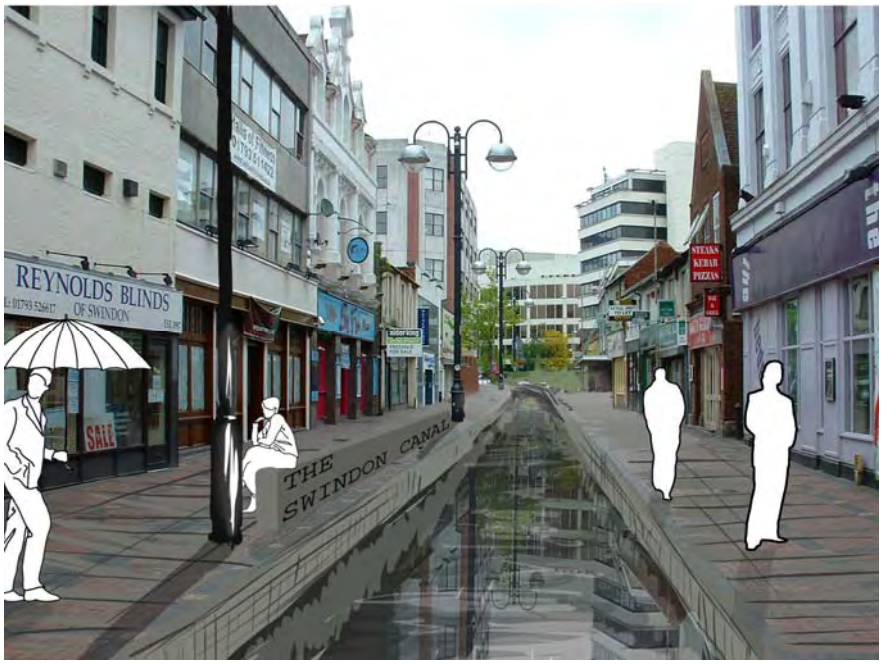
SWINDON BOROUGH COUNCIL

SWINDON CENTRAL CANAL
ROUTE STUDY
August 2007

Halcrow Group Limited



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Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	0	Internal issue	June 07	PJM
2	1	Draft Issue for comment	June 07	PJM
3	2	Updated with comments from SBC and W&BCT	Aug 07	PJM

Contents

1 Executive Summary

1.1 *Introduction*

This study has been undertaken on behalf of Swindon Borough Council (SBC) and investigates the feasibility of constructing a new canal into Swindon town centre from the Wilts and Berks Canal which when fully restored will run around the southern side of Swindon. The route is approximately 1.6km long and runs from the Kingshill area along Westcott Road and into Fleet Street via Faringdon Road. The ultimate plan is to link this arm up with the North Wilts Canal to reform the north south canal link through Swindon.

1.2 *Canal Route*

The alignment of the proposed route is shown on the plan at the end of this summary. The route starts at the currently restored section of the canal in Kingshill. A lock then lowers the canal sufficiently to allow boats to pass under the Kingshill road. The canal then follows the original route of the canal before crossing onto Westcott Place via a sharp S bend. Westcott Place will be closed to traffic and the canal will run along the line of the road. The difference in levels along road results in the need for another lock to drop the canal levels down.

Faringdon Road will be completely closed to traffic and the canal routed along the north side of the road. The pinch point at Park House will require the canal to be narrowed slightly allow sufficient space to realign underground services and maintain the width of the cycle path and service road. From Faringdon Park area the canal runs along Faringdon Road past the railway village. Faringdon Road is wide enough along this section to increase the width of the canal up to 9m wide whilst still retaining space for a cycleway and service road. The changes in levels of ground along the canal result in the need for a lock along this section to raise the pound level to that close to existing levels in Fleet Street.

Due to the building frontages and space restrictions along Fleet Street the canal width needs to be restricted to less than 5m wide, this allows space for two boats to pass but also retains space for a walkway along the shop frontages on both sides of the canal.

The construction of a canal basin will allow boat owners to stop overnight when visiting Swindon and provide a location for turning boats. The preferred location for a basin is in the John Street area off Fleet Street. The space available in this area and its proximity to the town centre would allow the area to be further enhanced and exploit the water side development opportunities.

A number of the properties in this area would need to be acquired and removed, including John Street multi storey car park, to provide space for the basin.

The option to redevelop the area around the bottom of Kingshill would give the opportunity to remove the awkward S bend in this area and to design the canal on a straighter alignment. This would also provide the opportunity to redevelop this area which forms part of the entrance way into Swindon and despite requiring the purchase of a number of properties should be given serious consideration.

The requirements surrounding the vertical alignment of the canal result in the section along Faringdon Road being the lowest point. A back pumping system will therefore be required to maintain a navigable depth of water in all the sections The pumping station could be located in Faringdon Park with associated pipes running alongside the canal. In addition a waste pipe would need to be laid from this low point across to the River Ray to take excess water away from the canal. An obvious route for this pipe is from the canal in Westcott Place running below Robert Le King Primary School grounds to the River Ray. The canal will provide additional surface water storage and therefore will have a beneficial effect on surface water flooding issues.

1.3 Traffic Issues

The construction of the canal along the proposed route will require the complete closure of Westcott Place, in addition the opportunity to completely close Faringdon Road should also be seriously considered. Whilst initial traffic modelling indicates this is feasible it will impact both on local and borough wide traffic flows and provides the opportunity to completely revise the traffic system around the Borough of Swindon and develop a sustainable integrated transport system.

The modelling work undertaken for closure of both roads plus changing Fleming Way to buses only shows the following significant changes during peak periods:

- Increase in traffic along Bath Road/ Kingshill;
- Increase in traffic along Eastcott Road;
- Increase in traffic along Great Western Way;
- Increase in traffic along Commercial Road /Princes Street/Corporation Street/Manchester Road;
- Increase in traffic along County Road;
- Reduction in traffic along Wootton Bassett Road;
- Reduction in traffic along Rodbourne Road;
- Reduction in traffic along Crombey Street;
- Reduction in traffic along Elmyn Sqaure/ Holbrook Way/ Farnsby Street;
- Reduction in traffic along Station Road.

For the typical weekday morning and evening peak periods, the modelling predicts a 4.6% increase in travel times, a 0.4% increase in travel distance and a 4.1% decrease in average speed which equates to a 2kph/hour reduction in speed. There will be an increase in the delays at specific locations and an increase in

overall congestion and delay in the Borough wide network, but the modelling work shows these are not of a magnitude that would result in the Borough wide network being over capacity. It should be noted that whilst the overall impact on the system is relatively small there will be a major impact and increase on the local journeys made by some of the residents along the route.

The removal of traffic from this area will provide the opportunity to develop a traffic free sustainable link through the town centre and link into the new Southern Development Area which will help to encourage sustainable transport and create a catalyst for redevelopment of properties along the route.

1.4 Highways and Bridges

New road bridges for access over the canal will be required at both Farnsby Street, for residents in the Railway Village and at Catherine Street to maintain access to the Brunel car parks. At both locations there are severe land constraints and it may be necessary to acquire corner properties to allow the ramps to the bridges to be constructed. These bridges will be highly visible and efforts should be made to make them 'feature' structures.

At Kingshill Road the canal would be confined within a box culvert to pass under the road. For safety pedestrians and cyclists would cross Kingshill Road at grade as they do at present.

To avoid the dividing effect of the canal nine new footbridges are proposed at regular intervals and generally in the locations where high pedestrian flows can be expected. Most of the bridges are in line with existing thoroughfares, thus enabling pedestrians and cyclists (but not motorised vehicles) to cross with the minimum of inconvenience.

All of the footbridges must be disabled access compliant, however given the space constraints this may not be possible at all locations and this will need more consideration at the detailed design stage. Alternatively lifting or swing bridges may be provided, but these can be vulnerable to vandalism and continued maintenance costs to ensure viability of the moving parts.

1.5 Landscape and Environmental Issues

A brief environmental baseline desk study has not identified any issues which are likely to prohibit the scheme. Appropriately-timed consultation with the public, statutory and non-statutory consultees will be needed as part of a formal Environmental Impact Assessment (EIA) process.

The new canal will have a significant impact on the character, form, structure and quality of the built environment.

The Kingshill, Shire Court and Erin Court area is currently visually poor. This area is, however, effectively a gateway into Swindon and its urban area and should be marked as such with a possible redevelopment of the whole area. A gateway feature could take the form of a signature bridge or as a location for public art.

On Westcott Place the canal will be close to the boundary of the school. There is scope for environmental improvements to be carried out at the towpath area between the houses on Westcott Place and the canal.

Faringdon Park is a relatively large park and forms a significant area of open space. The canal widens out for this section and follows the line of the boundary to the park, so maintaining a wide towpath and access roads to the houses on the south side of Faringdon Road. The route will mean the loss of some of the trees along with the brick boundary wall. Whilst these are relatively significant impacts, there is a great potential to link the canal and the park for the benefit of both. The park will be able to utilise the canal as a focal point and feature with wide paths and seating alongside the canal.

The Railway Village is the most distinctive area in Swindon. This section of the route is one of the most sensitive in urban design terms and will require a comprehensive approach to designing the canal and the adjacent streets. High quality materials will be required to complement the materials within the railway village. The two road bridges in this area will also be highly visual and need careful design to make feature of them whilst integrating them into the area.

Fleet Street forms part of the retail centre of Swindon and is a pedestrianised street extended north from Faringdon Street. The area is considerably denser in its urban form with larger scale blocks and buildings with retail and commercial uses. It is more enclosed and quieter without the traffic noise. The canal would be at a similar level to the adjacent ground levels. Fleet Street would need to be re-built with new paving and street furniture.

The preferred location for a basin is the redevelopment of the John Street block to the south on the east side of Fleet Street as a focal point for new mixed used development. This would allow a much greater integration of the canal into the town centre and also provide a focal point close to the main shopping area. This could be developed as a leisure / rest area for people using the town centre and provides the space to develop street cafes and restaurants overlooking the basin.

There are a number of interesting and distinctive historic buildings along the route of the canal, from the larger scale Railway Village and Health Hydro down to the smaller locally attractive pubs and shops which should be highlighted and used as local focal points and way-markers on the route.

1.6 Other Impacts and Considerations

The proposed canal is in a built up area which is heavily used by both residents and businesses. The canal will have an impact on the current situation across the whole of the Borough both during and after construction. The key to the success of this scheme will be ensuring that the majority of the public are behind the proposals. This will require a well planned and co-ordinated consultation process both to meet statutory requirements and to ensure public buy in.

One of the major problems with the route is the ad-hoc underground services system which has developed along the proposed route over time. This will require major works in conjunction with service providers and diversions will constitute a major cost and programme period for the scheme.

One of the key concerns will be public safety, particularly in the Fleet Street area where there are numerous busy nightspots and pubs. Whilst there is always the risk that people will either fall or be pushed into the canal, as with urban canals in other major cities it envisaged this section will be unfenced. A footway will be maintained each side of the canal to maintain access and it may be prudent to install short localised sections of railings opposite the busier nightspots.

The urban location of the proposed canal unfortunately means that debris and rubbish will end up in the canal either by deliberate or accidental means. This will need to be removed at regular intervals.

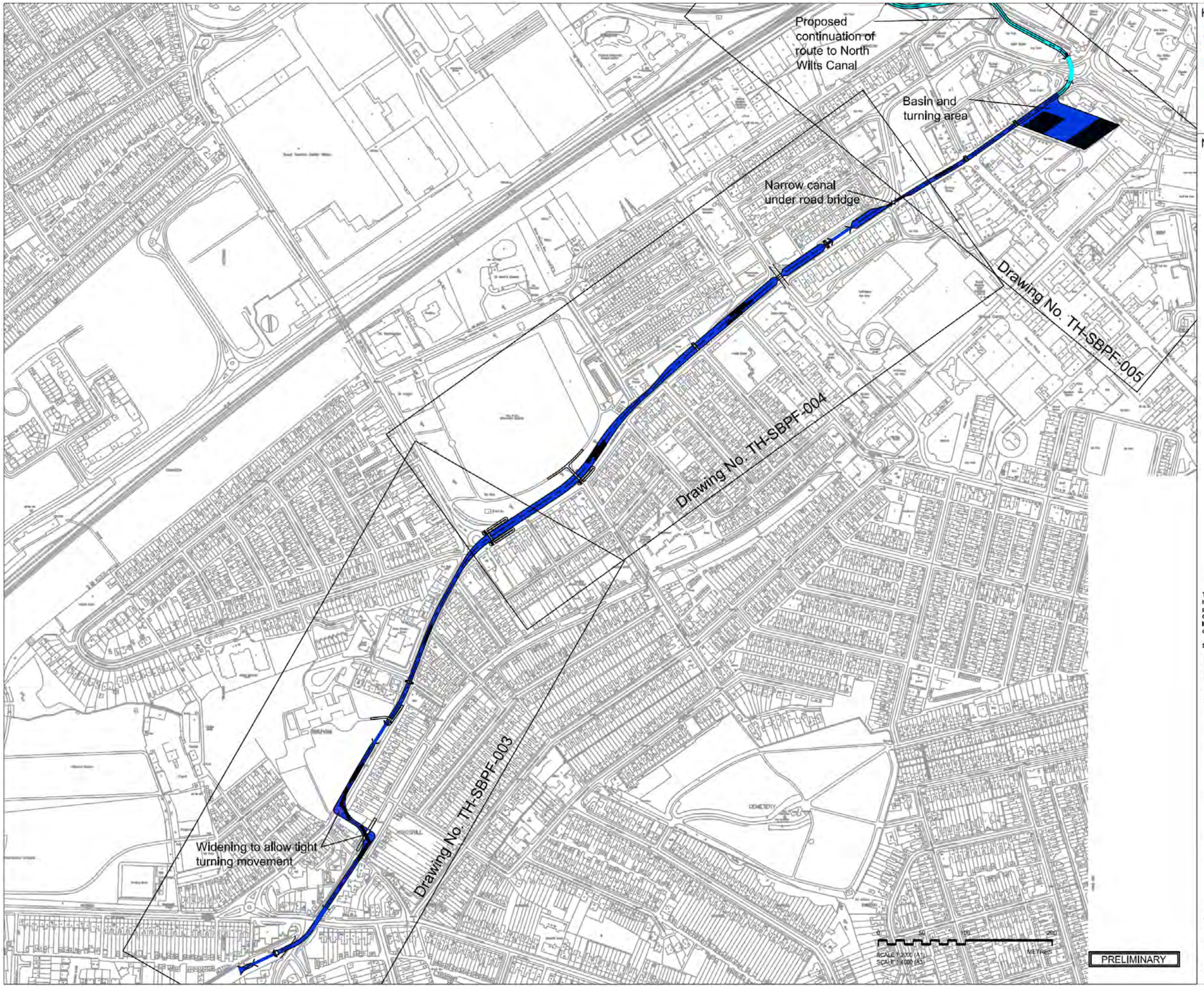
1.7 Costs and Benefits

Based on 2007 market costs the estimated construction costs of the scheme is £47,893,500. A number of significant issues which have not yet been fully resolved have been included in the risk register and it is recommended that a risk contingency of £4,300,000 is included resulting in an overall construction budget estimate of £52,193,500.

The estimated direct retained income to the Swindon economy, based on 2007 figures, is £6,881,708 per annum. However many of the key benefits are centred around the creation of a feature and sense of place for the town centre. There will be direct redevelopment opportunities around the proposed basin area but the canal will also act as a catalyst for private redevelopment along its whole route in addition to the reduction of flood risk from surface water along the route.

1.8 Conclusion

Based on the results of this brief study the reintroduction of a narrow beam canal into the centre of Swindon is technically possible on the proposed route from Kingshill to Fleet Street via Westcott Place and Faringdon Road. Whilst feasible there are a significant number of difficulties that would need to be overcome. In particular, major service diversions and significant changes to the road transport network around the route and the wider Borough would be necessary to accommodate the canal.



Key:

- Proposed Central Canal route
- Future North Wilts Canal connection

Notes:

Rev	By	Chkd	Apprvd	Date	Description
B	IR	RM	-	12/07	Link drift added to Dft
A	IR	RM	-	03/07	Formal to Inability only

Client: Swindon

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Halcrow

Project: SWINDON CANAL

Drawing: PROPOSED CENTRAL CANAL ROUTE

Drawn by: NR	Date: 14.05.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No.: TH-SBPF-145-002	Revision: B

Drawing Scale: at A1 - 1:2000

2 Introduction

2.1 *Background*

The Wilts and Berks Canal was abandoned by an Act of Parliament in 1914 and the section through the centre of Swindon was subsequently infilled and built over. Part of the canal to the southwest of Swindon has been restored and re-watered by the Wilts and Berks Canal Trust (W&BCT) and there are plans in place to restore the canal and reintroduce boat traffic by 2014. However this plan proposes to take the canal in a new alignment around the south of Swindon and avoids the traditional route through the town centre.

Swindon Borough Council (SBC) wishes to determine the feasibility of constructing a new canal, to extend the re-watered section of canal into Swindon town centre from the west. The route is approximately 1.6km long and has been termed the Swindon Canal Central Route. The ultimate plan is to link this arm up with the North Wilts Canal to reform the north south canal link through Swindon.

2.2 *Scope of Study*

In February 2007, Halcrow Group Ltd was assigned a task under its Civil Engineering and Transportation Services Partnering Contract with SBC to investigate the feasibility of the proposed canal.

The scope of the Study was to review the viability of a canal route from Kingshill to the town centre development including;

- Review of horizontal and vertical alignment issues of the preferred route.
- Integration of the canal into the heritage of the area and to engage with the Railway Village.
- Integration of the canal with plans being proposed by the New Swindon Company for the public open space at the Plaza.
- Review potential water quality issues.
- Compare costs of construction between the preferred route and the route via SDA/Mannington/Barnfield (costs to be growthed)
- Review solutions to dealing with service crossings.
- Review access arrangements to properties.
- Review of reassignment of traffic along preferred route.

In addition a review of the potential engineering difficulties of routing the North Wilts Canal across the Bruce Street Bridges area of Swindon was also included as part of the Study.

Throughout the study consultation has been undertaken with both Swindon Borough Council representatives from various interested departments and with members of the Wilts and Berks Canal Trust. Some consultation has also been carried out with the New Swindon Company.

2.3 Methodology

This study undertakes to review the technical feasibility, limitations and opportunities for reinstating a canal into the centre of Swindon from the southern Development / Kingshill area of Swindon. The following key tasks have been carried out to assist in the assessment of the route feasibility;

- Review the alignment issues of the potential route
- Consultation with Stakeholders
- Services review
- Collect and review topographical data of the route (and potential route to Bruce Street Bridges)
- Review and analyse engineering issues/constraints – including land space, existing structures and road crossing/road space e.g. practical solution to service crossings, practical solution for crossing Kingshill Road, review of the proposed road crossing at Station Road.
- Assess engineering issues only at Bruce Street Bridges roundabouts
- Farindgon Road – review/assess the idea of complete traffic removal.
- Review traffic reassignment through the removal/reduction of road space for canal implementation.
- Review of water quality issues - considerations / implications for water supply to isolated sections in the short term.
- Water quality – consideration of how quality can be maintained.
- Concepts for integrating the canal into heritage of town
- Concepts for integration into the Railway Village area
- Concepts for integration with the New Swindon Company plans for the Plaza.
- Concept design for the canal in the urban environment – landscape drawings
- Potential for economic benefit.

2.4 Limitations of Study

The study has concentrated on the issues surrounding the construction of a new arm of the Wilts and Berks Canal into the centre of Swindon. It looks at the most practical way of doing this without being constrained by the original canal route.

A number of previous studies have been undertaken which investigated the restoration of the original canal. Whilst these have not been reviewed and commented on in detail some of the key points which are still relevant have been taken on board during this study.

This study is a high level feasibility study. The following items have not been included or undertaken as part of this study;

- Condition surveys of existing infrastructure associated with the canal route, adjacent buildings or services.
- Water supply issues, these are being considered by Carl Bro Ltd as part of a separate study commissioned by the Wilts & Berks Canal Trust.
- Liaison either with the general public or landowners along the proposed route.
- Investigations related to detailed feasibility and costs of alternative traffic routes where existing roads are affected by the canal.
- Wider strategic issues surrounding the restoration of the Wilts and Berks canal.
- Detailed design considerations of the proposed route alignment.
- Detailed economic appraisals of canal benefits although an overview has been provided.

2.5 Consideration of Examples of Canal Restoration in Urban Environments

During the course of this study a number of examples of restoration schemes have been reviewed to provide inspiration and draw upon key experiences of restoration of canals in urban environments to the benefit of this scheme.

Examples inspected and reviewed include;

- Kennet & Avon Canal in the Reading Area
- Gas Street Basin in Central Birmingham
- Paddington Basin in London
- Brindley Place in Birmingham
- Huddersfield Narrow Canal

- Bridgewater Canal in Manchester
- Rochdale Canal in Manchester

These canals all demonstrate how canals can be integrated into an urban environment to the benefit of the surrounding area. Where applicable the best elements from previous restoration schemes have been drawn on in the initial proposals put forward in this study.

3 Canal Route

3.1 *Design Considerations*

The Wilts and Berks Canal main route was designed as a narrow canal to take only 7ft wide traditional narrow boats. Any new sections of canal will be designed on a similar basis. The following details and dimensions have been used as a basis for this study;

- Maximum boat size – 22m (72ft) long by 2.1m (7ft) wide.
- Minimum canal width through structures – 2.5m.
- Minimum lock width – 2.5m.
- Minimum radius of bends – 4 to 6 boat lengths, approx 90m.
- Maximum canal width in urban area – 9m.
- Canal water depth – 1.5m.
- Minimum airspace below bridges (above water) – 2.3m.
- Minimum freeboard – 300mm.
- All footbridges to be Disability Discrimination Act (DDA) compliant with 1:20 ramps where space permits or lift type bridges.

