11. Water Supply Issues

The original water supply for the Shrewsbury and Newport Canal was supplied from the Shropshire Union Canal (SUC).

When consultants W.S.Atkins investigated the availability of water supplies in 2003, British Waterways confirmed that water could no longer be supplied from the Shropshire Union to the S&NC as the traffic volumes on the Shropshire Union, which were predicted to rise, would required all the water supplies available to that Canal during the boating season. Water for the initial fill of S&N Canal could, however, be supplied during the winter months.

As a result Atkins confirmed that the water required to operate the locks on the Newport Canal would have to be recycled by back-pumping the volume of water dropped, each time a boat passed through the locks, back up to the top pound on the Shropshire Union Canal. This involved lifting the water up a flight of seventeen locks over a length of 2.4 kilometres and a rise of 31.6 metres. In addition to the water required to operate the locks there are water losses through poorly sealed lock gates and the normal losses from the pounds between the locks that will all require pumping.

The provision and installation of the back-pumping equipment required will add to the cost of traditional restoration of the flight and will incur a considerable ongoing operational cost in energy consumption as well as the carbon costs involved.

Based upon a range of boat passages through the locks of between 7500 and 16,000 per annual boating season of 245 days, the average daily volume of water to be pumped will be: -

LOCKS 1 to 17 (Including 10% additional volume to allow for gate leakage)

- 16,000 drops per annual boating season equates to 7.84 million litres per day. Back pumping cost £51,136 per annum.
- 7,500 drops per annual boating season equates to 3.67 million litres per day. Back pumping cost £23,970 per annum.

Fitting the modern lock gate module design is estimated to save 9% on these costs.

POUNDS 2 to 17

Traditional channel design equates to a loss of 2.77 million litres per day. Back pumping cost - £18,092 per annum.

Modern channel design equates to a loss of 0.87 million litres per day. Back pumping cost - £5,674 per annum.

Comparative Pumping Costs

Traditional Lock and Channel Design:

16,000 drops £69,228 p.a.

7,500 drops £42,062 p.a.

Modern Lock and Channel Design:

16,000 drops £52,588 p.a.

7,500 drops £27,665 p.a.

As a result of this problem, an alternative solution of an Inclined Plane has been designed by the Trust Engineer, which will fulfil the purpose of a stop-lock but without the disadvantage of unequal levels. Being balanced it means that it will require relatively little energy to operate.

This solution replaces the first twelve locks, thus restricting the back-pumping requirements to the final five locks only. In comparison with the relative installation and ongoing operational costs of the 12 locks these 5 locks have additional relative savings in the order of 30% for installation and ongoing operational costs. This is due to the pounds between the 5 locks being shorter thus involving a combined shorter length of 0.5 kilometres and a smaller rise of 9.29 metres. However the capital construction cost of the Inclined Plane is significantly more than the capital cost of the restoration of the first 12 locks including the back pumping installation.

12. Engineering and other Construction Issues

12.1. The Traditional Solution (Restoration of Existing Locks)

Work Packages WP1 to WP4.

***Locks*.** The Trust has been informed that explosives were used to blow the topsides of the locks into the chambers prior to covering over with soil. It is not confirmed whether all the thirteen buried locks were treated in this way but the lie of the land in the areas of the locks indicates that all have had the wall structures lowered by bulldozing the wall tops into the chambers to flatten the land for agriculture. If the top coping stones and bricks blown or pushed into the locks are in reasonable condition they could be reused for the rebuild, but it could be that the coping stones that have a value may have been sold and the bricks utilised for maintenance of farm tracks.

In the light of this it is considered that major reconstruction work utilising new authentic materials will be required. The work involved is of a specialist nature if the locks are to be sympathetically restored utilising traditional materials and methods. Smaller civil engineering companies that specialise in restoration work would be appropriate. The voluntary Waterways Recovery Group (WRG) has these skills but it takes a year to restore one lock utilising these voluntary resources. Otherwise for expediency, specialist contractors would undertake the work on the whole seventeen-lock flight.

