individual wishes to carry out any of the activities specified as a Potentially Damaging Operation (PDO) for that SSSI. If the restrictions on activities in an SSSI are broken, English Nature may seek a prosecution or court injunction.

The SSSI status is highly restrictive with regard to what can be done with the Canal if it is closed to navigation. The channel must be kept dredged to avoid it silting up and the sluices and weirs must be kept in working order so the water levels can be controlled effectively. It also means that English Nature will almost certainly refuse any proposal involving major construction works. It may be possible to get the SSSI status removed, though this is unlikely as the special interest in the site will not have been lost by closure of navigation, in fact it may even be enhanced due to the reduction in traffic.

The Basingstoke Canal conservation area encompasses the entire canal in both Hampshire and Surrey. Generally the conservation area includes the canal itself, the banks and towpath, and some tree belts. If the Canal were to be closed, it is likely the conservation area would remain very much as it is now, as the lack of boat traffic

would not change the architectural and historical interest the area seeks to protect. The requirements of the conservation are will probably prevent any major changes to the locks, such as converting them to weirs.

RISK ASSESSMENT

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 and CDM Regulations 1994) to maintain the asset in a safe condition to protect employees and the public. It is not possible to insure against breach of statute.

Levels of risk and economic costs have been assessed for four Levels of Service as follows:

- Existing situation
- Partial Closure to navigation – water out
- Partial Closure to navigation – SSSI water levels
- Investment plan

It has been assumed that closure to navigation would only apply to the Surrey section of the Canal within the Deepcut flight.

Embankments

A breach of one or more of the embankments on the canal is one of the largest risks that needs to be managed, particularly given the poor condition of some of them. A risk evaluation matrix (see Table 1) has been prepared based on data provided by a British Waterways inspection of the Canal.

It should be noted that the level of risk at 10 of the 15 embankment sites is unaffected by the partial closure proposals in the lower Surrey section. Therefore, partial closure would not significantly affect the overall level of risk faced by the Canal Authority.

Towpath and Locks

Similar exercises have been completed for the lock gates and for towpath users (see Table 2). The retention of sufficient water to satisfy the SSSI requirements means that there is no change to the level of risk for lock gates compared with the existing situation (apart from in the Woking section where the SSSI requirements do not apply). There is a lower level of strategic risk for lock gates than there is for earthwork embankments

Table 1 – Embankment Risk Rating Matrix

Location	BWB Scores		Risk Rating			
	Condition	Effect	Existing	Partial Closure (no water)	Partial Closure (SSSI)	Investment
1	C	5	High	Low	High	Medium
2	C	4	High	Low	High	Medium
3	C	4	High	Low	High	Medium
4	C	4	High	Low	Low	Medium
5	C	4	High	Low	Low	Medium
6	C	5	Unacceptable	As existing	As existing	Medium
7	C	4	High	As existing	As existing	Medium
8	D	4	Unacceptable	As existing	As existing	Medium
9	B	4	High	As existing	As existing	Medium
10	C	4	High	As existing	As existing	Medium
11	D	2	High	As existing	As existing	Medium
12	C	2	Medium	As existing	As existing	Medium
13	C	2	Medium	As existing	As existing	Medium
14	D	1	Medium	As existing	As existing	Negligible
15	E	2	High	As existing	As existing	Medium

Table 2 – Towpath Users Risk Ranking Matrix

Typical Locations	Risk Ratings			
	Existing	Partial Closure (no water)	Partial Closure (SSSI)	Improvement
Towpath Condition	Medium	Medium	Medium	Low
Lock Chambers	Medium	High	High	Medium
Paddle Gear	Low	Medium	Medium	Negligible
Bywash Culverts	Medium	High	High	Low
Navigable Channel	Medium	High	Medium	Medium
Political Risk	Low	High	Medium	Negligible

It can be seen that the levels of risk are likely to increase for towpath users if the canal were to be closed to navigation – particularly if it its condition were to be allowed to decline, especially for the 'water-out' option. The main concern here is the expanse of silt that would be left exposed. Furthermore, a lock in an effectively derelict condition poses a higher level of risk than one that is being properly maintained.

ENGINEERING AND ECONOMIC CONSIDERATIONS

The levels of risk associated with the operation of the Canal could be reduced if the Canal were to be partially closed to navigation and the water levels were to be substantially reduced. This is unsurprising as the greatest level of risk is a breach of the canal inundating populated areas. However, this step would be in direct contravention of the SSSI requirements as well as being environmentally undesirable.

The revenue allocation for structural maintenance (£25,333) is very small given the size of the asset and it is hard to see how this could possibly be reduced any further for any of the proposed Levels of Service. The 'fire-fighting' approach to structural maintenance tends to increase overall costs. It would be more cost-effective in the long term to improve the overall condition of the asset by an injection of capital so that revenue maintenance could be more effectively employed.

Partial Closure (SSSI water levels)

The Canal would be partially closed to navigation but the water levels would effectively be maintained at the current design levels to satisfy the requirements of the SSSI (although this does not apply to the section through Woking). This option has very little effect on the levels of risk associated with embankments and lock

gates. However, there could be a reduction in the level of maintenance associated with the paddle gear.

In the longer term it would be necessary to replace the lock gates with a weir within the lock chambers. This would avoid some of the revenue maintenance costs but would require a significant capital investment in order to carry out this type of construction at remote locations. Further consideration needs to be given to the hydrology of this option. However, it is unlikely that any form of solution would cost less than £50,000 per lock. The need to secure Conservation Area Consent for the effective demolition of the existing locks also needs to be taken into account.