3.2 *Outline of Route*

Previous studies have concentrated on restoring the alignment of the original canal through Swindon. This study investigates the opportunities for reinstating a canal into the centre of the town on a route which maximises the profile and benefits of the canal and forms a focal point for the town to encourage maximum usage of the asset. The preferred route and alignment is presented in this section, however during the study a number of alternatives for the route were considered and these are presented in Section 13 of the report.

3.3 *Horizontal Alignment*

3.3.1 *Description of Basic Potential Route*

(a) Kingshill Area

The alignment of the proposed route is shown on the plans in Appendix D. The route starts at the currently restored section of the canal in Kingshill. A lock (No1) will be required to lower the canal sufficiently to allow boats to pass under Kingshill road. The canal will then follow the original route of the canal to the rear of the current Westcott Autos premises. Here it will cross via a sharp S bend onto

Westcott Place. This S bend will be widened as far as possible to ease boat traffic but some of the larger boats may well experience some difficulties negotiating the turns in one movement.

(b) Westcott Place

From Westcott Auto's site the canal will be on a new alignment from the original canal route. Westcott Place will be closed to traffic and the canal will run along the line of the road. Alongside the school grounds the canal will be wider and located on the northern side of the existing road and partly on the edge of the school grounds. The line of trees along the school boundary will be retained. Towards Faringdon Road Westcott Place narrows and the canal will need to do the same. The difference in levels along this stretch will result in the need for a lock. A service road for emergency vehicles and residents use will be provided which will be combined with a new cycleway and footpath.

(c) Faringdon Park Area

Ideally Faringdon Road will be completely closed to traffic and the canal routed along the north side of the road. However a number of traffic options for this road and the effects on the wider road system in Swindon have been investigated and the results are presented in Section 3 of this report. If traffic is removed then there is sufficient space to incorporate a reasonably wide canal, a service road and a combined cycle path and footpath.

There is a pinch point at Park House where the canal will need to be narrowed slightly to allow sufficient space to realign underground services and maintain the width of the cycle path and service road. The wall alongside Faringdon Park will be removed to enable the park and the canal to be integrated. The north side of this stretch of the canal is the only area where the canal bank could be graded back and environmental improvements made, however this would be at the expense of a number of mature trees and would need detailed consultation before a decision on the final arrangement in this area could be finalised.

(d) Railway Village

From Faringdon Park area the canal will run along Faringdon Road past the Railway Village. Faringdon Road is wide enough along this section to increase the width of the canal up to 9m wide whilst still retaining space for a cycleway and service road. The changes in ground level along the canal will result in the need for a lock along this section. It is proposed to locate this towards the north eastern end of Faringdon Road as this places the lock close to the town centre and would

enable it to be developed into a feature. The exact location for this lock will need to be confirmed in the detailed design stage. Service road access for Railway Village residents will be maintained.

(e) Fleet Street

Due to the building frontages and space restrictions along Fleet Street the canal width will need to be restricted to less than 5m wide, this will allow space for two boats to pass but will also retain space for a walkway along the shop frontages on both sides of the canal. This will also allow space for relocating services along both sides of the canal to maintain connections to all the premises in this area. From Fleet Street the canal will run at the same pound level into the proposed canal basin area.

(f) Canal Basin

The construction of a canal basin within the central Swindon area will be crucial to the success of any new canal. The basin will allow boat owners to stop overnight when visiting Swindon and provide a location for turning boats, this is particularly important during the period between construction of this arm and final connection to the North Wilts Canal. The facility to moor overnight will attract a greater amount of boat traffic by creating a new destination on the canal system. The opportunity for a permanently moored restaurant boat could also add to the area.

The installation of permanent marina facilities has been considered, however this was discounted due to the need for space to provide permanent facilities both on the water and on the land side. It was also considered undesirable to have residential boats permanently moored in this area of the town.

From both an engineering and development aspect the preferred location for a basin is in the John Street area off Fleet Street. The existing ground levels in this area are favourable to developing a basin with water levels close to existing ground levels allowing integration of the basin into the town centre. The potential space available in this area and its proximity to the town centre would allow the area to be further enhanced and exploit the water side development opportunities, as has been done in other cities where cafes and restaurants have improved the social integration of the canal.

A number of the properties in this area would need to be acquired and removed, including John Street multi storey car park, to provide space for the basin.

The canal will effectively sever the current access to this area so a new access will need to be included to provide service access to the rear of the shops in this area for deliveries etc. This could be achieved using the currently blocked off access via King Street from the Queen Street service area.

3.3.2 *Option 1 - Alternative at Kingshill*

The option to redevelop the area around the bottom of Kingshill would give the opportunity to remove the awkward kink through the Westcott Autos area and to design the canal on a straight alignment. By removing this double bend the canal would be easier to navigate and provide a more visually integrated canal whilst also avoid a number of services which have now been laid along the old canal route. This would also provide the opportunity to redevelop this area which forms part of the entrance way into Swindon from Junction 16 of the M4. Section 7 discusses this opportunity in more detail. The availability of this area during construction would enable a compound to be located here to service the canal construction which would greatly simplify construction logistics and reduce costs.

3.3.3 *Option 2 - Alternative Alignment in Faringdon Park*

The plan provided in this study indicates the new canal running along the southern boundary of Faringdon Park. During this study an alternative route of taking the canal through the middle of the park and then down Taunton Street was considered. This route has the benefit of providing a slightly better canal navigation alignment and avoids the 'pinch point' at the Park House property along Faringdon Road.

However during the consultation process this option was discounted for a number of reasons, the principal ones being the fact that this route has a far greater impact on the Railway Village, severs access to Park House and also significantly reduces the open green area of Faringdon Park which is one of the few green leisure spaces close to the centre of Swindon.

3.3.4 *Option 3 - Canal Basin Location*

An alternative canal basin location has been considered in the Cheltenham Street car park area. Maintaining the canal water level close to ground level in the main section of Fleet Street will allow the canal to pass below Fleet Street but will result in the water level in the basin being approximately 2m below road levels on the western side of the basin. However there is insufficient room in this area to add in a lock and accommodate a change in water levels. Due to the buildings on the

eastern side a terrace wouldl be required to achieve ground levels closer to water level and allow public access.

The existing levels and the space restrictions imposed by the road and adjacent buildings would result in a compromise in terms of boat and recreational access. This location would also provide little scope to integrate it into the town centre and exploit the possible waterside development and leisure opportunities and would result in a sterile basin area.

It is also understood that this area is being considered for development into a bus drop off and pick up area as part of the ongoing Exchange development and sufficient space is unlikely to be available for a basin at this location. Space will still be required in this area to allow the North Wilts connection to be made.

3.4 Vertical Alignment

3.4.1 Engineering Issues

Generally canals follow the contours of the topography of the route to maintain a pound level (normal operating level of the canal) over a greater distance as possible. This avoids the need for locks which are expensive to build and also slow the movement of boats. In a green field situation significant sections of cuttings and embankments are used to maintain a single pound level.

However the route chosen for this canal will be through an urban area where space is limited by the levels of existing buildings along the route. Deep cuttings are undesirable in this situation as visually the pound levels need to be close to ground level to give the feeling the canal is integrated into the area rather than imposed on it.

The historical pound level of the original canal was 99.1mAOD and was the 'upper pound' or 'summit' of the canal with no locks through the centre of Swindon and this is the water level in the restored section of the canal in the Kingshill area. However as the proposed route deviates from the original route the pound levels will need to vary to take into account varying ground levels and this will require the introduction of a number of locks. Detailed plans and longitudinal sections showing the vertical alignment of the proposed canal are shown drawings TH-SBPF-145-003, 004 and 005 in Appendix D.

3.4.2 *Proposed Pound Levels*

(a) Kingshill to Westcott Place

As noted the pound level of the restored canal is set at 99.1 mAOD. Due to the current levels on Kingshill road and the need to maintain sight lines there is limited scope for raising road levels and therefore the canal will have to be lowered below the road and the services in this area.

Lock No. 1 will be located immediately prior to Kingshill Road and drops the pound level 1.64m to 97.46 mAOD. There will be a 1.5m drop in existing ground levels across the Westcott Auto's site. To reduce the number of locks it is proposed to run the canal in a cutting along this section of the route, which will require retaining walls along the edges of the canal. To minimise excavation and allow space for serviced to be diverted the cycleway and footpath will run at existing ground levels.

(b) Westcott Place to Park Lane

The existing road levels along Westcott Place fall approximately 2.2m from Westcott Auto's to Park Lane roundabout. This will need a further lock to reduce water levels by 1.8m and maintain canal pound levels as close to ground levels as closely as possible. The location of the existing building lines restricts the amount of regrading of existing levels which can be undertaken. The lock will be located alongside the school grounds as there is sufficient space in this area to fit the lock and the proposed service road into the existing road width. A small amount of ground raising is proposed around the lowest area of levels at the north east end of Westcott Place.

(c) Park Lane to Fleet Street

From Park Lane the existing levels rise gradually by approximately 2.3m to the John Street area of Fleet Street. This will again require an additional lock to raise the pound level by 1.32m to a level of 97.60mAOD and maintain pound levels close to ground levels in Fleet Street. The location of this lock is a compromise as ideally pound levels will need to be close to ground levels along side the Railway Village as well. However the location has been chosen to be as close to the town centre as possible which will help to make the lock a feature and an attraction.

These levels are initial estimates and together with the exact locations of the locks will require refining as part of any detailed design process. The overall concept is not, however, expected to change.

3.5 Services

3.5.1 General

As part of the study detailed service information has been obtained from all the major statutory service undertakers in the Swindon Area with the exception of British Telecom. As would be expected in an established urban environment there is an extensive underground network of services which has developed on an ad-hoc basis over time as demand has risen in certain areas.

Summary plans of the main services along the preferred route of the canal appear in Appendix E. As the canal will run approximately 1.5 to 2m deep it will clash with most of the services along the route which tend to be located in the top 1.0 to 1.5m below ground level.

3.5.2 Statutory Services

The table below highlights the major statutory services along each section of the route which will require diversion to allow construction of the canal, in addition to those highlighted below there will also be numerous smaller services to individual properties and street lighting cable which will also requiring diversion. It should be noted that insufficient time was available for detailed consultation with service providers and the possible mitigation or diversion proposed may need to be refined or revised as part of the detailed design process.

Table 3.5 – Major Services on Proposed Route

Key Services	Conflict with canal	Possible mitigation
Kingshill Area		
BT services	Runs along route of original canal and cross route running along Kingshill Road	Maintain space to realign into cycle path alongside and raise over the culvert
225mm diameter foul sewer	Runs parallel to the route between the houses on the old canal route	Re-align into cycle path which runs at high level.
355mm low pressure gas main and service valve house	Runs along route of original canal and crosses route on Kingshill	Maintain space to realign into cycle path alongside, realign over or under culvert
Several 11kV power cables	Criss-cross over proposed culvert under Kingshill Road from substation	Realign to pass over the culvert

Key Services	Conflict with canal	Possible mitigation
Several water mains (3, 4 and 6 inch pipes)	Criss-cross over proposed culvert under Kingshill Road both on main road and into Dunsford Close	Rationalise and realign to pass over the culvert
Fibre optic cables	Cross culvert running along Kingshill Road	Raise over the culvert
Westcott Place		
6 and 12 inch low pressure gas mains plus 3 perpendicular crossings	Pipes on both sides of road one clashes directly with the canal route	Move into edge of school grounds or investigate rationalising services with provider to reduce number of pipes.
600mm dia gravity sewer	Diagonally crosses route at Westcott Autos then down Wescott Place to Park Lane	Realign alongside the canal the route under canal at Park Lane junction
Fibre optic cables	Runs along footpath on North side of road	Realign northwards in edge of canal or consider moving canal across closer to centreline of road depending on cost
Combined foul and surface sewer	Runs along centreline of the road and crosses at Westcott Street	Move across or investigate realignment on canal waste pipe route through school grounds to foul pumping station on Birch Street
11kV power cable	Crosses route at Read Street	Realign over footbridge r route under canal.
4 inch water mains plus a 5 inch crossing at Park Lane	Clear of canal however may feed properties on both sides	Feed properties on north side from Birch Street or lay additional service on north side.
BT telephone cables	Most appear to run on south side of road close to houses	Realign any on north side to ducting on the south side then cross to north side via bridge to service flats

Key Services	Conflict with canal	Possible mitigation
Faringdon Road		
1200x825 foul sewer	Runs along canal route	Relay smaller services each side to pick up effluent from each side of canal, should pass under bed of canal at Park Lane
450mm dia surface water sewer	Runs parallel to route alongside Railway Village	Realign and combine with service in Taunton Street.
6 inch water main alongside Railway Village	Conflicts with canal route and crosses at Park House	Move over into service road area which is to remain, relocate crossing over canal via bridge
Fibre optic cables	Perpendicular to canal route at Milton Road	Realign over footbridge
11kV power cables plus low voltage cable	Perpendicular to canal route at Milton Road, Farnsby Street and Park Lane area. LV cable runs parallel.	Realign over bridges or duct under the canal. Move LV cable to one side of canal.
600x450 mm surface water sewer	Runs parallel to route but may be clear of route in some places	Minor realignment around Railway Village Area
BT services	Run along route of canal in Railway Village area	Realign on walkway on each side of the canal
150mm dia low pressure gas pipe	Conflicts with route in Park House and Railway Village areas	Investigate realigning on Taunton Road or leave service wayleave on north side of canal
Fleet Street		
11kV cable crossings	Crosses entrance to basin.	Requires lowering below canal bed.
BT services	Run along route of canal	Realign on walkway on each side of the canal
900mm dia foul sewer	Clashes with canal route	Realign smaller sewers on both sides of canal to pick up effluent on both side of Fleet Street
150mm dia water main	Runs on one side but feeds properties on both sides	Lay additional service on opposite side of canal

Key Services	Conflict with canal	Possible mitigation
10 inch dia low pressure gas service plus a 100mm dia gas pipe in the proposed basin area	Runs on one side but feeds properties on both sides and clashes with basin excavation	Lay additional service on opposite side of canal, realign alongside proposed basin

If the canal basin is located in second choice location of Cheltenham Street car park then a 1.8m dia surface water sewer, a major fibre optic cable and other minor services would need to be crossed beneath Fleming Way. Even if the basin is located in the preferred John Street area these services will need to be crossed in the future by the North Wilts canal connection.

The Park Lane Junction area contains a complex network of services, in particular gravity drainage pipes, it may be possible, in conjunction with service providers, to rationalise and upgrade the services in this area. This could be done in partnership with providers and the costs shared.

Given the age of the properties along the route it is also anticipated that a significant number of old and abandoned services will also be encountered during excavation works. The locations and previous uses are often no longer on records and significant amounts of time could be spent confirming these are actually abandoned before removal.

3.5.3 *Private Services*

In addition to the main services identified on the drawings there will also be a large number of privately owned services running from the main services to individual properties which are not picked up on service searches. It is anticipated that the number of these albeit small services will require a significant amount of time to address issues associated with them, including the need to liaise with all the individual property owners affected.

3.6 Water Quality

As noted in Section 2.4 water supply issues are not considered as part of this study, these are subject to a separate study by Carl Bro Ltd commissioned by the Wilts & Berks Canal Trust. However it is noted that there may be some water quality problems with the proposed canal, particularly if short sections are built independently or until the Central Canal is connected to the main canal network at

the Southern Development Area and the North Wilts Canal and boats use the canal regularly.

During operations boats using the canal will push water along both by their action of movement and by using locks. On most canals this is sufficient to keep the water 'sweet' to avoid stagnation and associated visual and odour problems. In addition there is usually some small flow along the canal from groundwater infiltration / leakage and rain fall etc.

The requirements surrounding the vertical alignment of this canal results in the section along Faringdon Road being the lowest point, the general effect will be to drain the higher sections each side in normal operation. Therefore as there are no sources of water adjacent to these pounds then a back pumping system will be required to maintain a navigable depth of water in the sections between lock Nos. 1 and 2 and Lock 3 and the basin. The pumping station could be located in or under Faringdon Park with associated pipes running alongside the canal. This type of arrangement is common on canals where water conservation is a key issue. The use of a renewable power source could be considered for the pumps to reduce operating costs and increase sustainability, see also Section 8 regarding sustainability issues.

3.7 Flood Risk

There may be a perception that the introduction of a large body of water into the centre of the town may constitute an additional source of flooding to adjacent properties. However, in reality the operating of the water level is at least 300mm below ground level and therefore the canal will tend to collect surface run off and will reduce the risk of flooding over the current situation by providing additional temporary surface water storage. If designed correctly the whole length of canal could provide approximately 3,600 cubic metres of storm storage before overtopping. If prior warning of a flood event was available the water levels in the canal could be lowered to provide additional storage.

Due to the anticipated ground conditions and need for vertical walls along the majority of the canal the canal will be watertight, which will reduce any potential impacts on the basements of any adjacent buildings. This will also help to conserve water.

The area alongside Faringdon Park will be the lowest point of the canal system in the town centre, therefore if there is a problem any water will gravitate to this

location away from residential and commercial properties in the Faringdon Park area. From this area a waste pipe would need to be laid from this low point across to the River Ray to take excess water away from the canal. An obvious route for this pipe is from the low side of Lock No. 2 running below Robert Le King Primary School grounds to the River Ray. A potential alternative could be via Birch Street but the installation would be more expensive and more disruptive on this route for both the Birch Street residents and adjacent allotment owners. The final route and size of the pipe would depend of the quantity of run off the canal collects and would need to be confirmed as part of any detailed design process.

This waste pipe could form part of a wider integrated surface water drainage system in conjunction with upgrades to the network facilitated during the canal construction when existing storm sewers need to be realigned. This approach would need to be designed as part of an overall flood risk assessment for the town and undertaken in partnership with Thames Water.

An alternative would be to utilise the pumping system described in Section 2.7 and pump waste water above Lock No. 1 where it could gravitate into the Rushey Plat area. This possibility would rely on a on mechanical pumped system during any storm event and it is recommended that a separate gravity waste is installed in conjunction with any pumped waste system for emergency use should there be a problem with the pumps.

Although the route of the canal does not directly impact on existing watercourses or flood plain a flood risk assessment will be requested by the Environment Agency during the detailed design and planning process to ensure flood risks associated with the River Ray are not increased, by waste canal water being discharged into the river.

3.8 Open Water Space at Faringdon Park

During the consultation the opportunity for developing an open water space for leisure purposes in the Faringdon Park area was discussed. This has not been pursued further as part of this study as it is not critical to the design or operation of a canal. Whilst the introduction of an open water facility in this area would bring a number of benefits they must be balanced against the loss of green open space close to the centre of Swindon which also has a leisure benefit. Any decision on the future use of this area would need careful consideration and detailed consultation.

4 Effects on Transport Network

4.1 *Introduction*

This chapter presents the work undertaken to understand the traffic impact associated with closing roads in the centre of Swindon, to accommodate the implementation of the canal. This chapter describes the methodology adopted to assess the traffic impact of the scheme, and presents the results of this work.

4.2 *Options Investigated*

Various route options for the canal were set out in Chapter 3 of this report. For the purpose of assessing the traffic impact of the scheme, two options have been developed:

- Option 1: Closure of Westcott Place (assuming the canal can be accommodated alongside Faringdon Road). This option includes minor changes to the coding of William Street to make this route unattractive to through movements and;
- Option 2: Closure of Westcott Place and closure of Faringdon Road. This option also includes the one-way reversal of Catherine Street and Villets Street to maintain access to the Brunel North Car Park.

In addition to the two scheme options, a sensitivity test has been conducted on Option 2 to test the impact of closing Westcott Place and Faringdon Road alongside the closure of Fleming Way to private vehicles. This test has been developed to reflect the proposed future year change to the Swindon Town Centre network as part of the New Swindon Company's Exchange Site. There are many other potential transport changes associated with the redevelopment of the town. This test includes the closure of Fleming Way to private vehicles because of its proximity to Faringdon Road.

These options are shown on drawing TH-SBPF-145-017 in Appendix G.

4.3 *Modelling Overview*

Swindon Borough Council has commissioned Halcrow Group Limited to update their Borough wide traffic model. The model was originally developed in 1999, and has now been updated with 2006 Road Side Interview data, and been revalidated to standards set out in the Design Manual for Roads and Bridges. The

model has been developed using the SATURN program, and contains information and the origins and destinations of car based trips in the Borough and hence can be used to assess the re-routeing impact associated with changing the transport infrastructure.

The model covers the urban area of Swindon, extending to Wroughton, M4 Junction 14, M4 Junction 16 and Blunsdon (the model also include a more crudely coded area around the main part of the model, to enable traffic to enter the Borough in the correct places).

To date 2006 SATURN models have been developed for the AM peak (08:00-09:00), and PM peak (17:00-18:00). The models currently represent weekday traffic flows for the busiest periods of the week.

Travel patterns in Swindon differ between the weekend and weekdays. In particular some routes into the town centre (including Wootton Bassett Road and Faringdon Road) are congested on Saturdays because of people accessing the town centre car parks. When assessing the traffic impact associated with the road closures required for the canal, consideration will need to be given to delays of those accessing the town centre, as it will be important that congestion does not reduce the attractiveness of the town centre.