None of the gates have survived and most of the associated iron fittings on the buried locks will have been damaged or lost. Construction of the traditional wood gates and the associated ironwork is still a craft and not a main stream manufacturing process, making them very expensive to produce. Also fitting the gates to ensure that they seal and do not loose water is time consuming and highly skilled. This is also an expensive ongoing maintenance task as the wood faces wear and distorts allowing water to be lost through the poorly fitting seal faces. It is extremely unusual to see a traditional lock gate that is not leaking or gushing water through the seal faces at various positions around the gates. Where there is a more than adequate water supply this does not present a problem but in the Newport Canal's case all this lost water will have to be pumped back up the flight (see Water Supply above), which is a further ongoing cost. It is therefore it is essential that these losses have to be minimised. In reality the costs involved in restoring the buried locks by retaining all the heritage features will not be much different than building a brand new lock, using mainstream contractors and modern materials and designs.

***Pounds*.** Suitable puddle clay would have been utilised originally to line and waterproof the channel. This at the time the canal was built was the only material available and is not immune to leakage. Today suitable puddle clay is difficult to source and, if available, is very onerous to lay effectively, and if available is very expensive and costly to transport and puddle, the overall cost being at least double that of modern linings. Another disadvantage is that the

channel has to have sloping sides resulting in the surface width being almost double that required for navigation, causing unnecessary evaporation losses. Water losses on the length from the Canal to Bridge B9 will have to be replaced by pumping from the River Meese. Therefore it is important that these losses have to be minimised by modern design. If the original route is adopted a new design would be used for all the lock pounds on these Work Packages WP1 – WP4, which is aimed at both water conservation and reduction of ongoing pumping costs.

The traditional channel design was suitable for horse drawn boats but the faster powered boats cause wash, which erodes the bank sides and silts up the channel. Over recent decades BW has carried out an extensive and costly maintenance program to rectify the damage, by sheet piling the channel sides of canals on the network. Although it maybe possible to reclaim the original clay lining provided it is not contaminated on some lengths of the S&NC route, the Trust's Engineer considerers that this would be a short sighted policy, as within a short period in operation the same expensive sheet piling solution would be necessary.

The type of spoil utilised to fill the pounds on these lengths down to Bridge B9 is unknown at this stage. However it is known that in various areas along the route of the S&N Canal the pounds were used for general rubbish disposal. If this proves to be the case this type of fill will have to be carted to landfill sites. A cost allowance has been included to cover this contingency.

Culverts. Culvert C1 will be replaced and the embankment and channel rebuilt. C2 has not been disturbed.

Bridges**.** Only Bridge B6a required will need to be replaced as the original bridge that served as both a footpath and farm accommodation bridge has been destroyed. This will be replaced with a steel lift bridge.

Work Package WP5

Pound. Pound P18 consists of three different channel conditions: -

The first length (400 metres) is filled and returned to agriculture. Construction work will involve digging out and reinstating the channel utilising a new modern channel section design. Spoil being spread on the surrounding land, or utilised in other areas that require to be made up in height. Unsuitable contaminated spoil will be taken to land fill site.

The second length (700 meters) is retained in water. This length will be dewatered and the silt removed and the new modern channel section design installed.

The third and last length (600 metres) is dry bed. This length will also have the new modern channel section design installed.

***Bridges*.** Bridge B7 will have the minor damage to the copingstones rectified and where necessary re-pointing carried out. Accommodation Bridge B8 will be replaced with a steel lift bridge.

***Culverts*.** Culverts C3 and C4 will be replaced and the channel over reinstated.

Estimated Costs - Original route WP1 to WP3.

Estimated Costs - WP1 to WP3	**£**
Refurbishment Locks 1 to 12	2,160,000
New Lock Gates	840,000
Pack Pumping Facility	1,900,000
Pounds 2 to12	1,369,000
Culvert C1	60,000
Landfill Allowance	100,000
Total Construction	***6,329,000***
Design and Project Management @10%	632,900
Preliminary Costs @1%	63,290
Contingency @5%	351,260
VAT @ 17.5%	1,290,880

Total Estimated Cost WP1 – WP3	**£ 8,667,330**

Estimated Costs – WP4

Refurbishment Locks 13 to 17	900,000
New Gates	350,000
Back Pumping Facility	650,000
Pounds 13 to 17	406,000
Accommodation Bridge B6a	60,000
Total Construction	***2,366,000***