The existing annual costs for lock gates and routine maintenance are £50,668 and £169,025 respectively. Assuming that one third of the routine maintenance costs is attributable to lock paddle gear then the effective closure of locks would save £107,009 per year. Given that there are 29 locks on the Canal then the average cost per lock is £3,689 per year. If a conservative figure of £50,000 per lock for the conversion to a weir is assumed then it would take at least 13 years to recover the investment.

The existing problems with the stability of the bywash culverts would remain and continued maintenance costs would be incurred. The recent (August 2006) cavity discovered at Brookwood Crossroads is pertinent. The water levels are currently well below design levels and yet this void still appeared confirming that the pre-existing condition cannot be changed simply by reducing water levels. In the longer term the bywash culverts could be replaced by a designed weir built within the lock chamber but the voids would still need to be dealt with.

There would be a continuing need to maintain the embankments. The engineering works cost of a typical breach depend on the topography of the site. Some published examples vary between £100,000 and £1.27m. The third party costs of a breach depend on the properties below the level of the Canal but could easily exceed £10m. The existing annual revenue allocation for bank inspection and bank protection amounts to £30,400. This is good value for money, given the potential consequences of a breach, as long as it effectively reduces the potential liability of a bank failure.

In summary, it is doubtful whether the capital investment required to convert the locks into weirs could be justified to save a small revenue allocation, particularly as the key risk liabilities would remain.

Partial Closure (water out)

In this option the Canal would be partially closed to navigation but the water levels would be allowed to drop so that the channel became an open ditch. The Canal would effectively revert to an abandoned condition if this option were pursued. However, it would be possible to reinstate at some point in the future unlike the option above which proposes the construction of weirs within the existing lock chambers.
The levels of risk associated with the stability of the embankments reduce because there is no impounded water. However, the nature of the embankment material is

such that as it dries out then it will tend to shrink and any subsequent return of water, either through design or from a storm event, is likely to substantially increase the risk of a breach.

The level of risk to towpath users would increase from large areas of exposed silt. There would also be a continuing need to maintain the towpath as a walking and cycling recreational route. This option would depend on the abandonment of the SSSI and this is considered to be unlikely.

Maintenance Backlog

The British Waterways inspection included a series of estimates of the work required to restore sections of embankment to a satisfactory condition. This information has been summarised below (see Table 3).

Table 3 – Embankment Remedial Works

Section	Existing Risk (see Table 1)	Short term (£) (< 3 years)	Medium term (£) (3 to 10 years)	Long term (£) (> 10 yrs)
1	High	1,500	45,000	nil
2	High	3,000	9,000	nil
3	High	nil	2,000	nil
4	High	2,000	27,000	nil
5	High	2,900	nil	nil
6	Unacceptable	359,500	65,000	nil
7	High	4,500	43,000	nil
8	Unacceptable	2,500	nil	nil
9	High	5,500	nil	nil
10	High	4,000	11,000	nil
11	High	38,200	nil	nil
12	Medium	1,000	18,000	nil
13	Medium	2,500	3,000	nil
14	Medium	2,100	nil	nil
15	High	13,800	nil	nil
Totals		443,000	223,000	NIL
Amount per year		147,666	31,857	NIL
Amount per year (excluding section 6)		27,833	22,571	NIL

The amount currently spent per year on bank protection is £15,200. This compares reasonably favourably with the recommended expenditure per year set out in Table 3 if the works to Section 6, which has been classified as a reservoir, are excluded. There is a strong possibility that the inspecting engineer will require a similar

amount of work to be carried out as currently recommended by the BWB inspection. The partial closure options have both assumed that section 6 would continue in navigation. Therefore, it would appear that substantial work will be required to this section irrespective of the outcome of the current Study. The remaining recommended work could be accommodated within a marginally restructured budget within existing limits. However, there is no scope for a reduction in budget, particularly as the sections inspected by the BWB are all likely to remain in full navigation.

CONCLUSIONS

The Basingstoke Canal is a very substantial asset. It appears to have been under funded since restoration. The present maintenance allocation is below recommended levels. There is a significant backlog of maintenance and the levels of risk are high.

The engineering and economic outcome is heavily influenced by environmental considerations (SSSI, Conservation Area, hydrology and recreation). The eventual conclusion will need to take all of these considerations into account.

A risk assessment exercise for the canal has been commenced. It has been shown that the earthwork embankments have a higher level of strategic risk than lock gates but the latter are more important at a tactical or operational level. The work done to date suggests that the closure of certain parts of the Canal to navigation does not significantly reduce the level of strategic corporate risk.

Partial closure to navigation within the Surrey section will not permit revenue savings to be made if the water levels are maintained at the current levels.

It is considered to be unlikely that the SSSI will be rescinded to enable the water levels to be reduced. Significant liabilities would remain for this asset in the event that a partial closure was determined.

The classification of the Mytchett section as a reservoir is likely to mean that a significant amount of work will be required by the Environment Agency. It has not been envisaged that this section would be closed to navigation.

The Canal is an important part of the drainage network in the area. Partial closure to navigation would still require the weirs and sluices to be maintained in order to effectively manage this drainage network.

Substantial progress has been made in recent years by the BCA to implement an effective inspection and record keeping regime. Further work is required, together with the implementation of an asset management plan, to permit a more effective maintenance plan.