The possibility of building a new Park and Ride scheme close to M4 Junction 16 would help to ease weekend congestion for traffic from outside Swindon but traffic from the West Swindon Area could still be affected. Swindon Borough Council have not commissioned the comprehensive collection of travel patterns at the weekend, and consequently a SATURN model or the traffic survey data to enable one to be created do not currently exist for the weekend scenario. However as most traffic will be accessing the shopping centre, a different type of analysis based on a number of assumptions about destinations could be undertaken to assess the traffic impact at the weekend to avoid the need for expensive new traffic surveys.

It should be noted that the existing models contain 'average hour' traffic conditions, and hence would not represent the 'peak within the peak'. So if a junction is at capacity for, say 15 minutes during the 08:00-09:00, and operates well under capacity for the remaining 45 minutes, the SATURN model may show the junction operating, just within capacity for the whole hour period. This therefore

means that at times during the modelled periods, the real congestion may be greater than that shown in the model.

4.4 Traffic Impacts of the Options

4.4.1 General

This section sets out the traffic impacts associated with the options, which can be divided into three groups:

- Changes to local access arrangements;
- Changes to traffic flows in the local road network; and
- Changes to congestion throughout the Borough wide road network.

Each of these options is discussed further in the following sections.

4.4.2 Changes to local access arrangements

The changes to local access arrangements associated with the three options are discussed in the following text, and drawing TH-SBPF-145-018 in Appendix G summarises the issues discussed in this section.

(a) Option 1

It has been assumed that the towpaths alongside the canal on Westcott Place would have a dual function so that they act as service roads to the properties along Westcott Place. These properties do not currently have on street parking, so make use of parking facilities to the rear of the properties. Also, there are a few streets that use Westcott Place as the only access to the local road network (e.g. Westcott Street, Read Street). Again, access to the properties on these streets could be retained by making use of the towpath.

Currently residents of Marlborough Street can access the local road network using Westcott Place, however, if Marlborough Street was provided with access via the Westcott Place towpath, it may result in longer distance trips using Albion Street or make inappropriate use of the towpath.

This option will extend the journey distance for some local trips, for example trips between Rodbourne Road and Kingshill.

(b) Option 2

In addition to the issues associated with Option 1, again, it has been assumed that the towpaths along Faringdon Road would have a dual function so that they act as

service roads to the properties along Faringdon Road. These properties do not currently have on-street parking, so make use of parking facilities to the rear of the properties.

A number of streets (e.g Chester Street, Cambria Bridge Road) access the local road network via Faringdon Road, and these are currently one-way streets so a revised traffic management system would need to be developed to retain adequate access to these streets, if Faringdon Road were closed. Solutions may include allowing limited use of the towpath on Faringdon Road, making streets two-way (and hence reviewing current on-street parking arrangements). Consideration will also be needed into providing turning facilities for some streets (e.g. Milton Road). Other streets and junctions in the area around Faringdon Road may have knock-on effects from the changes listed above. Again these would need to be considered in more detail.

Access into the Brunel North Car Park has been assumed to be via Catherine Street and Villetts Street (operating in a reverse direction to the current operational layout). This could increase the traffic behind the adjacent properties on Faringdon Road. Egress from the car park would be onto Farnsby Street.

The closure of Faringdon Road would extend to Fleet Street; this would remove the ability to access John Street Car Park and the adjacent shop service area. A direct access could be made from Fleming Way, however this area is being considered as part of the Exchange development site by the New Swindon Company.

This option would extend the journey distance for some local trips, for example trips between Rodbourne Road and Brunel North Car Park.

(c) Option 2 – Sensitivity Test

The changes to access arrangements are the same as those for Option 2, but in addition the closure would result in the removal of access to John Street Car Park and the adjacent shop service area. This area may be changed as part of the plans for the New Swindon Company, or some access may be retained along Fleming Way.

4.4.3 *Changes to traffic flows in the local road network*

The 2006 AM (08:00-09:00), and PM (17:00-18:00) SATURN models have been used to assess the impact of the options on the local road network.

(a) Option 1

Drawings TH-SBPF-145-019 and 020 in Appendix G show the changes in traffic flow between the base and Option 1 for the AM and PM peak periods respectively. In summary the modelling work shows the following significant changes in traffic flows during the AM (08:00-09:00) peak:

- Increase in traffic along Bath Road;
- Reduction in traffic along Wootton Bassett Road (eastbound); and
- Reduction in traffic along Faringdon Road (inbound).

Also, the modelling work shows significant changes during the PM (17:00-18:00) peak:

- Increase in traffic along Great Western Way between The Meads and Bruce Street Bridges;
- Increase in traffic along Bath Road/Kingshill (westbound);
- Reduction in traffic along Faringdon Road (eastbound); and
- Reduction in traffic along Wootton Bassett Road (westbound).

(b) Option 2

Drawings TH-SBPF-145-021 and 022 in Appendix G show the changes in traffic flow between the base and Option 2 for the AM and PM peak periods respectively. In summary the modelling work shows the following significant changes during the AM (08:00-09:00) peak:

- Increase in traffic along Bath Road;
- Increase in traffic along Princes Street (northbound);
- Increase in traffic between the Cocklebury Roundabouts;
- Reduction in traffic along Wootton Bassett Road (eastbound);
- Reduction in traffic along Rodbourne Road (northbound);
- Reduction in traffic along Crombey Street; and
- Reduction in traffic along Emlyn Square/Farnsby Street.

Also, the modelling work shows significant changes during the PM (17:00-18:00) peak:

- Increase in traffic along Great Western Way between Transfer Bridges and Bruce Street Bridges (westbound);
- Increase in traffic along Cirencester Way (northbound);
- Increase in traffic on County Road (northbound);

- Increase in traffic on Princes Street (northbound);
- Increase in traffic along Bath Road/Kingshill (westbound);
- Increase in traffic on Eastcott Road (southbound);
- Reduction in traffic along Wootton Bassett Road (westbound);
- Reduction in traffic along Rodbourne Road;
- Reduction in traffic along Crombey Street;
- Reduction in traffic along Holbrook Way/Farnsby Street; and
- Reduction in traffic on Great Western Way, between Transfer Bridges and Cocklebury Bridges (westbound).

(c) Option 2 – Sensitivity Test

Drawings TH-SBPF-145-023 and 024 in Appendix G show the changes in traffic flow between the base and Option 2 – Sensitivity Test for the AM and PM peak periods respectively. In summary the modelling work shows the following significant changes during the AM (08:00-09:00) peak:

- Increase in traffic along Bath Road;
- Increase in traffic along Great Western Way (between Cocklebury Roundabouts);
- Increase in traffic along Princes Street/Corporation Street/Manchester Road (south-west bound);
- Increase in traffic along County Road (northbound);
- Reduction in traffic along Wootton Bassett Road (eastbound);
- Reduction in traffic along Rodbourne Road;
- Reduction in traffic along Crombey Street;
- Reduction in traffic along Elmyn Sqaure/Farnsby Street; and
- Reduction in traffic along Station Road.

Also, the modelling work shows significant changes during the PM (17:00-18:00) peak:

- Increase in traffic along Bath Road/Kingshill (westbound);
- Increase in traffic along Eastcott Road (southbound);
- Increase in traffic along Great Western Way (westbound from Cocklebury Roundabouts to Bruce Street Bridges);
- Increase in traffic along Commercial Road/Princes Street/Corporation Street/Manchester Road (south-east bound);
- Reduction in traffic along Wootton Bassett Road (westbound);
- Reduction in traffic along Rodbourne Road;
- Reduction in traffic along Crombey Street; and
- Reduction in traffic along Holbrook Way/Farnsby Street.

4.4.4 *Changes to traffic flows throughout the Borough wide road network*

The SATURN models have been used to assess the impact of the three Options on the Borough wide network. Table 3.4 shows summary statistics for Options 1, 2 and 3.

Table 3.4 - Summary statistics for Options 1, 2 and 2 – Sensitivity Test compared to the base models

	AM Peak (08:00-09:00)			PM Peak (17:00-18:00)		
	Option 1	Option 2	Option 2 – Sensitivity Test	Option 1	Option 2	Option 2 – Sensitivity Test
No. of Over Capacity Simulation Links	6.5%	10.9%	21.7%	9.1%	42.4%	60.6%
Total Travel Time	1.1%	2.6%	3.4%	0.6%	4.2%	4.6%
Travel Distance	0.4%	0.6%	0.7%	0.5%	0.5%	0.4%
Overall Average Speed	-0.5%	-2.0%	-2.5%	0.0%	-3.7%	-4.1%

Table 3.4 shows that all three modelled Options create an increase in the number of links in the network that are over capacity with Option 1 showing the smallest increase and Option 2 – Sensitivity Test showing the largest increase. The change to total travel time, travel distance and average speed show less pronounced changes between the base and the options. This analysis indicates that the reduction in network capacity for all options (Option 1 showing the least reduced in capacity, and Option 2 – Sensitivity Test showing the largest reduction in capacity), resulting in a reduction of up to 2kph/hour reduction in overall speed. There will be an increase in the delays at specific locations and increase overall congestion and delay in the Borough wide network, but the modelling work shows these are of a magnitude which would not push the Borough wide network, as a whole, over capacity.

4.5 *Recommendations for Future Study and Concluding Comments*

The modelling work has highlighted the following issues associated with the implementation of the canal scheme:

- Increases in traffic in local areas in the town (including Old Town, Great Western Way, County Road);
- Closing Faringdon Road and Westcott Place would result in more network wide congestion than closing Westcott Place alone;

- The sensitivity test of closing Fleming Way results in further network wide congestion to Option 2;
- Overall reduction in network wide capacity, resulting in small Borough Wide repercussions;
- Increases in journey for some local trips; and
- Local access issues for some streets directly accessing Westcott Place and Faringdon Road.

Following this initial work it is suggested that the following work be undertaken as part of the preliminary scheme work:

- Further detailed design work at junctions directly affected by the scheme;
- Remodelling of the scheme, and future year modelling; and
- Design work associated with the streets directly accessing Westcott Place and Faringdon Road, to ensure access is maintained (may require TRO's to be revised).

These modelled changes should be considered in the context of other changes in the town centre. The Swindon New Company is proposing changes in developments, and Swindon Borough Council is working to reduce the through movements in the town centre.

To conclude; this initial modelling work indicates that closing Westcott Place and Faringdon Road to general traffic would have some negative traffic impacts, including increases in traffic delay, increased journey lengths (due to detours), and possibly the loss of some on-street parking. However, the modelling work shows that other areas of the network will experience reductions in traffic/congestion, and hence, overall the network would not reach capacity and therefore could accommodate the closure of Westcott Place and Faringdon Road. However, other potential future year changes may also add to congestion in the Borough, which may result in unacceptable delays.

5 Highways Issues

5.1 General

Chapters 3 and 4 have presented route options and considered the effects of the preferred route on the transport network. This chapter considers the specific highway issues with particular regard to the impact of the canal on the existing roads and the infrastructure that would be required to accommodate the canal.

5.2 Road Alignments

The closure of Westcott Place as a through road to the east of Manor Road will require the introduction of a turning facility adjacent to the canal at around chainage 250. This could be introduced in association with the potential development of the area of land between Kingshill and Westcott Place.

A number of the roads adjoining Westcott Place will no longer have access to Westcott Place and alternative arrangement s would need to be developed, as set out in Chapter 4.

The closure of Faringdon Road will similarly impact upon existing adjoining roads and utilities within the road and as set out in Chapter 4 a more detailed examination of the traffic circulation in these areas will be required. Subject to further study and consultation it is proposed that a service road would be maintained on the south side of Faringdon Road, providing emergency and local residents access.

At Farnsby Street it is anticipated that a bridge will be constructed to maintain one-way northbound traffic flow to Emlyn Square with southbound flow being retained by the introduction of a one-way bridge at Holbrook Way. At both locations there are severe land constraints and it may be necessary to acquire corner properties to allow the ramps to the bridges to be constructed. At this stage these crossings are considered to be essential to maintain access to the multi-storey car park off Farnsby Street.

To the east of Holbrook Way the road has already been pedestrianised and hence access provision for emergency services will be the key issue.

Localised raising of Fleming Way will probably be necessary to facilitate the canal passing beneath the road into the canal basin.

5.3 Highways Bridges

5.3.1 *Kingshill Road*

Kingshill Road represents a through route of major importance connecting West Swindon with Old Town. Any constriction of the traffic flow during construction should be kept to a minimum to reduce inconvenience. The limitations of the site make it difficult to provide sufficient space for two way traffic to be maintained during the construction period. The close proximity of the junction with Sunnyside Avenue with its broad verges will enable working space to be available, but if a two way traffic diversion were to be attempted, the curvature of alignment will be unsatisfactory within the existing highway boundaries. During the construction period traffic wishing to access Sunnyside Avenue and Dunsford Close will do so via Grosvenor Road.

The original Kingshill Road Bridge had a significant hump in the vertical alignment, and thus restoration to the original level would be unacceptable from a traffic safety perspective. The length of crest curve and ramps required to comply with standard would require lengthy retaining walls with encroachment into adjoining properties, as well as interfering with access to the adjacent petrol station. Furthermore, the configuration of the bridge would be complicated by the junction of Sunnyside Avenue which has been partly constructed on the line of the former canal.

To overcome this difficulty, a lock is proposed immediately to the south of the Kingshill Road/Sunnyside Avenue junction to enable the water level to be 1.64m lower than previously. This will enable the existing highway alignments, both vertical and horizontal to be maintained. The canal will be confined within a box culvert some 65 metres in length, slightly curved in plan. Sunnyside Avenue and Kingshill Road pass over the top of the continuous structure on skews of 61° and 24° respectively.

Due to the length and curvature, there will not be a clear line of sight between portals. For reasons of safety and potential misuse, there will not be a towpath provided inside the box; pedestrians and cyclists would cross Kingshill Road at grade as they do at present.

5.3.2 *Farnsby Street*

A highway bridge will be required at this location to cater for existing residential traffic flows to Emlyn Square and in particular the one way bus-only route that crosses Faringdon Road southwards into Farnsby Street. A single lane width is proposed, flanked by footways on either side at least 2m wide.

The canal will be in shallow cutting at this point, thus the soffit of the bridge needs to be only 1.2m above the existing ground level. The span of the bridge will be at least 10.5m, consistent with the need to provide for free flow of pedestrians and cyclists underneath in an area likely to be busy close to the commercial and retail centre of the town. The headroom underneath (around 2.4m) will however not be sufficient for emergency vehicles such as fire engines, which will need ramps to ascend to the level of the road over the bridge.

For a bridge of this size, the most economic form of construction is likely to be steel sheet pile abutments, with a capping beam supporting pre-cast concrete inverted 'T' beams. The connection between bridge deck and abutment will be made integral in accordance with current practice in order to enhance durability and reduce maintenance costs. Brick or stone cladding could be attached to the abutments to mask the corrugated appearance of steel sheet piles that arises when using traditional Larsen or Frodingham profiles. An alternative would be to create a feature bridge at this location which could replicate in form the original Golden Lion Bridge which was originally located on Bridge Street, however this would need to be a lift type bridge which would be expensive to build and maintain if sized to take vehicular traffic.

5.3.3 *Holbrook Way to Catherine Street over Fleet Street*

As at Farnsby Street, this bridge will be single lane in width carrying one-way traffic and two footways. The soffit of the bridge will be higher at around 2.1m above existing ground level, as a result of the canal gaining 1.32m height at a lock 50 metres to the west. Ramps will be needed in the order of 40m length either side to obtain the required height. The bridge will need to be around 12m to 13m span to ensure continuity for pedestrians underneath on either side of the canal. The bridge will cross Fleet Street on a skew of 35°, roughly on the same alignment as Holbrook Way. A similar form of construction to that at Farnsby Street is proposed.

5.3.4 *Fleming Way*

If the Cheltenham Street car park area is utilised for the canal basin a tightly curved box type structure is proposed under the intersection of Fleming Way, Milford Street and Holbrook Way, where the canal turns through 117° from Fleet Street to Beales Close basin. The length of the culvert will be around 29.3m, on a plan radius of 30m; as at Kingshill Road, a towpath will not be provided internally to avoid public nuisance.

A structure of this type is most economically formed as a cast in-situ reinforced concrete box supported by spread footings. In the event of poor ground conditions, piled supports may be necessary. Construction can be enabled without closure of any traffic lanes since both Milford Street and Fleming Way narrow to one lane within the extensive junction area before converging in Holbrook Way. There is sufficient space within existing highway boundaries to enable temporary lane diversion around the working area, and the Beales Close car park may be utilised for extra working area if required.

It should be noted that even if the basin is located in the preferred area of John Street then a culvert in this location will still eventually be required to connect the North Wilts canal to the Central Canal.

5.4 Footpaths and Cycleways

5.4.1 *Footbridges*

In order for the canal not to have a dividing effect upon the town, footbridges are provided at regular intervals and generally in the locations where high pedestrian flows can be expected. Most of the bridges are in line with existing thoroughfares, thus enabling pedestrians and cyclists (but not motorised vehicles) to cross with the minimum of inconvenience.

The nine proposed footbridge locations will be as follows:

(a) Back of Westcott Autos
(b) Westcott Place, in front of Robert Le Kyng Primary School
(c) Westcott Place, junction with Andover Street
(d) Faringdon Road, east of Park Lane roundabout
(e) Faringdon Road, junction with Cambria Bridge Road
(f) Faringdon Road, junction with Chester Street
(g) Faringdon Road, mid-way between road bridges at Farnsby Street and Holbrook Way

(h) Fleet Street, junction with Bridge Street

(i) Fleet Street, junction with John Street

5.4.2 *Footbridge Layouts*

All of the footbridges must be DDA compliant, and this has an onerous bearing upon the lengths of approach ramps. Compliance with Highways Agency standard BD 29/04 'Design Criteria for Footbridges' requires that ramps have a gradient of 1 in 20, with intermediate landings 2.0m long every 2.5m of rise. Gradients up to 1 in 12 may be acceptable, provided that landings occur at intervals of 0.65m rise.

However the government guidelines on inclusive mobility are far more onerous: http://www.dft.gov.uk/transportforyou/access/tipws/inclusivemobility?page=8#a1050 provides full details, and requires more frequent landings.

Given that most footbridges will have to gain at least 2.5m, plus the depth of construction and any additional headroom over the towpath, it becomes apparent that with approach ramps of gradient 1 in 20, approach ramps up to 60m long will result. This becomes unnecessarily circuitous for able bodied people if the ramps are not aligned directly with the desire line, therefore steps also have to be provided.

Alternatively lifting or swing bridges could be provided, but these can be vulnerable to vandalism, and continued maintenance costs to ensure viability of the moving parts. These may be appropriate in the Fleet Street area where building frontages restrict the space for ramps. The Wilts and Berks Canal Trust are keen to replicate the Golden Lion lift bridge which was sited on Bride Street on the original canal and the new footbridge on Bridge Street would be an ideal location the achieve this.

In the Fleet Street area it may also be possible to create high level walkways between the buildings as the various properties are redeveloped which will further improve access across the canal, however due to the properties being in private ownership this is considered to be a long term consideration.

All footbridges must have a minimum width of 2.0m, over all parts of steps and ramps.

6 Environmental Baseline Review

6.1 General Methodology

6.1.1 Scope of the Baseline Review

A desk-based study of environmental and planning baseline information was carried out in May and June 2007. The aim was to identify any potentially major environmental or planning issues that could affect the viability of the Swindon Central Canal Route proposals. The aim was also to identify any key environmental opportunities presented by the option so that they could be incorporated into the scheme at an early stage of its design. The purpose of the review was not to look into detailed local records of the existing environment or to be an environmental impact assessment, but a broad-scale review of the key issues.

6.1.2 Potential Environmental Impacts

At a future stage in the proposed canal scheme, a full assessment of all the potential environmental impacts will need to be carried out and a formal Environmental Impact Assessment (EIA) is likely to be needed in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999. The EIA should consider the potential impacts (adverse and beneficial) during the construction, operation and maintenance and decommission phases, and direct, indirect, cumulative and synergistic impacts. Screening and Scoping Opinions should be sought from the Local Planning Authority to agree the requirements of the EIA.

This section indicates the likely key potential environmental impacts and enhancement opportunities presented by the proposed Central Canal Route.

6.1.3 Sources of Information

Information about the baseline conditions has been collated from the following sources:

- MAgiC (the GIS-based database of environmental information from six UK government organisations) for information on:
  - International, national and local nature conservation designations
  - National Parks, Areas of Outstanding Natural Beauty (AONB)

- Scheduled Monuments (with an extract from English Heritage's record of Scheduled Monuments)
- Registered Parks and Gardens, Registered Battlefields
- Registered Common Land, Community Forests, Millennium Greens
- Environmental Stewardship Areas, Countryside Stewardship Areas
- Environmentally Sensitive Agreement Areas, Nitrate Vulnerable Zones, Nitrate Sensitive Areas

(http://www.magic.gov.uk/, accessed on 15.05.07 and 01.06.07).