Estimated Costs – WP5

Pound 18	585,000
Culverts C3 & C4	100,000
Accommodation Bridge B8	60,000
Landfill Allowance	16,000
Total Construction	***745,000***

Total Construction Cost (WP4 - WP5)	3,111,000
Design & Project Management 10%	311,100
Preliminary Cost 1%	31,110
Contingency @ 5%	172,660
VAT @ 17.5%	634,530
Total Estimated Cost WP4 – WP5	**£4,260,400**

12.2. The Inclined Plane Solution at Shelmore

Work Packages IP-WP1 and IP-WP2

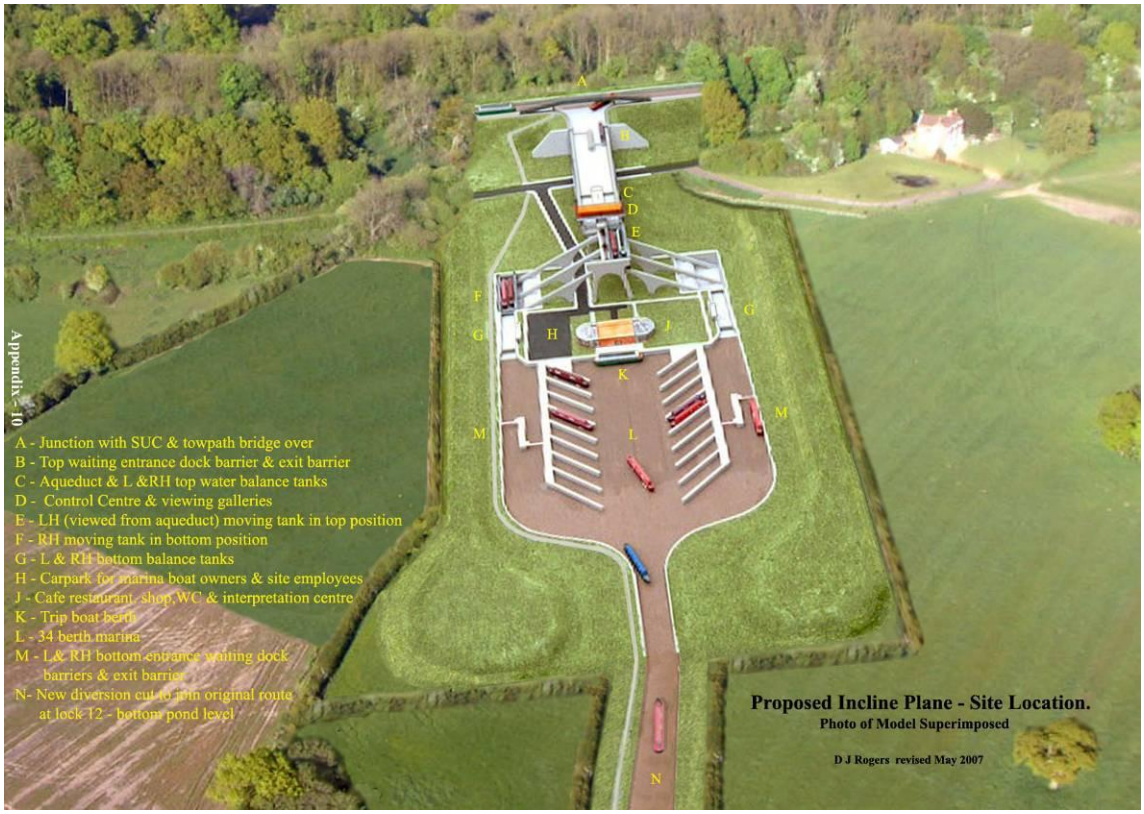
This alternative solution for the replacement of the first 12 locks involves the adaptation of 19th century technology to provide a 21st century solution to transfer boats through the 22.31 metres change in level between the two canals. It operates in a sustainable manner which minimises the water losses on the transfers and requires a very low energy input to operate compared to the high energy requirements to back pump very large volumes of water.