- Natural England's "Nature on the Map" website for information on:
  - Statutory nature conservation designation citations
  - UK Priority Biodiversity Action Plan (BAP) habitat

  (http://www.natureonthemap.org.uk, accessed on 30.05.07).
- Environment Agency's "What's in your backyard" website for river water quality data and targets (http://www.environment-agency.gov.uk/maps, accessed on 30.05.07).
- Ordnance Survey maps for information on public rights of way (http://getamap.ordnancesurvey.co.uk, accessed on 30.05.07).
- Swindon Borough Council website for the Swindon Borough Local Plan 2011 (Local Plan and Proposals Map) (http://www.swindon.gov.uk/environment/environment-forward/localplan/environment-forward-localplan-maps0609.htm, accessed on 01.06.07)
- The proposed World Heritage Site listings: Department for Culture, Media and Sport Buildings, Monuments and Sites Division (1999) World Heritage Sites The Tentative List of The United Kingdom of Great Britain and Northern Ireland.
- The Wiltshire Wildlife website for information on Rushy Platt (http://www.wiltshirewildlife.org, accessed on 01.06.07).
- England's Community Forests website (http://www.communityforest.org.uk/index.htm, accessed on 01.06.07).

6.2 Environmental Designations/Protection

6.2.1 Nature Conservation

There are no national or international statutory nature conservation designations within the proposed route. The nearest nature conservation sites are Coate Water Site of Special Scientific Interest (SSSI) (National Grid Reference (NGR) SU 188820) and Burderop Wood SSSI (SU 165810), which are approximately 2km from the route. The nearest international designation is at North Meadow and Clattinger Farm (SU 014934), approximately 11km from the proposed route.

There is a local nature conservation site designated as a Local Biodiversity Site in the Local Plan called Rushy Platt (SU137 836) adjacent to the restored section of the canal, approximately 50m from the proposed route. The site is managed as a wetland habitat by the Wiltshire Wildlife Trust, and supports protected species such as water voles (*Arvicola terrestris*) and great crested newts (*Triturus cristatus*), and birds such as jack snipe (*Lymnocryptes minimus*) and reed warbler (*Acrocephalus scirpaceus*).

The whole of Swindon and the surroundings is included in the Great Western Community Forest, which is one of twelve areas earmarked for England's biggest environmental regeneration initiative.

6.2.2 *Geology*

The proposed route is near to three geological SSSIs located in Old Town, Swindon:

- Okus Quarry SSSI (SU 147836), approx. 650m from the route;
- Great Quarry, Swindon SSSI (SU 151836), approx. 1km from the route; and
- Old Town Railway Cutting SSSI (SU 153832) approx. 1.3km from the route.

These sites are designated for their classic late Jurassic exposures of residual sections through the local Portland succession that are especially rich in molluscan fauna. They are important localities in Jurassic palaeontological and stratigraphic studies.

Surface geology is discussed further in Section 10.3.

6.2.3 *Cultural Heritage*

There are several Scheduled Monuments (SMs) near the proposed route:

- Bowl Barrow 210m north east of Rushy Platt Farm (SU 136837), approx. 200m from the route;
- Medieval settlement and associated ridge and furrow, West Leaze (SU 137832), approx. 500m from the route;
- Site of watermill 290m south east of West Leaze (SU 140829), approx 750m from the route; and
- Remains of Holy Rood Church, The Lawn, Old Town (SU 160836), approx. 2km from the route.

The search also highlighted two Registered Parks and Gardens nearby:

- Queens Park (SU 156842) Grade II listed, approx. 750m from the route; and
- Town Gardens (SU 152834) Grade II listed, approx. 1.2km from the route.

The proposed route of the canal runs along the southern boundary of the Great Western Railway Conservation Area (SU 144846). These former railway engineering works and railway village are included in a proposed World Heritage Site designation for The Great Western Railway: Paddington – Bristol (selected parts). The Tentative List by The Department for Culture, Media and Sports (1999) for review by the World Heritage Committee describes the railway village, which is immediately adjacent to the proposed route, as "without doubt the finest surviving example in the country of a planned railway town".

There is potential for some of the buildings and structures along the proposed route to have a Listed Building status, and information on this should be obtained from English Heritage during the next stage of the scheme. Similarly, there is potential for some of the trees in the vicinity of the route to be protected by Tree Preservation Orders (TPOs), and information on this should be sought from the Planning Authority during the next stage of the scheme.

6.2.4 *Planning*

The proposed route falls wholly under the jurisdiction of the Swindon Borough Council. The Development Plan for Swindon Borough incorporates four documents:

- Wiltshire and Swindon Structure Plan 2016 (adopted in 2006);
- Swindon Borough Local Plan 2011 (adopted in 2006);
- Wiltshire and Swindon Minerals Local Plan; and
- Swindon Waste Local Plan.

The most relevant document for the proposed canal development is the Local Plan, which presents the local land use planning policies and incorporates the more strategic policies of the Structure Plan. There are several relevant policies listed in the Local Plan, which are described further below. The canal development proposal should be assessed against these Local Plan policies to establish whether it conflicts or actively supports them.

Full details of the policies listed below are available online at http://www.swindon.gov.uk/environment/environment-forward/localplan/environment-forward-localplan-maps0609.htm.

The Local Plan shows the original route of the canal (Local Plan policy R10), which is also shown as an existing cycle route (T6) and a Strategic Corridor (ENV 20). The section of the proposed route and the reinstated canal south of Kingshill Road is shown as Open Space (R4). Further areas of Open Space are found at the adjacent Rushy Platt Local Biodiversity Site and the surrounding parks and playing fields, including the Robert Le Kyng School fields on Westcott Place and The Park on Faringdon Road. Within the housing areas nearby are areas designated as major local centres (S12) and housing commitment.

The Conservation Area around the railway works and village is described as the Great Western Railway Heritage Area (CA4, ENV1) in the Local Plan. The Scheduled Monuments described in Section 6.2.3 are highlighted on the proposals plan (ENV5, ENV21).

The northern part of the proposed route follows a bus prioritisation measure, and an area designated as a secondary frontage (CA11, CA12), adjacent to the Central Office Area (CA6A) and into The Railway Corridor (CA14).

The more rural area southwest of Swindon is highlighted as the Southern Development Area (DS2, DS4, E7, ENV21, H3, S9, S12, S13, R5, CF4) part of which is currently being constructed. Part of the SDA and the park north of Wootton Bassett Road are designated as Indicative Areas of Flood Risk (ENV 23).

6.2.5 *Recreation*

Leisure interests within the study area include walking and cycling in the parks and using the public rights of way and cycleways, and angling on the restored section of the canal.

Important recreational facilities at or adjacent to the proposed route include three areas of open space and parkland: the school fields on Westcott Place, The Park on Faringdon Road and the original route of the old canal, including the restored section of canal and Rushy Platt. To the west of the proposed route is a large park north of Wootton Bassett Road.

A public footpath and off road cycleway follows the route of the original canal. The dismantled old town railway south of the proposed route is designated as a cycleway and crosses over the restored section of the canal. Further north, a public footpath and off road cycleway follows the original route of the old canal under the railway to connect the town centre with the North Star area.

6.3 Other Key Environmental Information

6.3.1 *Water Quality*

The River Ray flows through the Rushy Platt nature reserve, in close proximity to the proposed route.

The Environment Agency regularly monitors water quality of rivers and canals by testing for chemistry, nutrients and ecology and comparing them against targets. The monitoring locations on the River Ray nearest to the proposed route are at Wroughton Ditch south of the M4 motorway, and at the Swindon Sewage Treatment Works to the north.

The Environment Agency river quality target for this stretch is 4, which has been met since 1991. The chemical water quality was classed as fairly good (Grade C i.e. natural ecosystems, or those corresponding to good cyprinid fisheries) between 2002 and 2005. It has reduced from Good (Grade B) between 2002 and 1998. The biological quality was classed as Fairly Good (Grade C i.e. biology worse than expected for unpolluted river) in 2005, which is a reduction from Good (Grade B) in 2002 and 2000. The level of nitrates has been classed as Moderately Low (Grade 3) since 1998 and the level of phosphates has been High (Grade 4) since 1999.

The River Ray has been monitored in one section further upstream, between the source and Wroughton Ditch. It has a river quality target of 2, which has been met since 1991. The most recent chemical water quality is classed as Very Good (Grade A) (between 2003 and 2005), which is better than the reach downstream. Similar to the reach downstream, the biological quality is classed as Fairly Good (Grade C) in 2005, a reduction from Grade B in 2002. The grade given to the level of nitrates is the same as the reach below, but the levels of phosphates are better, being classed at Moderate (Grade 3).

The area is designated as a Nitrate Vulnerable Zone (NVZ), a policy introduced by the European Nitrates Directive (91/676/EC) designed to reduce nitrate levels in drinking water. Since 2002, farmers located in the NVZ have been required to apply Action Programme measures to reduce water pollution by nitrate from agricultural sources.

Hydrogeology is discussed in Section 8.4 and potential sources of contamination are discussed in Section 8.8.

6.3.2 *Other Issues*

Other key environmental issues are presented separately in future sections of this report. These include:

- Landscape, visual amenity and urban regeneration issues (see Section 7);
- Contaminated land (see Section 7.8);
- Waste management issues (see Sections 3.6 and 3.7);
- Potential environmental considerations required in designing ground investigations (see Section 8.10); and
- Socio-economic issues (see Section 12).

6.4 *Key Potential Environmental Impacts*

This review of environmental baseline information is not intended as a full EIA, which will be required at a later stage. However, it gives an initial indication of the potential environmental impacts based on the limited information that should be included in the EIA.

Issues that are likely to be key during the construction phase include:

- Noise, dust, visual impact and vibration issues affecting residents and local businesses;
- Disruption to traffic, transport and private access;
- Risk of encountering contaminated ground;
- Waste management issues;
- Nature conservation;
- Risk of encountering archaeological finds; and
- Health and safety of the workers and the public.

Issues that are likely to be key during the operation phase include:

- Socio-economic impacts;
- Traffic and transport;
- Landscape and visual amenity;
- Changes to the setting of the railway heritage area;
- Health and safety of the public;
- Risk of vandalism;
- Hydrology and water resources;
- Water quality; and
- Recreation.

These lists are not exhaustive, are based on the limited information from this initial baseline review and would need to be refined during the scoping stage of a future EIA.

6.5 Key Environmental Opportunities

There are major opportunities for environmental enhancements associated with the proposed Central Route. The EIA of the proposals will look into the potential beneficial impacts, or environmental opportunities. At this stage in the project, it looks like the main environmental opportunities are related to socio-economic impacts, traffic and transport issues and an improvement in the landscape associated to the potential for urban regeneration.

The Central Canal Route proposals would require a review of the transport network in the centre of Swindon (see Section 4). This could potentially lead to benefits in how traffic and transport issues are resolved in this part of the town. Any reductions in traffic in the town centre will potentially have associated beneficial impacts, such as locally improved air quality and pedestrian safety. However, an assessment would need to consider all of the changes likely to be felt in the surrounding area as a result of the proposals.

The canal proposals potentially also present social and economic benefits, such as improved health from encouraging recreation, and the businesses that may be attracted due to the urban regeneration. The opportunities for landscape and visual amenity enhancements associated with the potential regeneration are discussed in Section 7.

6.6 Consenting Implications

Development consent in the form of planning permission will need to be sought from the local planning authority, Swindon Borough Council, according to the Town and Country Planning Act 1990. The proposals should also consider the UK Government's Planning Policy Statements (PPSs) and guidance. It is recommended that there is early consultation with the local planning authority to gain an understanding of what is and is not likely to be acceptable. The planning authority will determine the planning application in accordance with the statutory Development Plan, unless other material considerations are more appropriate.

EIA is a procedure for ensuring that the likely effects of new development on the environment are fully understood and taken into account before the development is allowed to go ahead. A statutory EIA will be required under the Town and

Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI No 293) ('the EIA Regulations'), as infrastructure developments including canalisation are listed under Schedule II. A screening opinion can be sought from the local planning authority to confirm this, and a scoping opinion can be sought to establish the required scope of the Environmental Statement before its preparation is begun. It is recommended that the whole development, not just the works that fall under the Regulations are subject to the EIA.

The EIA Regulations require that certain statutory consultees are consulted about the proposals. It is also recommended that non-statutory consultees with knowledge of local environmental and the general public are consulted about the environmental issues during the preparation of the Environmental Statement. Key consultees for these proposals include English Heritage, particularly with regard to any listed buildings and Scheduled Monuments; the Swindon Borough Council Conservation Officer for works affecting the Conservation Area; and Natural England, particularly with regard to any protected species that might be affected and assent needed for works that may affect the SSSIs, under the Wildlife and Countryside Act 1981. If works could potentially affect protected species, the proposals and appropriate mitigation measures will need to be agreed with Natural England and protected species licences may need to be obtained.

Conservation Area Consent could be required to demolish buildings/structures in the Conservation Area. It is recommended that the Local Plan policies are consulted and clear directions are sought from the Conservation Officer on what is and is not likely to be acceptable. Similarly, permission will need to be sought for any treeworks within the Conservation Area and trees designated by Tree Preservation Orders, unless these treeworks are clearly identified within the planning application. If the railway heritage area receives WHS status, the UNESCO representatives would need to check the proposals to verify whether they will affect the setting of the site, in consultation with English Heritage, even if the proposals do not fall inside the boundary of the WHS.

The Environment Agency will need to be consulted, with particular reference to the water resources and quality issues, as well as the potential requirements for abstraction licences, transfer licences and waste licensing and exemptions.

6.7 Conclusions

Some of the environmental issues identified above are likely to have a significant influence on the planning consent decision of the local planning authority and also on the decisions of the other consenting bodies described above. In particular, for example, effects on local residents and traffic flows, and any effect on the setting of the proposed World Heritage Site. Consequently, thorough and appropriately-timed consultation with statutory and non-statutory consultees will be an essential element of the EIA and the development of the proposals. The central canal route also present possible opportunities for enhancing the environment largely associated with the potential urban regeneration.

7 Urban Design: Effects and Regeneration Opportunities

7.1 *General*

A new canal from the edge of Swindon through to its centre will have a significant impact on the character, form, structure and quality of the built environment. In order to assess what these effects are likely to be, the proposed route has been broken down into a series of character areas. These are shown on drawing TH-SBPF-025 in Appendix H.

For each area, a brief assessment of the existing character has been made, a description of the likely changes as a result of the canal is given, and implications which need to be considered at a later design stage to ensure that the canal fits into the built environment. In addition, potential wider redevelopment opportunities are discussed in outline.

A number of concept sketches have been prepared to illustrate the canal and how it could fit into the existing streets.

7.2 *Kingshill Road*

The area to the south of Kingshill Road is the urban-rural fringe of Swindon. The canal route will pass between existing residential areas with the gardens backing onto the canal. The boundary is marked by mature tress and is typically sub-urban and relatively tranquil in nature.

The petrol station is a locally dominant feature which also backs onto the canal route along with the electrical sub-station on the corner. The junctions between Kingshill Road and Sunnyside Avenue, and between Kingshill Road and Westcott Place create wide open and disjointed spaces which are dominated by the roads and its associated traffic signs, road markings and pedestrian guard rails.

Extending the canal through this locally complex area will have a significant impact requiring complex structures and level changes to enable the road to cross the road at the junction with Sunnyside Avenue. A lock (No 1) will be required to lower the canal so it can pass under the road junction.

In order to successfully incorporate the canal, a wider and more comprehensive approach will be required. It will need to address level changes, loss and replacement of existing trees and shrub planting, reinstatement of boundaries, clearly defined pedestrian routes and avoidance of awkward spaces so that a clearly defined and attractive environment is created.

This area is effectively a gateway into Swindon and its urban area and should be marked as such. A gateway feature could take the form of a signature bridge or as a location for public art. See drawing TH-SBPF-026 in Appendix H..

7.3 Shire Court and Erin Court

To the north of Kingshill Road is a residential area known as Shire Court and Erin Court. These 2 storey houses in brown brick and tile are set at an angle to the line of the canal on either side. The houses also have unfenced boundaries with open grass areas backing onto the line of the old canal. This has resulted in poor urban form with triangular grass areas and poor definition of public-private space. Localised level differences also contribute to a low quality environment. A number of nature trees on the line of the old canal are locally dominant features.

To the north of Shire Court an open car park backs on the houses which front onto Westcott Place and the roundabout with Kingshill Road.

It will be possible to fit the canal between the houses of Shire Court. However this will mean that the existing mature trees will have to be removed. Due to the lack of space it will not be possible to replace these. There will also only be space for a narrow tow path. It is also worth noting that the new canal will be in up to 2.5m of cutting at this point.

This tightly constrained section will need carefully detail to ensure that the new canal fits reasonably into its surrounding. There is however a significant opportunity to redevelop the adjacent land. To the north the block of land is well defined by Kingshill Road and Westcott Place, and to the south Erin Court is separated from adjacent housing by its car park.

Redevelopment could create a signature development on a prime site overlooking a new canal. The redevelopment will also enable more space for a wider canal, tow paths and changes in level so that the canal is successfully incorporated into the adjacent development. See drawing TH-SBPF-027 in Appendix H.

7.4 *Robert Le Kyng School*

The route of the new canal will cross from its old alignment to its new proposed route on Westcott Place by passing through Westcott Autos and onto the north side of Westcott Place.

Westcott Auto's creates a gap in the line of houses on the south side of Westcott Place with open forecourt and single storey building to the rear of the plot. The rest of the south side of Westcott Place in this section is two storey terraced residential development with doors directly onto the street. The buildings are mostly rendered in brown and cream colours, with gable ends facing road at either end and within the centre of the block. The Falcon Inn at the southern end is faced in stone and forms a small scale attractive building.

The north side of the road is the boundary to the school with grass verge, chain link fence on concrete posts, with a line of dense mature trees behind.

Transferring the route of the canal onto Westcott Place will involve the demolition of Westcott Autos and using the forecourt to turn the boats through two tight 90° corners. The canal follows the northern side of Westcott Place retaining an area in front of the housing on the south side. The canal will continue to be narrow in this section allowing the boats to pass but not space for mooring.

The remaining area of Westcott Autos will need to be designed with a positive use, such as open space linking the line of the old canal and Westcott Place. The buildings either side have blank elevations facing this space so it will not be overlooked. A foot bridge will cross the canal at this point on the line of the old canal. This area will need to be designed carefully to avoid creating a space which is un-used and poorly treated.

Redeveloping the Shire Court area to the south also enables a better alignment of the canal to be achieved which avoids the tight corners and creates more positive uses of the land and spaces.

On Westcott Place the canal will be close to the boundary of the school. The potential impact on the boundary trees will need to be carefully handled, particularly during any construction period, to avoid damage to the trees or killing them. This will particularly be the case to the north end of the school where a lock (No 2) will be required to lower the canal level. There is scope for environmental

improvements to be carried out at the towpath area between the houses on Westcott Place and the canal. See drawing TH-SBPF-028 in Appendix H.

7.5 Westcott Place

The upper section of Westcott Place north of the school is a relatively narrow street with large blocks of flats on the north side and two storey buildings to the south. The buildings on the south side from the ends of blocks between the roads perpendicular to Westcott Place and include some larger buildings containing small businesses. The northern end of this section is the junction with Faringdon Road and Park Lane which takes the form of a roundabout which is partly enclosed by local shops and pubs. The narrowness of the street means that only a narrow canal can be built, with minimal space either side between it and the buildings. Other than the treatment of the tow path/footpaths there is little scope for enhancement.

It is worth noting that the canal will need to be above the surrounding ground levels as it passes the Ship Public House on the Faringdon Road roundabout. The lack of space means that walls will probably be required.

Redevelopment of land either side of Westcott Place would be complex. The large blocks of flats on the north side could not be easily adapted and would require complete redevelopment. On the south side it would be possible to redevelop the ends of the blocks by 'cutting them back' to create more space by the canal. New 3 storey buildings could then be built which overlook the canal.

7.6 Faringdon Park

Faringdon Park is a relatively large park and forms a significant area of open space. The park is relatively simple in form with a large central grass area bounded by trees and shrubs. The boundary with Faringdon Road is marked by a low brick wall with distinctive blue brick coping with buttresses where railings used to be. Behind this is an area of grassland managed for wildflowers with various species of nature trees forming informal rows 2-3 trees deep.

To the south there are rows of storey terraced houses with small front gardens facing the road. The houses are either stone fronted or in brick with low garden walls in a wide variety of materials.

The pub on the corner with Cambria Bridge Road forms a locally distinctive building.

The canal will widen out for this section and follows the line of the boundary to the park so maintaining a wide towpath and access roads to the houses on the south side of Faringdon Road. The route will mean the loss of a significant number of the existing trees along with the brick boundary wall. Whilst these are relatively significant impacts, there is a great potential to link the canal and the park for the benefit of both. The park will be able to utilise the canal as a focal point and feature with wide paths and seating alongside the canal. The park will also create variety for the canal users and be a place to stop. See drawing TH-SBPF-029 in Appendix H.

The canal will be slightly higher than the adjacent levels in the park. However there will be sufficient space to grade out the slopes within the park and re-plant with new trees and shrubs.

7.7 Railway Village Area

The Railway Village is the most distinctive area in Swindon. Centred around the Mechanics Institute building, the 2 storey stone cottages set out in formal terraces are currently being proposed as a World Heritage Site. The housing is well cared for and managed. The housing is set back from Faringdon Road and separated by narrow front gardens with hedges and the gated service road. The southern section is further separated by a triangular open grass area and car park to the north of Park House. Park House is a distinctive 4 storey building on the corner of the park which is now used for serviced offices.

The south side of Faringdon Road is a combination of 2 storey terraced houses in brick, often with a ground floor shop, with large scale buildings including the Health Hydro and Bridge House. The Health Hydro is a large scale red brick building which is high distinctive. Bridge House is a modern multi-storey office block in brown brick on the corner of Farnsby Street which dominates the local streets. The traffic on Faringdon Road also currently dominates the landscape.

The new canal will narrow in width as it passes Park House before widening out again alongside the Railway Village. It will occupy most of existing road and the service road infront of the Railway Village housing on the northern side. A relatively wide space to the south will be maintained for local service access.

The canal will be mostly in cutting with a new lock north of Farnsby Street required to raise the water level. A road bridge will be required at Emlyn Square and Farnsby Street for residential access and new bridge will be required to take

traffic into Catherine Street and onto the car parks in this area. This bridge will be high visible as it will need to rise up over the canal at this point, the canal will be narrowed below the bridge to maximise space for the approach ramps.

This section of the route is one of the most sensitive in urban design terms and will require a comprehensive approach to designing the canal and the adjacent streets. High quality materials will be required to complement the materials within the railway village. See drawing TH-SBPF-030 in Appendix H. The two road bridges in this area will also be highly visual and need careful design to make feature of them whilst integrating them into the area.

7.8 Fleet Street

Fleet Street forms part of the retail centre of Swindon and is a pedestrianised street extended north from Faringdon Street. The area is considerably denser in its urban form with larger scale blocks and buildings with retail and commercial uses. It is more enclosed and quieter without the traffic noise.

Buildings are a mixture of small scale 2/3 storey historic buildings with larger scale modern buildings. There is a wide variety of building materials and styles.

Fleet Street is on the edge of the retail core and is characterised by second tier shops, bars and other uses. This is again a relatively narrow street with little space left over either side of the proposed canal. The canal will be at a similar level to the adjacent ground levels. Fleet Street will need to be re-built with new paving and street furniture. See drawing TH-SBPF-031 in Appendix H.

Redevelopment opportunities would more successfully involve relative large scale redevelopment of whole blocks, within the east side offering the most potential. Redevelopment of this block could be centred on a new canal basin with a variety of mixed uses overlooking the waterfront. See Figure 8.

7.9 Exchange Development

The proposed route of the new canal terminates with a basin in the Fleet Street / Fleming Way area, although the long term connection of the North Wilts canal will create a through route for boats.

The preferred option for a boat mooring basin is the redevelopment of the John Street block to the south on the east side of Fleet Street as a focal point for new mixed used development. See also Section 12 which discussed the redevelopment

benefits this could bring to Swindon. This will allow a much greater integration of the canal into the town centre and also provide a focal point close to the main shopping area. This could be developed as a leisure/rest area for people using the town centre and will provide the space to develop street cafes and restaurants overlooking the basin.

The use of the alternative Cheltenham Street car park for a basin area is undesirable and is a second best alternative. The car park is located within a traffic dominated area enclosed by large scale office buildings between 3 and 7 storeys.

Whilst this location offers a practical solution which does not involve demolition of buildings, it is not an attractive place to stop and offers few facilities for boat users. The basin would be set below the surrounding levels with the busy roads of Fleming Way and Holbrook Way to close proximity, although it is noted that this route may be restricted to buses only in the future. The future proposal to locate a bus terminus in this area further limits the space to develop facilities to utilise the basin as a town centre focal point.

7.10 ***Materials and Image***

There are a number of interesting and distinctive historic buildings along the route of the canal, from the larger scale Railway Village and Health Hydro down to the smaller locally attractive pubs and shops. See drawing TH-SBPF-032 in Appendix H. These buildings should be highlighted along the route and used as local focal points and way-markers on the route. The buildings should also be used as a source of ideas in developing the design details.

In addition to the buildings, there are also interesting details to be found on other features such as walls and gates which again should be used in developing design details.

These historic details should be used in way which inspires a contemporary design theme for the canal, placing modern design into a historic context.

The design of the canal should also be developed with high quality at its core. It is important that the canal is considered as setting high standards for the streets of Swindon. It is hoped that the canal will also act as a catalyst for redevelopment and enhancement of adjacent areas, from the larger scale regeneration as outlined above through to smaller scale shop from improvements and the like.

8 Geotechnical Considerations

8.1 General

This section undertakes a brief review of the potential issues surrounding the design and construction of a new canal into the centre of Swindon. The majority of the design considerations will centre around excavation of the canal and the associated retaining walls, bridge foundations and embankments therefore this section concentrates on the potential issues surrounding the geotechnical aspects of the canal.

8.2 Sources of Information

The review is based on a desk study of existing information available in May 2007 that is summarised in Table 8.2. Whilst information has been gathered, due to the limited timescale for the project some data has not been fully assessed or has only been briefly reviewed. This is noted in the table. At this stage of the study, no intrusive investigations have been completed.

Table 8.2 – Source of Information for Desk Study

Ref	Title	Description
1. Surface Mapping, Topographic Survey and Aerial Photography		
1.1	HGL topographic survey, May 2007	Existing ground levels along the route
1.2	National Monuments Record Office, aerial photograph collection	A brief review of aerial photographs that were collated for an adjacent development south of Faringdon Rd.
2. Environment and Former Land Use		
2.1	Envirocheck Report	Site sensitivity maps and datasheets (pollution incidents, hydrological, waste, hazardous substances, geological, sensitive land use, historical Ordnance Survey mapping)-
2.2	Envirocheck Historical Land Use report	
2.3	Envirocheck Historical Town Plans	
3. Site Walkover		
3.1	April 2007 half day visit	Brief walkover of the Bruce Street Bridges area by a HGL geo-environmental specialist

Ref	Title	Description
4. Geological and Hydrogeological Maps and Memoirs		
4.1	1:63,660 geological map for Swindon (Sheet 252, 1974) IGS	
4.2	Envirocheck geology report	Reproduces geological map with updated formation names, see Figure 7.3
5. Previous Canal Studies		
5.1	The Wilts and Berks Canal Pre-feasibility Study for the Canal in Swindon, Ove Arup, Draft Final Report, 2003	Limited geotechnical and geo-environmental data.
6. Previous Ground Investigations		
6.1	British Geological Survey on-line borehole database	Four logs ordered from the Bruce St Bridges area, not received yet. Others available along the route, not requested at this stage.
6.2	Archive search of SBC ground investigations stored in connection with historical planning applications.	Several ground investigation reports from nearby developments (see **Table 2.2**). Brief review only.
7. Other Local Studies		
7.1	The Wilts and Berks Canal by L.J. Darby, 1986	Books detailing the history and construction of the canal. Brief review only.
7.2	The Thames and Severn Canal by Humphrey Household, 1983	

8.3 Geology

The published 1:63,660 geological map for Swindon (Sheet 252, 1974) (ref 4.1), shows that the proposed canal route is located entirely within the Upper Jurassic Age Kimmeridge Clay Formation. A general description of this material is stiff to very stiff medium to dark grey fossiliferous clay, silty mudstone and thin siltstone. The geology is shown on Figure 8.3, extracted from the Envirocheck Geology Report (ref. 4.2).

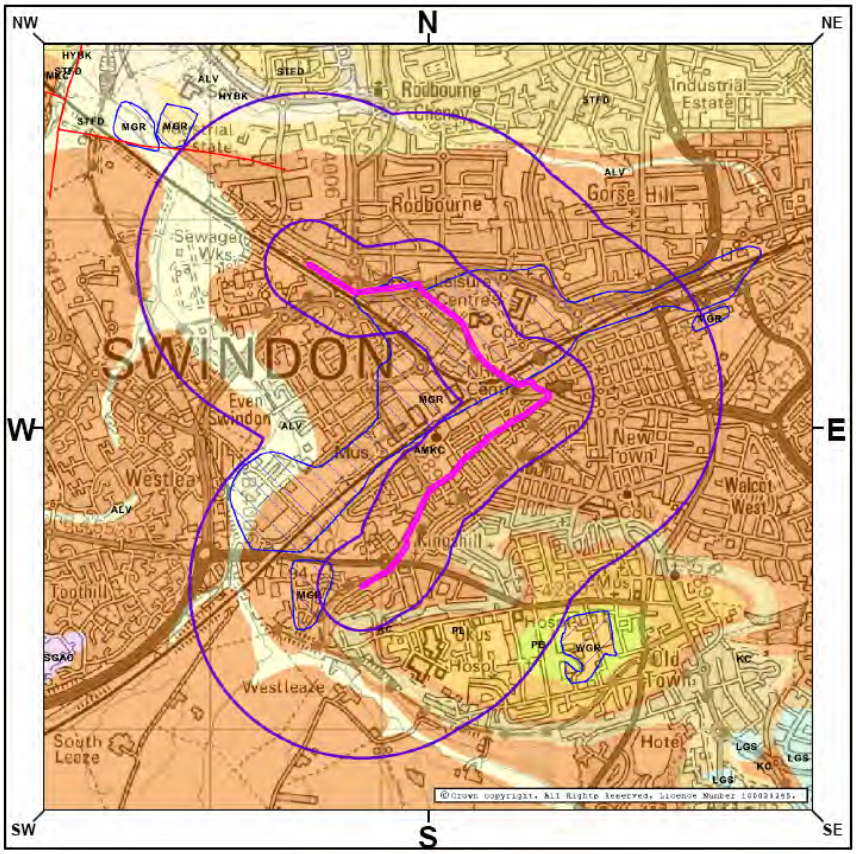

Figure 8.3 Surface Geology (from ref. 4.2)

Canal route shown in pink with 250m and 1km offset shown in blue. Grid squares are 1km. Key: MGR = made ground; ALV = alluvium; PB = Purbeck Limestone, PL = Portland Limestone, AMKC or KC = Kimmeridge Clay; STFD = Stanford Fm (formerly Lower Corallian)

A geological cross section included with the geological map indicates that at the canal location the Kimmeridge Clay is about 18 to 20m thick and underlain by the Corallian sequence of limestone, sand and clay (Stamford Formation, formerly Coral Rag).

At Swindon there is a localised geological sequence, in the Kimmeridge Clay that forms the slope of Swindon hill immediately south of and above the canal route. The lower and mid-slope comprises the Cemetery Sand Beds (named after Swindon Cemetery) which is a thick (approximately 30m) sequence of clayey fine sand, with a gradational boundary with the underlying clay units that can be difficult to distinguish. The Cemetery Sand beds are loose and potentially unstable

in excavation, with groundwater from Swindon Hill emerging as springs at the base and within the beds.

The geological map does not indicate the presence of superficial or man made deposits along the route, but it is likely that historic development along the route will have formed a widespread surface layer of made ground of variable thickness and composition. An extensive deposit of made ground is identified on the published geological map along the railway line and at the former railway works north of the canal route.

8.4 Hydrogeology

The Kimmeridge Clay is classified as a non-aquifer (negligibly permeable) and there are no groundwater source protection zones in the immediate vicinity (**Ref 2.1**). Springs or seepage emerge from at least two spring lines around Swindon Hill above the Kimmeridge Clay and drain northwards. Historically, these have formed marshy areas in disused brick pits at the base of Swindon Hill.

8.5 Historical Development

Swindon has a long industrial history, mostly associated with the railway works. A brief review of the likely previous land use has been completed based on the historical Ordnance Survey maps (**Ref 2.1**), from the 1st edition maps published in about 1889. At this time the canal, railway, main roads and Faringdon Park were already constructed.

South of the railway the route mainly passes through mostly urban areas which have not had previous industrial uses. The exception to this is near the Esso Garage in Kingshill, where a brickworks was located in 1923. Brickworks were usually associated with quarries (for winning the clay for brickmaking). These quarries were then infilled. There is usually no record of the nature of the infill.

North of the railway the route passes though the former railway works and a gasworks, both major sources of potential contamination. The gas works were developed progressively between about 1925 and 1960, and the Great Western Way dual carriageway was built through this area in the 1980's.

There are lagoons next to the railway line at Cheney Manor, north west of Bruce Street bridges. These are shown on the 1st edition O.S. map and it is likely that they were built for water supply for the railway works (it is understood that water was piped to the railway works from Kemble to the north).

8.6 *Previous Ground Investigations*

A search has been made by HGL of miscellaneous ground investigations completed in connection with planning applications and held by SBC. Data from over 15 ground investigations has been reviewed that were located close to the proposed route (including the Cheney Manor area). It appears that there are no former ground investigations in the SBC archive that are directly along the proposed route (i.e. within the roads). However, there are likely to be substantial records in the area of the mooring basin near Fleming Way where there has been significant recent development.

The boreholes are generally 5 to 15 deep and encountered 1 to 2m of fill (usually firm clay) overlying Kimmeridge Clay which shows a weathering profile from soft or firm at shallow depth to very stiff at depth. Some boreholes terminated in a hard grey limestone band at about 15 to 17m depth (potentially underlying Corallian Limestone). Occasional perched groundwater was encountered in the fill or top of the Kimmeridge Clay.

In the northern area, an early ground investigation for the Great Western Way construction is held in archive (Northern Distributor Rd, Wembley Laboratories, 1973), and borehole logs from work at Bruce Street Bridges in 1988 have been obtained from the British Geological Survey. These indicate about 2 to 3m of fill overlying Kimmeridge Clay, but are dependant on the exact location of the borehole, as some may have been bored through the existing railway embankment.

It should be noted that details of substantial ground investigation are held in the SBC archive that covers the potential route of the North Wilts Canal from Bruce Street Bridges northwards (Hreod Parkway / Purton – Iffley Link Road, C J Associates, 2001).

8.7 *Geotechnical Issues*

8.7.1 *Earthworks*

Most of the canal will be in shallow cut through variable made ground (fill) and weathered Kimmeridge Clay, with potential for localised shallow embankment and a landscaped section of embankment in Faringdon Park. Earthworks balancing will be used wherever possible to minimise spoil disposal and transportation.

Excavated Kimmeridge Clay is likely to be suitable for use as engineered fill, but the feasibility of re-using made ground is not known and will require intrusive investigation to determine the physical and chemical properties. The made ground

will be composed of waste materials or spoil available at the time and is likely to include clay, gravel, ash, clinker, coal, bricks, wood and glass. Engineered fill (graded sand and gravel) is likely to be present as the sub-base to the roads and possibly water pipes. Fleming Way is constructed on the route of the former North Wilts Canal and more substantial and variable fill may be encountered in this area.

Given the space restrictions along the route there is little scope for major earthworks. However if required then cut and embankment slopes of 1V:3H horizontal should be assumed. The most likely method of constructing steeper embankments would be to use a reinforced soil system.

8.7.2 *Retaining Walls and Foundations*

The ground is likely to be suitable for using driven steel sheet piles to form vertical canal sides, but the use of such as system also depends on the space available for plant to operated, the vibration impact on adjacent properties, and the presence of foundations and services in the roads. It is anticipated that due to the proximity of buildings along sections of the route sheet piles will not be suitable unless vibration free installation techniques are used which can be expensive.

The Kimmeridge Clay should also be suitable for driven or bored pile foundations and temporary excavation for raft or spread footings. This would need to be confirmed for specific structures at detailed design stage.

The Kimmeridge Clay is recognised as containing sulphates (gypsum) and sulphides (pyrite). The use of sulphate resisting cement in buried concrete foundations should be assumed.

8.7.3 *Groundwater Control and Resource*

Only minor seepage into excavations is anticipated from perched water. However, it should be noted that there are understood to be several springs emerging from the Cemetery Sand units around Swindon Hill immediately south and upslope of the canal route, and therefore there is potential for more substantial but isolated flow. The drainage of these springs probably feeds into the urban run-off system but should be confirmed.

A detailed study of the feasibility of groundwater supply is understood to have previously been completed by Scott Wilson in 1998 (reference not obtained) and that a study of water resources is currently underway. Water supply is outside of

the scope of this work, and it is recommended that the feasibility of using these springs is included in the current water resource assessment.

8.7.4 *Canal Linings*

Although the Canal Central Route will be located on relatively impermeable clay, there is also likely to be an overlying deposit of made ground with a variable thickness and probable higher permeability. At this stage of the study, it is considered prudent to assume that the entire length of the canal will need to be lined. At present a sheet piled wall and concrete base has been assumed as this provides an efficient structural solution. However it may be that excavated Kimmeridge Clay is suitable for forming puddle clay and therefore it is likely that suitable material could be sourced from the canal excavation itself, or from adjacent town centre developments, or from the development of Wichelstowe to the south of the Swindon.

8.8 *Potential Contamination*

The route can be divided into four scenarios in terms of potential contamination:

- Infilled former canal
- New canal route, uncontaminated
- New canal route, potentially contaminated.
- New canal route, existing lagoon

The potential sources of contamination are shown on drawing TH-SBPF-145-016 in Appendix I.

If excess excavated material cannot be re-used within the scheme then disposal will be required. Under current legislation waste is divided into three categories:

- Inert – contain very little contaminants or biodegradable matter
- Non-Hazardous – Neither inert nor hazardous waste
- Hazardous – waste which has hazardous properties as defined The Hazardous Waste (England and Wales)Regulations 2005

It is worth noting that non-hazardous waste may still be classed as Contaminated Land and may contain concentrations of contaminants harmful to humans and/or the environment in some scenarios.

8.8.1 *Infilled Former Canal*

The nature of the infill is unknown and previous experience indicates that some contamination should be expected. Obviously surrounding landuses may contribute so sources of infill or the canal may have been simply used for domestic disposal over many years. Waste materials from these areas of the canal are likely to be classed as "non-hazardous wastes" with potential for small amounts of "hazardous waste".

8.8.2 *New Canal Route, Uncontaminated*

This is the majority of the route south of the railway. Waste materials from this section are likely to be "inert waste" although if significant made ground is encountered there is the potential to encounter "non-hazardous wastes". There is potential to re-use inert wastes within other schemes in the areas, depending on the requirements for fill materials locally at the time of canal construction.

8.8.3 *New canal route, potentially contaminated*

This mainly relates to the area east of the Bruce Street Bridges and north of the Great Western Way. Here the new route of the canal passes through a former gasworks which may be very heavily contaminated. Wastes produced by the excavation of the canal in this area may be classed as "Hazardous" and "Non-hazardous" wastes. A greater proportion of Hazardous wastes should be expected in this area.

8.8.4 *North Wilts Connection, existing lagoons*

North of the Bruce Street bridges the proposed route coincides with several linear lagoons. Whilst the volume of material within the lagoons will be less than for sections of new and/or infilled canal the sediments from the lagoons will require either disposal or re-use (depending on the contamination content).

8.9 Environmental and Waste Management Issues

Materials generated by excavation of the canal route will likely be classed as waste unless they can be re-used within the scheme. To allow the material to be re-used the following must apply:

- A genuine reason for reuse, i.e. as part of a landscaping plan approved by the planning permission;
- The material must be suitable for use, i.e. any contamination must not present a risk to humans and/or the environment.

The excavation of new canal route or restoration of infilled canal will create significant volumes of excess fill/soils some of which may be contaminated. It is considered doubtful that there is potential to re-use the excess fill within the scheme itself although there may be potential to re-use clean fill and topsoil on other schemes locally (this will obviously depend on what projects are ongoing at the time).

Unsuitable excess fill will require disposal to a suitably licensed landfill. All Hazardous and Non-Hazardous waste will require pre-treatment prior to disposal as required by the Landfill Regulations. Approximate unit costs for disposal of wastes at 2007 prices are:

- Inert - £22 / m^3 (disposal cost £16.2/m^3)
- Non-Hazardous - £82 / m^3 (disposal cost £34/m^3)
- Hazardous - £125 / m^3 (disposal cost £80/m^3)

All prices include transport and landfill tax but not cost of pre-treatment. Pre-treatment may cost in the range of £10-75 / m^3. Obviously the more non-hazardous and hazardous waste generated equates to higher costs.

8.10 ***Outline Ground Investigation Requirements***

A ground investigation would be required along the route with the following objectives:

- Confirm the ground model (geology and groundwater) along the route;
- Determine the geotechnical properties for use in detailed design
- Determine chemical properties in order to estimate costs associated with re-use and or disposal of excavated material.

The investigation is likely to comprise boreholes and trial pits at major structures and earthworks with intermediate boreholes and trial pits between where appropriate. Geo-environmental and geotechnical soil sampling would be combined wherever possible. Data from the existing adjacent ground investigations would also be used.

The following will be major considerations in designing the ground investigation:

- traffic disruption / diversion for safe working

- maintaining access for pedestrians and emergency services
- buried services
- noise, vibration, nuisance to adjacent shops, houses, pedestrians

Boreholes are likely to be 10 to 20m deep, depending on the anticipated depth of foundations and excavation of the each structure. Trial pits would principally be used to investigate the made ground and the depths depend on the thickness of made ground, the space available for plant and the risk of collapse of the pit side walls.

For waste disposal classification, the following trial pit spacing is recommended:

- Infilled former canal – one trial pit every 25m
- New canal route, uncontaminated – one trial pit every 50m
- New canal route, potentially contaminated – One trail pit every 10-15 m
- New Canal Route, existing lagoon – 10 sediment samples from varying depths.

For soils expected to be either inert or hazardous waste, waste acceptance criteria testing will be required in addition to contaminant testing.

8.11 Scope for Potential Cost Savings

A high proportion of the cost of constructing the canal will be associated with the disposal of excavated arisings. Therefore, ideas for cost saving are all linked with reducing the amount of arisings generated or reducing the cost for disposal. The following ideas are suggested for consideration:

- Earthworks balancing by raising the level of Faringdon Park, or use of the canal embankment across the park
- Ground compaction – the idea of this is to minimise the amount of arisings generated by compacting the ground beneath the canal excavation. To evaluate cost savings a small scale trial will be required. Vibration to adjacent properties and services may make this unfeasible;
- Construction of New Landfill – to save disposal costs (but not transport and landfill tax). Depending on the volumes of waste, constructing a new landfill may save money (although there are programme and political implications.