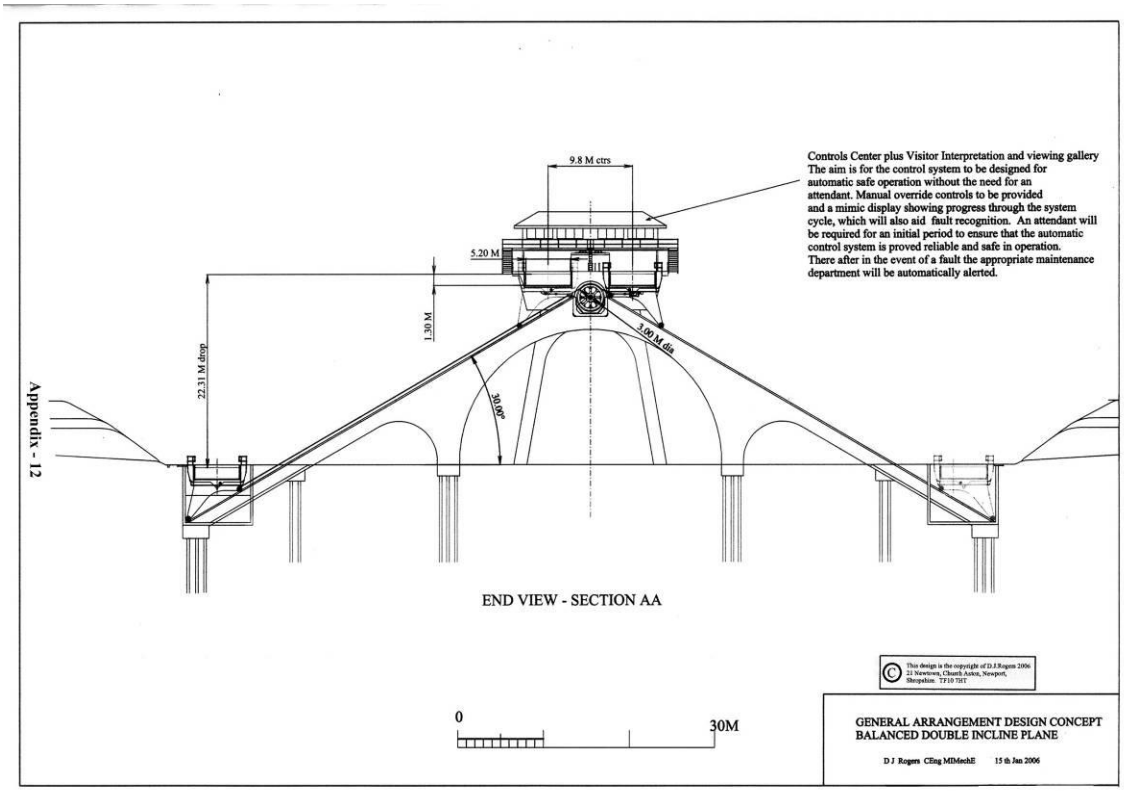
It follows the example of the Falkirk Wheel in adopting a modern engineering solution. It will create the most significant structure on the Midlands canal network and, in the light of the 500,000 visitors' p.a. to the Falkirk Wheel, is likely to generate substantial tourism interest from day visitors, staying visitors and boat operators and users.

The Inclined Plane would be constructed at Shelmore about 800 metres south of the original junction and could be approached either by a disabled compliant pathway or by trip boat from Norbury Junction.

As a result this Solution includes:-

- An "iconic" structure on the canal network at Shelmore, 800 metres south of Norbury Junction and within easy reach of the West Midlands, Stoke, Liverpool and Manchester,
- the creation of a new 1km access road direct from the A519 to Norbury Junction to remove all tourism traffic from Norbury village,
- Construction of on site visitor centres at Norbury Junction and at the Inclined Plane with interpretation and educational facilities, toilets, catering and conference facilities etc.
- new car/coach parks adjacent to the existing junction,
- construction of two new marinas
- Supporting the existing boat hire and repair, chandlery and catering facilities at Norbury Junction
- Opportunities for day and trip boat activities from Norbury Junction to and through the Inclined Plane onto the Newport Canal.