There may be scope to reduce geotechnical investigation, design and construction costs where crossings are incorporated into adjacent developments, for example footbridges at first floor level.

9 Sustainability

9.1 *Carbon Footprint/Energy Use*

It is recognised that there will be direct energy use both during the construction of the canal and from its operation (such as from waterpumps). There will also be indirect impacts, such as energy used by boats that navigate the canal.

An offset strategy should be developed following guidance given by the Carbon Trust. This will include reducing direct emissions, developing low-carbon solutions, reducing indirect emissions and then developing an offset strategy.

The design of the scheme should be such that during operation the scheme will be carbon neutral. The operation of the lock gates would be the traditional hand operated system; this will avoid unnecessary power requirements at locks and simplifies construction and operation. Some power will however be required to drive the pumps to re-circulate water back up the locks which will reuse and conserve water. This power for the pumps should be generated locally wherever practical, using solar panels and mini hydro power installations built into the locks.

9.2 *Recycling and Sustainable Materials*

Wherever possible material arising from the construction process should be reused within the permanent works. However a significant quantity of new materials will be required in the construction of the canal. Where new materials are to be used then locally sourced materials will be used, this will reduce transport costs, support local businesses and help ensure the canal is in keeping with the local environment.

Lock gates will be timber which will be from a sustainable source and easy to repair if damaged. Experiences over time has shown these are as durable as more expensive steel gates which have a high carbon footprint during production and are more difficult to repair.

9.3 *Key Sustainability Indicators*

The Government via Defra and National Statistics have published a number of UK Government Strategy Indicators, the proposed scheme will potentially meet and help to improve a significant number of these indicators.

The table below indicates which indicators would benefit from the canal however it is anticipated that further indicators could added as the scheme develops.

Table 7.1: Defra Key Sustainability Indicators

Defra Indicator Reference Number	Indicator Title	Scheme Benefit
1	Greenhouse gas emissions	Removal of through traffic car journeys in Swindon centre.
8	Private cars	Provision of new footpaths and cycle ways to encourage people away from car use
11	Service sector	Long term opportunities for new service industries in relation to servicing needs of canal users
13	Resource use for construction sector	Use of recycled sands and aggregates
18	Waste arising from construction	Reuse and use of second hand materials as far as possible
20	Bird populations	Additional and greater variety of habitat created in urban area
24	Land use	Addition inland water created and roads removed.
27	Fish stocks	New habitats created
31	Flooding	Canal would provide addition storage for surface water during storms
32	Economic growth	Assist with regeneration of Swindon
40	Employment	Scheme will create new job opportunities both in short and long term
50	Healthy Life Expectancy	Improved quality of life and environment in central Swindon
53	Childhood obesity	New, safe traffic free spaces to encourage out door activities
58	Road accidents	Designated footpaths and cycle ways away from main roads, removal of through traffic from Swindon town centre
61	Air, quality and health	Reduction in traffic pollution in central Swindon. Improved facilities for alternative transport such as walking and cycling
65	Local environment quality	Addition facilities to area and improved focus for area.
66	Local environment satisfaction	Additional facilities and consultation with local households to ensure buy in to the scheme

10 Health and Safety

10.1 *General*

The design and construction of the proposed canal must comply with the Construction Design and Management Regulations 2007 (CDM 2007). These require the main parties of Client, Designer and Principal Contractor to ensure the works are built, operated and able to be decommissioned in a safe manner.

As part of this study includes an element of design a high level Health and Safety Risk review has been undertaken in accordance with CDM 2007 regulations. The Hazard Elimination and Management (HEM) List produced as part of this risk assessment is included in Appendix L. At this stage this covers high levels risks and will need further development should the scheme be taken forward for implementation.

10.2 *Design Considerations*

As the canal constitutes new works rather than restoration works and is located in high profile area it will need to comply with current health and safety design requirements as far as possible. Edge protection will need to be provided where the public can fall from any height, this will include sections of the canal which are within cuttings such as just north of Kingshill Road. However sections of the canal through the town centre where the water level is close to ground level then there are numerous precedents in other urban areas where the canal edge is not protected.

Whilst many original urban canal towpaths were cobbled, however this does present an uneven surface to walk on and makes disabled access difficult so should be avoided in Swindon.

10.3 *Public Safety*

One of the concerns arising from the consultation process was public safety, particularly in the Fleet Street area where there are numerous busy nightspots and pubs. Whilst there is always the risk that people will either fall or be pushed into the canal, as with existing sections of urban canals in other major cities it envisaged this section will be unfenced. A footway will be maintained each side of the canal to maintain access however due to space constraints this will be in the region of 3m wide so it may be prudent to install short localised sections of railings opposite

the exits from the busier nightspots. The canal water depth will be 1.5m deep with a hard concrete bed which will be firm to stand on. A number of egress points and possibly safety chains should be provided along Fleet Street to allow any persons in the water to easily climb out.

The main sections of footway and cycle path will be unfenced however where space is restricted and a vehicular service road runs alongside the canal then vehicle safety bollards will need to be provided.

10.4 Maintenance

10.4.1 *General*

Any new canal must be as maintenance free as possible to reduce costs but also minimise disruption to canal users and residents close to the canal. In common with construction industry standard practice it is proposed that the canal will be designed for a 60 year design life. The walls and beds of the main sections of canal will require very little routine maintenance.

Bridges over the canal will be designed to relevant Highways Standards and be relatively maintenance free, safe access for routine inspections will be provided.

10.4.2 *Debris and Rubbish Clearance*

The urban location of the proposed canal unfortunately means that debris and rubbish will end up in the canal either by deliberate or accidental means. This will need to be removed at regular intervals. Access along the canal is straightforward and maintenance vehicles can gain access via proposed service roads to most section of the canal for maintenance operations. At present it is impossible to predict the frequency these clearance operation will be required as it depends on the rate of build up of debris. The concrete bed to the canal will facilitate safe and easy access into the canal if necessary and also allow for debris removal using boat hooks without the need to enter the water and minimises the risk of damaging the canal liner.

10.4.3 *Silt Clearance*

The location of the canal means that siltation should not be a major issue as there are no significant sources of silt along the route of the canal. However the canal will pick up a certain amount of surface water run off during heavy storms and this is likely to include quantities of grit. This is likely to be focused on individual areas where surface run off naturally falls to so over a number of years small areas of grit

could build up and require periodic removal, again the hard engineered canal will facilitate easy and safe removal.

Weed growth chocking the canal can be an issue on lightly used rural canals however the hard engineered sides and bed to the proposed canal will prevent significant weed growth. Some limited growth may be experienced if siltation of local areas occurs however this will be easy to remove.

10.5 Construction

Undertaking major construction works in a densely populated urban area needs careful planning and execution to ensure the safety of the public and the workforce. The works will need to be carefully phased including any works to improve traffic routes around the town as these will need to be implemented prior to construction works commencing. Generally the public will need to be excluded from the working areas however access for residents will need to be maintained at all times which will need careful planning to ensure safety standards are maintained.

Significant amounts of public liaison will be required during the construction works to ensure that affected residents and businesses are kept informed of the works. To minimise the period of disruption along the route the canal and ensure that safety of the public is actively managed the canal will need to constructed in relatively short sections.

In addition to the physical construction of the canal there will be noise, dust and mud nuisance to local residents which will also need to be managed carefully and restricted working hours may need to be imposed.

Traffic movements in relation to the construction of the scheme and in particular movements of heavy goods vehicles will need to be coordinated to avoid increasing hazards to motorists.

11 Costs

11.1 *General*

This section provides details of the outline budget cost of constructing the Central Canal from Kingshill to the proposed basin. The construction cost estimate has been produced by George Brownlee and Partners, Chartered Quantity Surveyors. The costs of the construction works have been based on current market rates, where possible for similar work, where prices for similar work were not available then rates have been estimated from first principles based on outline quotations from suppliers.

11.2 *Cost of New Canal*

11.2.1 *Construction Cost*

The following table provides a summary of the estimated construction costs of the scheme. A further detailed build up of the construction costs are presented in Appendix J.

Design fees have been estimated at based on outline costs of undertaking the detailed design of similar work elements which make up this scheme. Construction supervision and contract management fees have been estimated as 5% of the construction cost. These figures are generally lower than the typical percentage figures used in preliminary estimates as it has been assumed the cost of the design of the majority of the necessary service diversions will be undertaken by the service providers.

It should be noted that due to time constraints on this study it has not been possible to undertake detailed discussions with service providers with respect to diversions and modifications to networks therefore the cost estimates have been based on a number of assumptions and experience of previous diversions. An allowance has been made in the risk register for uncertainties with the service diversions required. Despite repeated requests no information on plant details has been received from British Telecom therefore the costs of the diversion of these services has been based on assessments made during site visits.

The cost estimates include for disposal of excavated material to tip, however it may be possible to realise savings of landfill charges by finding alternative disposal routes such as use to form a noise bund in the Southern Development Area.

All costs are based on current 2007 market prices, no allowance for future inflation or VAT costs are included.

Table 11.2 – Construction Cost Estimates

Element	Estimated Cost (£k)
Site Clearance	£45.00
Canal Pounds and Basin	£10,013.00
Locks	£2,050.00
Culverts	£1,675.00
Footbridges	£1,120.00
Road Bridges	£1,250.00
Roads and Pavings	£4,150.00
Pumps and Pipework	£1,570.00
Service and Sewer Diversions	£15,100.00
Site set up / Miscellaneous Costs	£7,394.60
Construction Cost	**£44,367.60**
Design Costs	£1,307.50
Supervision Costs	£2,218.40
Total Construction Cost Out-turn	**£47,893.50**

11.2.2 *Compulsory Purchase and Land Acquisition Costs*

The route of the canal crosses land currently owned by Swindon Borough Council or follows the route of public highways which are the responsibility of the council, however there are some areas of privately owned sections. These are the triangle of land bounded by Kingshill and Westcott Place including Westcott Autos, which would enable the canal alignment to be improved and the John Street area where the basin would be located.

Discussion with SBC Planning department has highlighted the fact that both these areas form part of the councils 'Central Area Action Plan' for redevelopment. Therefore any proposals for this area need to be taken forward for public consultation as part of wider development proposals and land acquisition costs would potentially be incorporated into these wider proposals.

11.3 *Costs Not Included*

The previous sections provide budget estimates for the construction of the central canal however there are number of issues surrounding the implementation of the canal which will have cost implications but are not included as follows;

- Costs associated with necessary transport network system upgrades due to the canal, these would be implemented as part of the overall transport strategy for Swindon.
- Swindon Borough Council and Wilts and Berks Canal Trust staff and internal costs.
- Cost associated with any public enquiry.
- Costs of the North Wilts connection.
- Inflation costs.
- Compensation costs to businesses affected by the construction of the scheme, although some limited risk allowance has been made in relation to this, see Section 11.4.
- Costs associated with water supply to the canal.
- Cost in relation to the Transport and Works Act, it is assumed this would not need to be implemented as SBC currently own the majority of the route.
- Any costs associated with road closure notices.
- Cost associated with redevelopments or improvements to residential and business properties along the route.
- Future operational or maintenance costs.

11.4 *Risk Budget*

11.4.1 *General*

As noted in Section 2 of this report, this study was a high level feasibility review and was subject to a limited timescale. Therefore it has not been possible to investigate and resolve all the potential issues associated with the canal and the proposed route.

As part of the project workshop held a number of key risks were identified, these have been refined and added to as the study progressed and any key issues which remain unresolved have been included in a risk register.

11.4.2 *SWOT Analysis*

At the workshop held at the end of the data gathering process s Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was undertaken where all

attendees listed out their top three ideas and concerns in relation to each of the four categories.

As far as possible the strengths and opportunities have been incorporated into the proposals and route details put forward in this study. Where possible the weaknesses and threats identified have been mitigated as part of the study. Where this has not been possible then they have been included in the Risk Register, see next section.

11.4.3 *Risk Register*

The project risk register has been produced and is included in Appendix G. This has considered risks which may affect the cost, quality of delivery programme for the scheme. The register identifies the most likely cost and the maximum cost of a particular risk and then utilises a proprietary software package to undertake a PERT statistical analysis using a normal distribution to estimate risk budgets for both cost and time.

This register will be used as a live document in any further stages of this scheme as the design develops to manage risks and develop mitigation measures. As the scheme develops and more information become available then some of the items in the risk register will be resolved and more budget certainty achieved.

11.4.4 *Summary of Key Risks*

Key risks identified at this stage are as follows;

- Accuracy of service diversion estimates.
- Unforeseen services.
- Disposal of excavated material.
- Public buy into scheme.
- Issues surrounding Compulsory Purchase of properties
- Compensation costs.
- Financial estimates.
- Funding issues.
- Borough wide transport planning issues.
- Programme and tie in with other regeneration schemes throughout the town.
- Fitting in access to central car parks.
- Ground raising problems around Faringdon Park.

Further details of these risks, potential impacts and the possible mitigation measures are included in the Risk Register.

11.4.5 *Risk Budgets*

Based on the risk analysis undertaken with the risk register the 95%ile risk figure has been estimated as £5M and the 50%ile figure has been estimated as £4.2M.

At this stage it recommended that the 50%ile figure is taken for budgeting purposes as the most likely to occur figure.

11.5 ***Cost Summary***

The following table summarises the costs of implementing the scheme.

Table 11.5 – Summary of Cost Estimates

Element	**Estimated Cost (£)**
Canal Construction	£44,367,600
Design Fees	£1,307,500
Supervision and Administration Costs	£2,218,400
Risk Contingency 50%ile value	£4,300,000
Overall Cost Estimate	**£52,193,500**

12 Economic Overview

12.1 *General*

Previous studies in relation to the reinstatement of a canal into the centre of Swindon have undertaken a detailed economic assessment of the benefits of a canal in the town. Most notably Section 6 of the 'Pre-feasibility Study for the Canal in Swindon' report published by Arup in 2003 (reference 1) on behalf of the Wilts and Berks Canal Trust covers the potential benefits in detail. Given the limited timescale for the current study a detailed reassessment of the economic benefits it has not been possible to reassess the potential benefits to a similar level of depth.

However, in conjunction with Swindon Borough Council and the Wilts and Berks Canal Trust a brief review of the previous assessment has been made and it is considered that the main issues covered are still pertinent to the Swindon area, therefore to avoid repetition of work the previous figures have been updated.

12.2 *Benefits*

12.2.1 *Direct Benefits*

Direct benefits are those attributable to the presence of the canal. These could include the following;

- Informal visitors such as families seeking a flat walking route into town
- Walkers
- Anglers.
- Cyclists
- Boaters, from narrow-boat users to small craft sailors
- Canoeist and other unpowered boat users
- Hire boats
- Trip boats
- Restaurant Boats
- Disabled visitors who are able to utilise the flat cycle path
- Reduction in surface water flood risk and associated damages

British Waterways' ambition is to double its visiting number by 2012 (compared to 2002), which is equivalent to an annual growth rate of 7%. However it should be noted the Environment Agency is reporting a recent drop in boat traffic on the upper reaches of the River Thames, however this is a dead end section of

navigation. It is anticipated that the opening of the Wilts and Berks Canal will change this as it will create a through route from the upper Thames to other areas of the country. Swindon will be an ideally located destination and a stop over location for boats and benefit from the income this could bring.

12.2.2 *Indirect Benefits*

Indirect benefits are those which are as a consequence of the presence of the canal but are not directly attributable to running of the canal itself. These could include the following;

- Indirect employment and income opportunities as a result of the canal, such a cycle or canoe hire
- Induced employment and income as a result of potentially buoyant market in Swindon
- Construction employment related to canal induced developments
- Properties uplift values
- Related entertainment i.e. night clubs, cafes etc
- Leisure facilities related to the route
- Increased visitor number using nearby accommodation
- Increased visitor numbers to other nearby attractions

Studies on other restoration projects have found that found that waterside properties command an average premium of 15 to 20% compared to similar properties away from the water. These impacts are borne out by results from scheme such as the Oracle Area of Reading on the Kennett and Avon Canal and the Stalybridge area on the Huddersfield Narrow Canal.

Evidence about the effects on the value of commercial premises is less strong, but there is a suggestion that waterside developments can generate rental premiums and be filled more quickly than those in non-waterside locations. Premises such as restaurants and hotels, that aim to create an attractive environment for the visiting public, are particularly likely to benefit. Another source of potential uplift arises from the ability to increase the density of properties in waterfront locations.

12.2.3 *Estimated Economic Benefit Values*

The following table summarises the estimated potential benefit values for the reintroduction of a canal into Swindon.

Table 12.2 – Summary of Estimated Economic Values

	No link built – baseline condition	Swindon Central Canal only	Additional benefit from North Wilts connection	Cumulative Impacts
Gross visitor expenditure p.a.	£26,142	£10,587,243	£1,738,280	£12,325,523
Income retained p.a.	£16,993	£6,881,708	£1,129,882	£8,011,590
Permanent jobs created (FTEs)	0.4	142	24	166
Construction employment (FTEs)	0	224	136	360

As noted this table utilises the economic estimates from previous reports, in particular the report 'The Wilts & Berks Canal Prefeasibility Study for the canal in Swindon by Ove Arup Ltd dated April 2003. These figures have been reproduced with the permission of the Wilts and Berks Canal Trust for whom the previous report was prepared. Halcrow Group Ltd accept no responsibility for the correctness of the previous values estimated by others. The figures have been updated to 2007 cost by using the Retail Prices Index - All Items Index published by the Governments National Statistics Office.

12.3 ***Long Term Costs***

The main issues surrounding the long term costs for the scheme centre on the maintenance of the canal itself and the associated pumping system.

Historic information published by British Waterways indicates that on an established canal, such as the Wey and Godalming Canal, the maintenance costs are in the order of £38k per mile. However this is for old canals in predominantly rural areas. This canal would be new build works designed for a long design life so from this aspect the costs would be reduced. However given the relatively short length of the new canal section and the high density of bridges and other retaining structures such as canal walls where failure could result in loss of life the costs will likely to be slightly higher than this figure.

Two proven options exist for the long term operation and maintenance of the canal, the first would be for British Waterways to adopt the canal upon completion, however this would be unlikely until the canal is connected to the main canal system including the restoration of the main Wilts and Berks canal and the North Wilts canal is connected. The second alternative is for the Wilts and Berks Canal Trust to set up a navigation trust to run the canal.

There may be an ongoing generation of funds for maintenance through for example, leasing agreements with providers of services e.g. telecommunication companies often use the canal banks to run fibre optic cables. Opportunities may exist to develop similar leasing opportunities with other utilities providers either by network upgrades undertaken during the construction process or for new services in the long term.

12.4 Public Liaison and Construction Issues

The construction of the canal will be extremely disruptive to residents and businesses along the proposed route. It is possible that the major changes to the current situation coupled with the disruption of construction will result in a large number of objections to the scheme. It is therefore important to start the public liaison process as soon as possible to get public buy in and allow time to ensure the scheme meets the general public aspirations for the scheme which will be different from boat users' requirements.

Public displays to secure high levels of awareness and engagement with the canal at shopping centres, council offices, libraries and possibly festivals in Faringdon Park would be required. Technical days and "Walk the Route" days also give local people further opportunities to learn about the development and have their say.

The project could also offer an opportunity to engage with black and minority ethnic communities who traditionally are under-represented amongst canal users.

Another method of engagement of public is via schools and actively involve children along the route particularly Robert Le Kyng School which is adjacent to the route. A borough wide competition could be held for older children to identify themes for the waterway and name particular locations along its route.

As part of the public liaison process there must be a realistic discussion regarding the likely disruption and difficulties during the construction period.

12.5 Canal Related Development Potential

As noted on Section 12.2 one of the key benefits of the restoration of canal is the regenerative effects which follow. The canal would create a major, conspicuous, well-known landmark feature for the area, helping to make it a "place" rather than merely a shoping area. It would be a major piece of "enabling infrastructure" in the town centre: it gives a reason for people to visit the town centre, cafes, sites and

educational resources along the route, and it creates an incentive for others to develop commercial facilities.

In addition to the financial benefits discussed in the previous sections the canal will also have benefits in the following areas;

- Enable residents to live healthier lives by offering them an outdoor leisure facility appealing to all the family and all families, incluidng providing a traffic free link to the Southern Development Area currently under construction.
- Contribute to the ecology and bio-diversity of the area, with carefully planned areas both in the water and on the land.
- Provide a major educational resource for the town and beyond.
- Contribute to the water management of the area, especially run-off management and flood avoidance for homes and businesses nearby.
- Contribute to the economy of the Borough.
- Provide sustainable transport routes under roads into the heart of residential and business communities.
- Provide a catalyst for developing a truly integrated sustainable transport system for the Borough.
- Provide a carbon netural water-conserving project which helps to reduce surface water flooding issues along the route.

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13 Alternatives for the Canal

13.1 *General*

The solution presented in the Section 3 replicates a traditional canal aligned to visually tie in with the existing features and topography of the proposed route. However in addition to the three sub-options presented in Section 3.3 a number of other options have been considered to try and either ease construction or reduce costs, these alternatives are discussed in more detail in the following sections along with reasons why they were not adopted in the final proposal.

13.2 *Canal Lining*

13.2.1 *Canal Walls*

The location of multi-storey buildings close to the route of the canal means that the sides of the canal must be structurally designed to prevent any ground movement which may cause settlement of the buildings. Where service roads run along the edges of the canal the walls must also be able to support imposed loading from vehicles. It is proposed to use steel sheet piles for the canal banks which are extensively used elsewhere on the canal network.

The use of reinforced concrete walls has been considered for the side support for the canal either utilising precast units or cast insitu sections. Precast units, whilst being quicker to install would result in a large number of joints between units which would eventually become a maintenance liability. In addition the size of the precast units would require large construction plant for which there is restricted access along parts of the route.

Building insitu canal walls would take much longer than using precast units, increasing the period of disruption to residents along the route. During the construction additional working space and temporary ground support would be required over the steel sheet pile option. This would increase the risk of ground movement and damage to both underground services and adjacent buildings, the majority of which are Victorian and are likely to have relatively poor foundations.

13.2.2 *Canal Bed*

Based on the limited currently available ground information it has been assumed the bed of the canal will need to be lined to ensure water tightness. The traditional bed lining material for canals is puddle clay. However as noted in Section 3 a

concrete bed is proposed for this canal which acts as a prop for the steel sheet piles and forms a hard bed to ease debris clearance.

A brief sensitivity test was carried out review any potential cost savings of using puddle clay in place of the concrete bed. This indicated that although the clay bed was cheaper than concrete the additional length of steel sheet pile required to support the bank without the aid of a prop resulted in a higher overall cost per metre of canal.

13.3 Vertical Alignment

As noted earlier in the report canals are traditionally built in cuttings and on embankments to maintain pound levels over a long a distance as possible. Due to the proximity of properties to the route there is insufficient physical space to incorporate embankments to raise the canal above ground level. However it may be possible to raise the canal above ground level in a trough. This could be steel or concrete and either partially buried or founded at ground level.

The external walls of a significantly raised trough would present a large surface likely to attract graffiti which would result in visually poor end product. The effect of raising the canal too much would reduce the visual integration of the canal as it would appear imposed onto the roads and surrounding landscape. The space constraints in Fleet Street and Westcott Place mean that raised walls to the canal would create narrow overbearing passages between buildings and the canal and block out natural light from ground floor of properties. There would be sufficient space in the Faringdon Road area however the benefits of raising the canal over this section are limited as the distance is not sufficient to avoid the need to use Locks 2 and 3.

It is proposed to use this trough concept to some extent in the Park Lane to ensure that the bed of the canal is raised up slightly to allow the large gravity sewers to cross below the canal. This will require the canal walls to be raised above existing ground levels to maintain freeboard in lower end of Westcott Place and the western end of Faringdon Road.

The use of an aqueduct as also been considered. This would run the canal at least 2.2m above ground level to enable pedestrians to be able to walk below the canal. This could incorporate cantilevered walkways alongside the canal to create additional space at a higher level and avoid the impression of cutting the town in two. An outline review of the potential costs of this option, based on prices for a

short section of aqueduct on a recent canal restoration scheme indicates the cost per metre is likely to be more than twice as much as the excavated proposal.

There would probably also be considerable public resistance to a high level aqueduct as the canal would be level with the second storey of buildings which could raise privacy issues with residential properties. There could also be a perceived additional flood risk of such a large body of water suspended above the ground level of properties.

An aqueduct would still require three locks as these would have to lock the canal up to the aqueduct level in the Kingshill area and then down again in the Fleet Street area. It would also be difficult to construct and in the long term expensive to maintain and therefore has not been considered further in this study.

13.4 Services

As noted in Section 3 a major element of the works is dealing with the numerous statutory services which run along and across the route. With the exception of the gravity sewers the bulk of these services are located in the first 1.2m below current ground level with the majority being in region 600mm to 1m deep. To avoid the expense of moving or diverting these services the canal would need to be founded within the top 300mm of ground level. This would be virtually impossible to achieve as the canal trough would need to be supported on footings which would in turn need to founded on firm compacted material and preparing this ground would in itself damage the services close to the surface.

Initial discussions with Thames Water have also indicated that services crossing below the new canal in a perpendicular direction will be acceptable however any services running parallel below the canal alignment will need to be realigned to the side to ensure they are able to dig down and access the service to undertake repairs in the future. This means that the canal cannot be built over and services unless they cross perpendicularly. It is highly probable that other service undertakers will impose similar requirements.

The raised aqueduct option may overcome this to some extent if there was sufficient headroom to access services below the canal. However the weight of the elevated canal will require significant support and the foundations for these supports will still conflict with services running below the canal.

Given the number of services and the costs of the excavations consideration should be given to providing dedicated service corridors along each side of the canal where service providers can install their services in a coordinated manner which would facilitate easier future access. This would enable new services to be laid and the old services abandoned. Where space is available the main services could be replaced prior to construction of the canal which would then remove a proportion of the significant risk of the construction programme being tied to service undertaker's performance which has caused significant delays on previous schemes.

One potential option which may become viable following detailed discussions with Thames Water is the possibility for designing the canal as a conduit of surface water during storm events. It may be necessary to provide some additional freeboard to the canal but may reduce the size and number of gravity sewers which need diverting and provide some additional capacity to the drainage system. The foul sewers would still require diverting but large combined sewers in Faringdon Road could be converted to just foul sewers and reduced in size.

13.5 Bridges

A significant cost of the footbridges is the DDA compliant ramps. To avoid the need for DDA ramps or moving bridges where space is limited in the Fleet Street area the bridges could be run at a high level at second storey level between the buildings. However, this has not been considered further at this stage as it would rely on the building owners including these into any redevelopment proposals which are likely to be more of a long term process. In the shorter term footbridges at ground level are still required.

It should also be noted that raising the canal in a trough above ground level, as discussed in previous options, would increase the height and thus cost of the DDA compliant ramps.

13.6 Other Alternatives

Other more localised alternatives considered include use of an incline plane in the Westcott Autos area which would make navigation in this area easier and remove the need for Lock No2. This would require an area approximately twice the current area of the existing Auto's site and a slightly longer cutting in Westcott Place. It would create a major feature and landmark in this area which would assist with the potential for redevelopment in the Kingshill area, see Section 3.3.2 – Option 1 for details. However, based on recently constructed mechanical lifts

Another alternative rejected on financial grounds was the possibility of increasing the drop across Lock No1 and then tunnelling or pipe jacking a culvert below Kingshill Road to avoid works on the road itself and to avoid dealing with the services. In addition to the financial constraints the lack of space on the north side of the road also restricts this option, although this would not be an issue if the Kingshill Area was redeveloped.

14 North Wilts Canal Connection

14.1 Introduction

Part of the brief for this study included a review of the engineering difficulties associated with linking of the North Wilts Canal into the town centre. This section highlights the key issues associated with this proposed route and the potential scale of the works required but does not look into details or costs of any solutions. Drawing TH-SBPF-145-001 in Appendix D indicates in dashed line type the proposed connection for the North Wilts Canal into the town centre.

14.2 Town Centre to Great Western Way

The route from the town centre would be routed under Station Road and the corner of the railway station car park, this would involve the moving of a small electricity sub-station but is necessary due to the presence of Holbrook House having been built on the original canal route. The remainder of the section from Station Road the Great Western Way is on the alignment of the original canal which has been infilled but remains as a wide cycleway and footpath.

In theory the pound level of 97.60mAOD could be run all the way up the Great Western Way. However this is lower than the original pound level and this may cause problems with the foundations of some of the original canal structures and any lining of the canal. Alternatively a lock could be installed to raise the pound levels, this would need to be located between Station road and the Railway Bridge and would need careful design due to space constraints in this area to fit in waiting areas etc. A further lock would then be required to get the canal down under Great Western Way, again where the footpath is in a cutting below the road level. Drawing TH-SBPF-145-014 in Appendix M shows the plan and long section through this route.

There are three bridges over the canal route on this section, one carrying the railway, and two road bridges including Great Western Way crossing. All are 5m or more wide so are of a sufficient width for the canal. There is currently at least 2.3m headroom between existing ground level and the soffits which provide sufficient air space for boats. However the foundation details for the bridges are not known, it is assumed that the two modern road bridges at Hawksworth Way and Great Western Way, and possibly the railway bridge will require some form of

underpinning to take foundations down to a depth below the excavation level of the canal.

The North Wilts canal connection into the town centre will also require a crossing of Station Road, it is envisaged that the new canal would sweep westwards, cutting the corner between Cheltenham Street and Station Road, to cross under the latter on a skew of about 62°. From there, use will be made of the corner of the station car park, before regaining the route of the original North Wilts Canal under the railway. This area is complicated by the need to fit in a lock to bring the canal back up to the original pound level along the North wilts connection, see above.

It should also be noted that since the canal has been infilled along this route a number of services have also been installed which may required diverting or moving, these include a sewer, power cables and telecommunications cables including cable TV services. There is an original brick wall along the eastern side of this section of the route onto which some of the power cables are already fixed, it may be possible to move more of the services onto this wall when the canal is redug.

14.3 Gas Holder Area

From the north side of the Great Western Way, the original route continued northwards across Iffley Road and out along Cheney Manor Road through the Industrial Estate. Developments in this area have necessitated the review of potential alternative routes in this area. The proposed canal route investigated in this study is westward past a gasometer, through the Bruce Street Bridges roundabouts on the north side of the Swindon-Gloucester railway line, terminating at an area of lagoons between the railway and rear of industrial units in the Cheney manor Industrial Estate. An outline plan of the route is shown in drawing TH-SBPF-145-015 in Appendix M.

The use of the existing sub-way crossing of Great Western Way will result in a loop in the canal alignment to get an adequate radius for navigation. To avoid an excessive number of locks in this area the section alongside Great Western Way would need to be in a cutting. There is potentially adequate space to fit a narrow vertical sided canal alongside the gas holder but a number of the gas service pipes to the gasometer would need to be lowered below the canal or taken over the canal on a pipe bridge. Details of the main services in the area are shown on drawing TH-SBPF-145-013 in Appendix M.

14.4 Bruce Street Roundabouts

The Bruce Street roundabouts create a significant obstacle for the canal in this area. This is one of the busiest junctions in Swindon and the proximity of the railway bridges and adjacent houses means that any significant road realignment is out of the question.

The obvious solution is to lock down the canal to go under the roundabouts in a culvert or short tunnel. To avoid the first house at the end of Iffley Road a curve will be required in the tunnel. If a section of the garden and garage of this property was to be acquired then the tunnel could be straightened making the tunnel simpler. There area number of major foul and surface water gravity services crossing the north eastern corner of the roundabout system which will required diverting. Whilst the number of these could probably be rationalised some form of canal crossing would be required either by siphon or possibly a pumping station, neither of which are desirable. Locations of the major services crossing the proposed route are indicated on the long section.

The layout of the four roundabouts means that traffic could be easily re-routed to allow open cut construction of the culvert section.

14.5 Lagoons Area

There are a series of engineered lagoons and ponds running alongside the railway embankment from the north side of the Bruce Street Bridges area. The origins of these are ambiguous although it is thought they were originally related to water supply to the GWR railway works. There is a small flow in a north easterly direction between the various lagoons indicating the possibility of a spring feeding them with water which could be utilised to feed any canal in this area. Further on the silted lagoons expand into a fairly large and heavily utilised fishing lake which ahs been taken as the north limit of the extent of this study.

The lagoon areas are heavily overgrown so access during the survey was limited but from the levels obtained it indicates that some form of dredging will be required in the area to maintain a navigable depth and a number of concrete structures and sluices across the lagoons will need to be removed. There is currently little drop in water levels between the lagoons so removal of the sluices should not be problematic.

The removal of the two concrete bridge type structures across the first lagoon area will be more problematic as these carry large gravity sewers, 900mm dia in the first

and 1300x600mm in the second, see drawing TH-SBPF-013 in Appendix M. These clash directly with the canal levels and have been marked on the long section.

As noted at present this is not sufficient depth of water in the area to allow navigation therefore some dredging would be required, however this section is alongside the railway embankment and any significant dredging without additional support to the toe of the embankment could cause potential instability of the embankment. An alternative could be to partially fill the lagoons and raise water levels along this stretch to provide a sufficient navigation depth, this may also have the added advantage of allowing reuse of material arising from elsewhere on the canal and save of disposal costs.

15 Summary and Conclusion

15.1 *Canal Feasibility*

Based on the results of this brief study the reintroduction of a narrow beam canal into the centre of Swindon is technically possible on the proposed route from Kingshill to Fleet Street via Westcott Place and Faringdon Road. However whilst feasible there are significant number of difficulties which would need to be overcome. The proposed route deviates from the original canal route and requires the installation of three locks to maintain the pound levels close to existing ground levels and make the canal aesthetically pleasing and to give the feeling the canal is part of the townscape.

This integrated approach would be further enhanced by the redevelopment of the area at the Kingshill –Westcott Place junction to facilitate the canal and avoid the awkward kink between the old canal route and the new route in Westcott Place. This would provide the opportunity to create a landmark development as a gateway to Swindon town centre.

To create an integrated canal in the centre of Swindon a canal basin is a necessity to provide overnight moorings and create a focus and feature for the centre of the town. The ideal location both technically and visually is to locate this in the John Street area of the town, this will require complete redevelopment of this area and provides the opportunity to create a real landmark for the town centre.

One of the major problems with the route is the ad-hoc underground services system which has developed along the proposed route over time. This will require major works in conjunction with service providers.

15.2 *Traffic and Highways Issues*

The construction of the canal along the proposed route will require the complete closure of Westcott Place, in addition the opportunity exists to also completely close Faringdon Road. Whilst initial traffic modelling indicates this is feasible it will impact both on local and borough wide traffic flows and provides the opportunity to completely revise the traffic system around the Borough of Swindon and develop a sustainable integrated transport system.

A detailed review of the one way system around the route will need to undertaken to provide optimum access to both the Brunel Centre car parks and for the local residents. A number of footbridges will need to be provided which should be DDA compliant, however in a number of areas there is insufficient space to meet these requirements and lifting or other types of bridge may need to be considered.

The removal of traffic from this area will provide the opportunity to develop a traffic free sustainable link through the town centre and link into the new Southern Development Area which will help to encourage sustainable transport and create a catalyst for redevelopment of properties along the route.

15.3 Other Impacts and Considerations

The proposed canal will be in a built up area which is heavily used by both residents and businesses. The canal will have a huge impact on the current situation across the whole of the borough both during and after construction. The key to the success of this scheme will be ensuring that the majority of the public are behind the scheme. This will require a well planned and co-ordinated consultation process both to meet statutory requirements and to ensure public buy in.

There will be considerable disruption and nuisance during the construction process. Whilst needing more detailed consideration with respect to the construction the following table indicates a possible project sequence.

Table 14.3 – Project Execution Sequence

Sequence No	Key Task
1	Develop Execution Plan
2	Identify Funding Sources
3	Appoint Design Consultants
4	Commence Public Consultation
5	Undertake Utility Diversion Designs
6	Detailed Traffic Modelling
7	Public Review and Updates
8	Planning Process and Flood Risk Assessment
9	Site Investigation
10	Undertake Detailed Canal Design
11	Implement Borough Wide Transport System Upgrades
12	Close Faringdon Road and Westcott Place and Update Residents Local One Way System.

Sequence No	Key Task
13	Tender Construction Works
14	Undertake Service Diversions
15	Undertake Piling Works
16	Undertake Excavation Works
17	Install Canal Base
18	Construct Locks and Pumping Systems
19	Install Bridges
20	Landscaping Works
21	Commission Canal

The above list is not exhaustive but attempts to indicate the sequence in which the project will need to develop. It should be noted that a number of the tasks below will need to run in parallel.

It is anticipated that construction would be undertaken in a rolling sequence in short sections commencing with service diversions, then piling works, the base construction, then landscaping works etc. This will require the whole route to be available to the contractor to allow efficient working for the contractor and avoid standing time and on / off hire costs for plant. Individual structures such as locks and bridges would be constructed separately.

It should be noted that there is the potential for the completion of the central canal prior to the complete restoration of the Berks and Wilts Canal, this is expected to be complete in 2025 although the W&BCT anticipate it will be sooner than this. This will result in a land locked section of canal, assuming the section of new canal through the Southern Development Area is completed on time that this could be connected to enable short boat trips to be run however it may be several years before the canal is connected the main Wilts and Berks Canal and the wider national canal network. The public perception of this will need to be handled carefully.

15.4 Cost Summary and Benefits

Based on 2007 market costs the estimated construction costs of the scheme is £47,893,500. However at this stage there are a number of significant issues which this study has not been able to resolve due to the limited timescale. These issues have been included in the risk register and it is recommended that a risk contingency of £4,300,000 is included making the overall the current budget estimate for the scheme £52,193,500.

The direct retained income to Swindon, based on 2007 figures, is estimated to be £6,881,708 per annum. However the key benefits are the creation of the feature and sense of place for the town centre. There are some potential direct redevelopment opportunities around the proposed basin area but the canal will also act as a catalyst for private redevelopment along its whole route.

15.5 Recommendations for Next Steps

The following next steps are recommended should this scheme be taken forward to the next stage;

- Develop a Project Execution Plan including developing a detailed programme for implementation.
- Investigate potential sources of funding for the construction of the canal.
- Commence a public consultation process to gauge public opinion to the scheme both borough wide and with adjacent property owners.
- Commence detailed investigations with respect to services including detailed discussions with service providers and surveys and trial pits to confirm exact locations.
- Move design of the canal onto next stage to address the issues raised in the risk register.
- Review surface water flooding events and enter into discussions with Thames Water regarding opportunities for reduction in flood risk.
- Investigate opportunities for acquiring properties in the John Street area to facilitate the basin through discussions with landowners.
- Undertake detailed investigations into requirements for transport system upgrades and integration with the long term transport vision for Swindon, including a review of weekend traffic flows.

16 Appendices

16.1 Appendix A - Project Initiation Document

Halcrow

Project Initiation Document

Project title: Swindon Canal Central Route Study

Introduction:
This Project Initiation Document has been produced in response to an order issued by the Transport Planning team at Swindon Borough Council. It has been jointly agreed as a way to approach the study and will be regularly reviewed by the key contacts throughout the study. The role of the Project Board is taken by the partnering contract management team acting as Senior user and Senior supplier.

1.0 Project Background:

Definition:
1) To prepare and review the feasibility of the Wilts & Berks Canal Trusts' preferred route for bringing the canal into the centre of Swindon as part of the regeneration scheme.

2) To assess the engineering issues only for routing the North Wilts Branch Canal around the Bruce Street Bridges

Business case:
Canal Trust and Swindon Borough Council

Objectives:
- *To review the viability of a canal route from Kingshill along Faringdon Rd to the proposed Plaza development.*
- *Integrate the canal as part of the heritage for the area and to engage with the Railway Village.*
- *Integrate the canal with plans being proposed by the New Swindon Company for the public open space at the Plaza.*
- *Review potential water supply and water quality issues.*
- *Compare costs of construction between preferred route to the Plaza only and route via SDA/Mannington/Barnfield (costs to be growthed)*
- *Attempt to provide innovative, practical and affordable solutions to dealing with service crossings.*
- *Review of access arrangements to properties.*
- *Review of reassignment of traffic along preferred route.*
- *and an assessment of engineering issues only relating to the potential routing around Bruce Street Bridges*

2.0 Project Scope:

Inclusions:

The agreed route section to be studied lies between the current termination point at Kingshill and should follow the route of Westcott Place – Faringdon Road – Fleet Street to the planned Plaza development. Consideration should be given to engineering issues only to routing possibilities for the proposed North Wilts Branch canal at Bruce Street Bridges roundabouts.

Exclusions:
- *Review of previous reports by Scott Wilson Fitzpatrick and Arup.*
- *Consultation with general public.*
- *Any issues related to the main line of the canal.*
- *Any issues related to the detailed feasibility of alternative traffic routes*

Constraints:
- ***Project scope** – as agreed in PID*
- ***Project fee** – to be agreed*
- ***Key dates** – project to be completed at end of June 2007.*

30th March 2007

• *Condition surveys of existing infrastructure, properties and services* • *Water supply issues to be completed by Carl Bro*	

3.0 Project Deliverables:

What are the main outputs;

A staged feasibility study, with draft sections of the Swindon Canal Central Route Feasibility Report submitted at completion of each stage. The stages to be fully defined following the outcome of project start-up workshop to determine the priorities

The possible contents of the report being:

- *Assessment of Engineering issues, Kingshill to planned Plaza development;*
  - *Outline engineering design*
  - *Number and location of locks (or level-change structures)*
  - *Location of culverts & capacity*
  - *Outline design for all road/bridge/rail crossings (innovative/feasible engineering solutions)*
  - *Outline design for all service crossings and/or diversions (innovative/feasible engineering solutions)*
  - *Horizontal and vertical alignment*
  - *Flood risk – operational rather than watercourse catchment.*
  - *Location and size of embankments, cuttings and retaining structures*
  - *Requirement for lining the canal*
  - *Interface with the existing highways*
  - *Areas to turn, canal basins*
  - *Landscape – 2 artists impressions*
  - *Footbridges, footpaths and cycle track considerations*
  - *Consideration of water quality*
  - *Consideration of environmental issues*
  - *Health and Safety Risk Assessment (CDM regs)*
  - *Desk study of ground conditions and possible requirements for ground investigation*
  - *Likely waste management strategy*
- *Review of engineering considerations only for route at Bruce Street Bridges.*
- *Development of a Risk Register*
- *Cost comparisons – North Wilts Route from SDA via Mannington and Barnfield.*
- *Broad economic considerations only – potential for economic benefit.*
- *Integration of canal with the planned regeneration of Swindon.*
- *Consideration of examples of canal restoration in urban environments.*
- *Planning and environmental baseline review.*
- *Assessment of traffic reassignment – future proof against strategies. e.g. car park strategy.*

4.0 Interfaces/Key Contacts

Name/organisation:	***Role/Reporting structure***
Tim Price, Swindon Borough Council	*The Project Board*
Rod Anderson, Swindon Borough Council	*The Project Board*
James Jackson, Swindon Borough Council	*The Project Board - transport*
Celia Carrington, Swindon Borough Council	*The Project Board*
Rob Richards, Swindon Borough Council	*The Project Board - property*
James Hawthorne, Halcrow Group Ltd	*The Project Board*

Ed Stanford, Swindon Borough Council Phil Marsh, Halcrow Group Ltd Ken Oliver, W&BCT E Thomas, W&BCT R Crutchley, New Swindon Company Swindon Civic Trust Swindon Contract Services Conservation Officer, Swindon Borough Council	Client Manager Project Manager Project Team Project Team Project Team Project Team Project Team Project Team

5.0 Project Methodology

Approach:

The approach to this study involves assessing the viability of bringing a canal through central Swindon along a preferred route, and to assess the constraints, implications and opportunities surrounding such a scheme.