Appendix - 10
A - Junction with SUC & towpath bridge over
B - Top waiting entrance dock barrier & exit barrier
C - Aqueduct & L &RH top water balance tanks
D - Control Centre & viewing galleries
E - LH (viewed from aqueduct) moving tank in top position
F - RH moving tank in bottom position
G - L & RH bottom balance tanks
H - Carpark for marina boat owners & site employees
J - Cafe restaurant, shop,WC & interpretation centre
K - Trip boat berth
L - 34 berth marina
M - L& RH bottom entrance waiting dock barriers & exit barrier
N- New diversion cut to join original route at lock 12 - bottom pond level
Proposed Incline Plane - Site Location.
Photo of Model Superimposed
D J Rogers revised May 2007


Appendix - 12
9.8 M ctrs
5.20 M
1.30 M
22.31 M drop
3.00 M dia
30.00°
Controls Center plus Visitor Interpretation and viewing gallery
The aim is for the control system to be designed for automatic safe operation without the need for an attendant. Manual override controls to be provided and a mimic display showing progress through the system cycle, which will also aid fault recognition. An attendant will be required for an initial period to ensure that the automatic control system is proved reliable and safe in operation. There after in the event of a fault the appropriate maintenance department will be automatically alerted.
END VIEW - SECTION AA
0
30M
GENERAL ARRANGEMENT DESIGN CONCEPT
BALANCED DOUBLE INCLINE PLANE
D J Rogers CEng MIMechE 15 th Jan 2006

Constraints – Site Access. There are four possible routes to Norbury Junction, all of which are narrow country roads not suitable for heavy construction traffic. It is therefore proposed to construct a new road from the A519 to Norbury Junction. A temporary stone track is planned to continue from the new road to the Inclined Plane site running through the original route embankment, cut through at the site of Culvert C1. This cut through only serves a small drainage ditch and will be widened to accommodate the temporary track. On completion of the heavy construction work on the Inclined Plane site the stone used for the temporary track will be removed and the land returned back to its original state. The stone removed being reutilised for the towpath along the new route.

Work Package IP.WP1. The Trust Engineer has completed a detailed concept design for the Inclined Plane. A future step will be the detailed design of the components and the programming of the sequence control system identified by the concept design. This will require the assembly of a team of engineers trained and experienced in the following disciplines: Mechanical Design Engineering; Electrical Design Engineering; Civil Design Engineering; Structural Design Engineering; Soil Mechanics Engineering; Computer Programming; Project Management. It is only larger Engineering Consultants who would have the capability of assembling such a team of experienced engineers.

Work Package IP.WP2. This package involves the construction of the new canal route from the base of the Inclined Plane to Bridge B5 utilising modern channel design. In addition, a manually operated lift bridge IP-B3 to serve a narrow country lane with low traffic volume; a farm accommodation lift bridge IP-B2; and a footbridge IP-B1 will be required. There is also the need to construct a culvert IP-C1 to accommodate the Wood Brook.

Estimated Costs – Inclined Plane route - Work Packages IP-WP1 to IP-WP2

Work Package – IP.WP1

Inclined Plane	8,000,000
Provision of temporary contractors access road	400,000
Construction Total	***8,400,000***

Work Package - IP.WP2

Footbridge BIP1	10,000
Channel from Inclined Plane to Bridge B5	1,520,000
Two steel lift bridges	120,000
Wood Brook culvert	50,000
Construction Total	***1,700,000***

General Infrastructure

Junction with and improvements to A519	500,000
New direct road to Norbury Junction	1,500,000
Visitor Centre	1,000,000
Car-parks – CP1 & CP2	600,000
Infrastructure Construction Total	***3,600,000***
Total Construction Cost of Inclined Plane including New Route & Infrastructure	**£13,700,000**
Design & Project Management @ 10%	1,370,000
Preliminary Cost @ 1%	137,000
Contingency @ 5%	760,350
VAT @ 17.5%	2,794,290
Total Estimated Cost of Work Packages IP-WP1, IP-WP2 and Infrastructure	**£18,761,640**

13. Comparative estimated Capital Costs for the two Options

Option 1 Traditional Restoration of Locks 1-17		**Option 2** Inclined Plane with restoration of Locks 13-17	
	£		£
Work Packages WP1 – WP3	8,667,330	Work Packages IP-WP1 –IP-WP2	18,761,600
Work Packages WP4 – WP5	4,260,400	Work Packages WP4 – WP5	4,260,400
Total Cost	**£12,927,730**		**£23,022,000**