The following key tasks are anticipated (to be confirmed following the workshop):

1. *Initial workshop (internal and with key interfaces)*
2. *Identify proposed route and map onto GIS.*
3. *Consultation with Stakeholders*
4. *Discussions with service provider.*
5. *Collect and review topographical data of the route (and potential route to Bruce Street Bridges)*
6. *Review and analyse engineering issues/constraints – including land space, ground conditions, existing structures and road crossing/road space e.g. practical solution to service crossings, practical solution for crossing Kingshill Road, review of the proposed road crossing at Station Road.*
7. *Review of (or confirmation to be able to use) existing crossings under the railway and roads.*
8. *Assess engineering issues only at Bruce Street Bridges roundabouts*
9. *Faringdon Road – review/assess idea of "bus only" lane.*
10. *Review traffic reassignment through removal/reduction of road space for canal implementation – assess impact of related strategies (ITS, Car parking, Rodbourne Road bus link, STEAM signage etc)*
11. *Note only of water supply issues (being undertaken by Carl Bro*
12. *Water quality – consideration of how quality can be maintained (Taylor Woodrow – SDA - also looking into this)*
13. *Cost comparison between central*

Assumptions:

- *No topographical survey exists for proposed route*
- *Stakeholders to include Swindon Borough Council, New Swindon Company and W&B Canal Trust.*
- *Internal Stakeholders include SBC Planning/Landscape officer, Transport Planning officer/s, Deputy Chief Executive SBC, Councillor for Regeneration, Planning and Development, Property and Conservation*
- *Water supply issues are undertaken by Carl Bro*
- *Existing infrastructure and properties along or adjacent to the route assumed to be in good condition (no condition surveys or structural surveys to be completed)*

(W&BCT) route and the North Wilts route (SDA via Mannington and Barnfield) 14. Concepts for integrating canal into heritage of town 15. Concepts for integration Railway Village area 16. Concepts for integration with NSC plans for the public open space at the Plaza and engagement with Railway Village 17. Concept design for the canal in the urban environment – landscape drawings (2) 18. Review examples of urban environment canal restoration. 19. Broad considerations for potential for economic benefit 20. General overview for contaminated land issues. 21. Reporting	

6.0 Project Control:

Methods of control:	***Tolerances:***
1. Meetings at key decision points – prior to initial workshop, post data collection and completion of draft report.	1. Study to commence April 2007and to be completed end of June 2007

7.0 Key risks:

Definition:	***Potential***
Scope of the study does not meet clients expectations / Halcrow are not aware of all the issues that determine the preferred route	High – needs to be managed by completion of a workshop with full participation and regular review meetings
Exceeding timescale	Low.
No consensus on the outcome	High – due to wide range of issues.
Scope creep	High – outside influences may impact on the depth and degree of agreed scope/methodology

8.0 Notes:

Initial Study Brief (attached for reference only)

Brief for Swindon Canal Central Route Study
Ver 1.3 Jan 2007

Background

The Wilts & Berks Canal is currently being restored with the objective of full restoration between the main line of the canal eastwards from Swindon to Abingdon , westwards from Swindon to Semington , and for the North Wilts Branch from Swindon and Cricklade. A ten year programme is in place to complete substantial restoration by 2014. This would include full restoration of the canal between Swindon and Cricklade (currently part of a Lottery Bid for

the Cricklade Country Way) and in partnership with British Waterways and the Cotswold Canal Trust to complete this link to the national network by restoration of the Thames and Severn Canal from Cricklade to Lechlade. Restoration of the whole canal is expected by 2020.

In 1998 the Wilts & Berks Canal Trust commissioned a study from Scott Wilson Fitzpatrick to provide a route solution for the whole canal restoration. This report identified 'bypass routes' for Swindon for the main line and North Wilts branches. These routes have been adopted into the Local Plan by Swindon Borough Council and the route protected.

In 2003 a further report was commissioned from Arup to look again at the historic route through Swindon. The conclusions were that it was so expensive that it should not be considered, The WBC Trust had many reservations about the report from the brief to the subsequent conclusion. It should be added that there was considerable opposition to the concept from the political administration at the time

Brief for 2007 study

1. *The Canal Trust and Swindon Borough Council wish to find a solution to bringing the canal into the centre of Swindon as part of the regeneration scheme. The previous studies have highlighted potentially expensive solutions to problems such as underground services. In commissioning a new study we would therefore wish for innovative practical and affordable solutions to these problems that allow a deliverable scheme preferably within 5 years*
2. *The route suggested on the attached map only concerns bringing the North Wilts Branch via the town centre. It is not intended that this study should look at any possibilities for the main line of the canal and it should be assumed that this will follow the route defined in the local Plan.*
3. *In using the central route for the canal some cost comparison should be made between this route and the North Wilts Route from SDA via Mannington and Barnfield. Any cost savings to the development should also be considered.*
4. *The study will be in two parts*
   Kingshill to the Plaza (see section 7 below)
   Mouldon Hill to the Plaza
   The significance of this is that there are two phases to the canal restoration beyond the central route and it may be necessary to consider the central route in two phases to coincide with these projects
5. *The southerly start point for the study will be the current termination point of the canal at Kingshill. The study will find a practical solution for a canal crossing of Kingshill Road. This will include provision of an acceptable scheme for traffic management during construction.*
6. *The assumption for this study is that the canal will follow a proposed route via Wescott Place to Faringdon Road. The proposal is to integrate the canal as part of the heritage of this part of town and to engage with the Railway village. In the wider part of Faringdon Road some allowance to be made for bus only lane*
7. *The scheme should integrate into the plans being proposed by the New Swindon Company for the public open space at the Plaza. This proposed area is situated on Fleming Way between the Parade and Fleet Street*
8. *On the historic route from the Plaza special attention to road crossing at Station Road including construction phase traffic issues*
   Confirmation of use of existing bridge structures under railway and roads. In liaison with New Swindon Co investigation of any financial aspects to housing around North Star (possibility of price gain from canal)
9. *Special attention to route possibilities near gas holder and Bruce Street bridges roundabouts including construction phase traffic issues*
10. *Confirmation of use of lagoons and 'River Ray' route to Mouldon*
11. *Water supply issues for the canal – much of this work is being carried out for the Trust by Carl Bro who will conclude their report in May 2007. Some note should be made of the special issues in supplying the canal in isolated sections, in the short term, and how water quality can be maintained*
12. *It would be expected that the experience of canal restoration in an urban environment such as the Rochdale Canal (Manchester) and Huddersfield Canal (Stallybridge) would be used to best effect.*

13 *General consideration of the design, use and maintenance of canals in an urban environment will be used by looking at examples such as Gas Street/Brindley Place Birmingham – Paddington Basin London*

The study will guided by a steering group consisting of ;
WBCT Chief Exec
WBCT Chairman
WBCT Engineering Director
Swindon BC Planning/Landscape officer
Swindon BC Councillor (Regeneration)

The study will be in 3 phases and should be completed in 6 months:
Preliminary report- To identify principal issues and to determine design parameters 3months
Draft Final Report 2months
Final Report 1month

9.0 Approval:

Signed:

Project Manager – Halcrow Group Ltd

Client confirmation of this PID will be assumed upon the receipt of a Work Order

16.2 Appendix B – References

List of References

The following key references have been used during this study

Ref	Title	Publisher	Date
1	The Wilts & Berks Canal, Prefeasibility Study for the Canal in Swindon	Ove Arup & Partners Ltd	April 2003
2	Large Scale Ordnance Survey Plans	Ordnance Survey	
3	Swindon Canal Topographic Survey	Halcrow Group Ltd	May 2007
4	Annual Retail Price Indices	National Statistics www.statistics.gov.uk	Jan 2007
5	Envirocheck Report for proposed canal route	Envirocheck / various sources	April 2007
6	The Wilts and Berks Canal	LJ Darby	1986
7	The Thames and Severn Canal	Humphrey Household	1983
8	The Swindon Canal – A Journey Through Time DVD	Wilts and Berks Canal Trust	2007
9	Wildlife Information	www.wiltshirewildlife.org	2007
10	Environmental Information	www.magic.gov.uk	Various
11	Geological Borehole Information	British Geological Survey	Various
12	Design Criteria for Footbridges	Highways Agency Standard BD 29/04	2004
13	The Value of Waterside Properties	K Willis & G Garrod	1993

16.3 Appendix C - Workshop List of Attendees & SWOT Analysis Results

List of Attendees at Project Workshop

An initial project workshop was held at STEAM on the 15th May 2007, this was to enable key persons to be consulted on the proposed route and to enable ideas and concerns to be put forward. The following persons attended the workshop;

Swindon Borough Council
Roderic Bluh – Leader of the Council
Ed Stanford – Project Leader
Andy Brown – Planning Development Control
Russell Weymouth – Landscape / Public Realm
James Jackson – Transport
Rob Richards – Property
David Dewart – Forward Planning
Bernie Maguire – Town Centre Management

Wilts & Berks Canal Trust
Ken Oliver – CEO
John Laverick- Chairman

New Swindon Company
Peter James

British Waterways
Andrew Stumpf – South Area Regeneration Manager

Halcrow Group Ltd
Phil Marsh – Project Manager
Andrew Linfoot – Landscape Architect
Mike Floyd – Geotechnical Engineer
Helen Spackman – Transport Planner
Mark Seward – Canals Advisor
James Hawthorne – SBC Framework Manager

As part of the workshop all attendees took part in a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), each person posted their three main ideas or concerns relating to each of the three categories and these are listed out below.

Swindon Central Canal Workshop Results of SWOT Analysis

Strengths

Top level leadership supporting the proposal
Strong political support from leader
Regeneration programme in town now creates the time to do it
Provide a cultural heart and pride for town
Link to heritage area (part of the story of the growth of Swindon)
Link town to countryside (ultimately)
Tourist destination
Town centre leisure area
Step change in perception of town
Potential for link through Swindon as a whole
Potential for waterside regeneration
Tourist attraction
Improve image of Swindon
Generate much needed civic pride
An attraction to bring people into the centre of Swindon
Health benefits
Will act as catalyst to other developers to restore remainder of canal
Improve social and physical well being (lifestyle) of people in area – improve quality of people's lives
Bold
Capitalises on assets (park and r. village)
Focus to town centre
Catalyst for reducing through trips in network
Scope for better walking/cycling/public transport with removal of car trips
Less traffic in some areas
Attractive visual impact
Boost to economic regeneration therefore attracting businesses e.g. cafes, bars, boutiques
Increase in sustainable factors e.g. health
Water front development will come naturally with the canal as can be seen in places like Newbury and Reading
(Geotechnical) level canal/long pound length = minimising ground works
Kimmeridge clay – good material
No major contamination
Economic
Environmental

Sustainable
Attraction – for leisure
Pedestrian and cycle link to SDA
Creates good pedestrian links in Swindon town centre
Gives opportunity for local involvement
Good opportunity for a major re-think of town centre
Northern route from basin will enhance link with STEAM
Good economic regenerator

Threats
Water supply issues relating to climate change
World heritage designation – objections from conservation lobby
People blaming traffic problems on canal
Don't go for "bare minimum" in terms of design – think big!
Public opposition – especially residents/landowners along route
Who will own/operate the canal?
Short term construction problems puts off developers
Cost
Congestion
Discourage people from West Swindon coming to town centre
Timing with other projects
Transport impact and funding
Unable to acquire ownership of canal route
Unable to identify funding
Residents and businesses don't buy in – political fall out
Failure to deliver other sections of the canal
Swindon gains reputation for being a traffic no go area = disinvestment
Political
(Geotechnical) canal leakage
(Geotechnical) affecting building foundations
(Geotechnical) change of brief/route affecting ground investigation design and location
Inarticulated vision
Insufficient engagement of local communities in design progress
Insufficiently robust demonstration/quantification of commercial/community and conservation benefits – the why
Intangible benefit unquantified
No easy answer to Great Western way issues
Public acceptability of road closures
Public acceptability of increase in traffic on some routes and more delay on others
Delays to current regeneration progress
Current regeneration vision excludes direct canal references
Local plan/planning requires realism/certainty
Significant ongoing maintenance/management costs (to public sector?)
Public reaction – canal adverse, no experience of living in waterside location
Adoption/maintenance arrangements for highways/open space
Accessibility to centre from west

Major disruption during construction
Public disapproval
Failure to secure funding
Failure to secure community buy in
Failure to safeguard route in the development plan

Opportunities
Water bus facility entering rural areas
Health benefits
Opportunity for re-developments 'improve arrival to town'
Chance to radically change (improve!) Swindon town centre with canal as centrepiece
Chance to improve the quality of development in town centre
Amend Great Western Way
Remove through trips from road network
Mode shift to walking/cycling
Once in a lifetime opportunity to rebuild a new heart within Swindon
"Opportunity to create a city of amazing bridges"
Increase in value of properties adjoining canal
Wider regeneration impact
Swindon town centre becomes a destination on its own right
Best chance for real town centre rejuvenation…. Alternatives???
Positive aspect and experience of Swindon
Unites railway village to town centre
Tourism
Redevelopment
Business
Transformation of the problem area at Fleet street
Improved links with tourism activities at Cotswolds
Opportunities for improved pedestrian/cyclist routes
Redevelopment of run down areas
Bring alive dead area of town
Creates green corridor
Chance for Swindon BC to lead the way in town centre waterside development – as example to other towns/ exemplar project
An integrated approach needs to be taken – social
The positive of the canal is to give Swindon a heart, something that it is lacking now.
Flooding is not an issue once the canal is complete as it's the quickest way of moving water away.
Map vs. area of deprivation – community capacity building
Shared space – reprioritise car vs. people
Change perception of Swindon – "heritage quarter"
Waterfront development
Facilitate development on canal route
Encourage park and ride
Focus for sustainable modes
Set parking outside centre

(geotechnical) use excavated fill at Wichelstowe or other development – needs to be part of the design
(geotechnical) use canal for surface water run off
(geotechnical) Use existing canal length to transport materials (e.g. spoil) during construction
Open up park are to new function – focal point
Improve sustainable travel into centre – link into cycle network
Re-think town centre regeneration and transport vision
To regenerate part of the town centre with a number of listed buildings that probably otherwise would not be improved

Weaknesses
Funding scenarios very slow to deliver – project lag could occur
Impact on town centre traffic effecting retail viability
Funding – development and short term consultancy
Awareness amongst local residents and businesses
Not on an existing route will make fund raising more difficult
Existing access routes will be cut
Time scale will adversely affect current planning measures
"Temporary" dead end will cause water quality issues and may spoil understanding of the completed scheme
How to keep 'stand alone' canal fresh, self sufficient as a landlocked bit of waterway
Canal will be seen as destroying transport links – (even though Swindon expansion generally may be the main cause rather than canal)
Put traffic into old town
Add more traffic to Crombey street
Difficult to access car parks
Limited opportunity to get parts of the canal built by developers redeveloping sites adjoining the route
Lack of unified buy-in to project
Congestion issues on Great Western Way
Unresolved transport issues
Timing in relation to current applications and development proposals
Fragmented phases of construction may challenge resources
Planning/strategy
(geotechnical) lack of space – all hard edging
(geotechnical) lack of space/highways - opportunity to ground investigate very limited
Significant funding issues, including directly related off site transport issues
Long delivery time – can't be phased
Uncertain costs – how many properties to buy, service diversions
Potential barrier to north south movement
Opportunity lost of targeting finite resources at delivering canal
Impacts on transport infrastructure
Duration of project creating disbelief
Premature development closing off routes
Parochial attitudes driving route/transport choices
Requires large scale maintenance

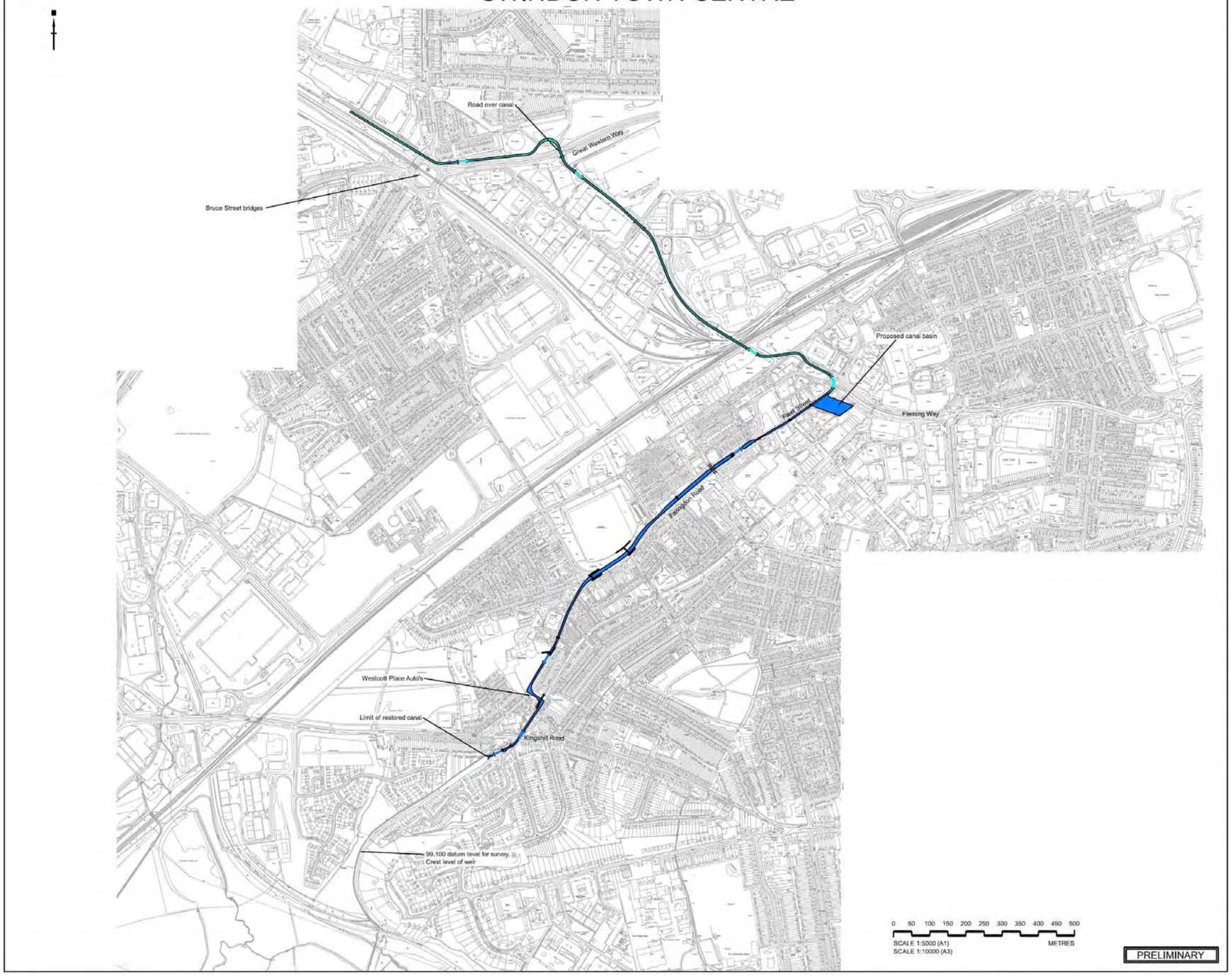
Not enough benefit over high cost of canal.
Piecemeal approach dilutes vision, quality and value for money
Planning, CPO, environment = delays = stagnation → drive
That this schedule delays other redevelopment and regeneration schedules
The quality is compromised because of costs
We implement a minimum scheme doesn't contribute to a greater long term vision

16.4 Appendix D - Plans of Proposed Central Canal Route

The following drawings are included in this appendix;

- TH-SBPF-145-001C – Outline Canal Route
- TH-SBPF-145-002B – Preliminary Canal Route
- TH-SBPF-145-003C – Plan and Longitudinal Section Sheet 1 of 3
- TH-SBPF-145-004C –Plan and Longitudinal Section Sheet 2 of 3
- TH-SBPF-145-005C – Plan and Longitudinal Section Sheet 3 of 3

SWINDON TOWN CENTRE



Key:

- Proposed Central Canal route
- Future North Wilts Canal connection

Notes:

Rev	By	Chkd	Apprvd	Date	Description
C	NR	RM	-	10/07	Less skills added to 3.2m
B	NR	RM	-	31/05/07	Harrow to Reddis, d.s.p
A	NR	RM	-	31/05/07	Route updated

Client: Swindon Borough Council

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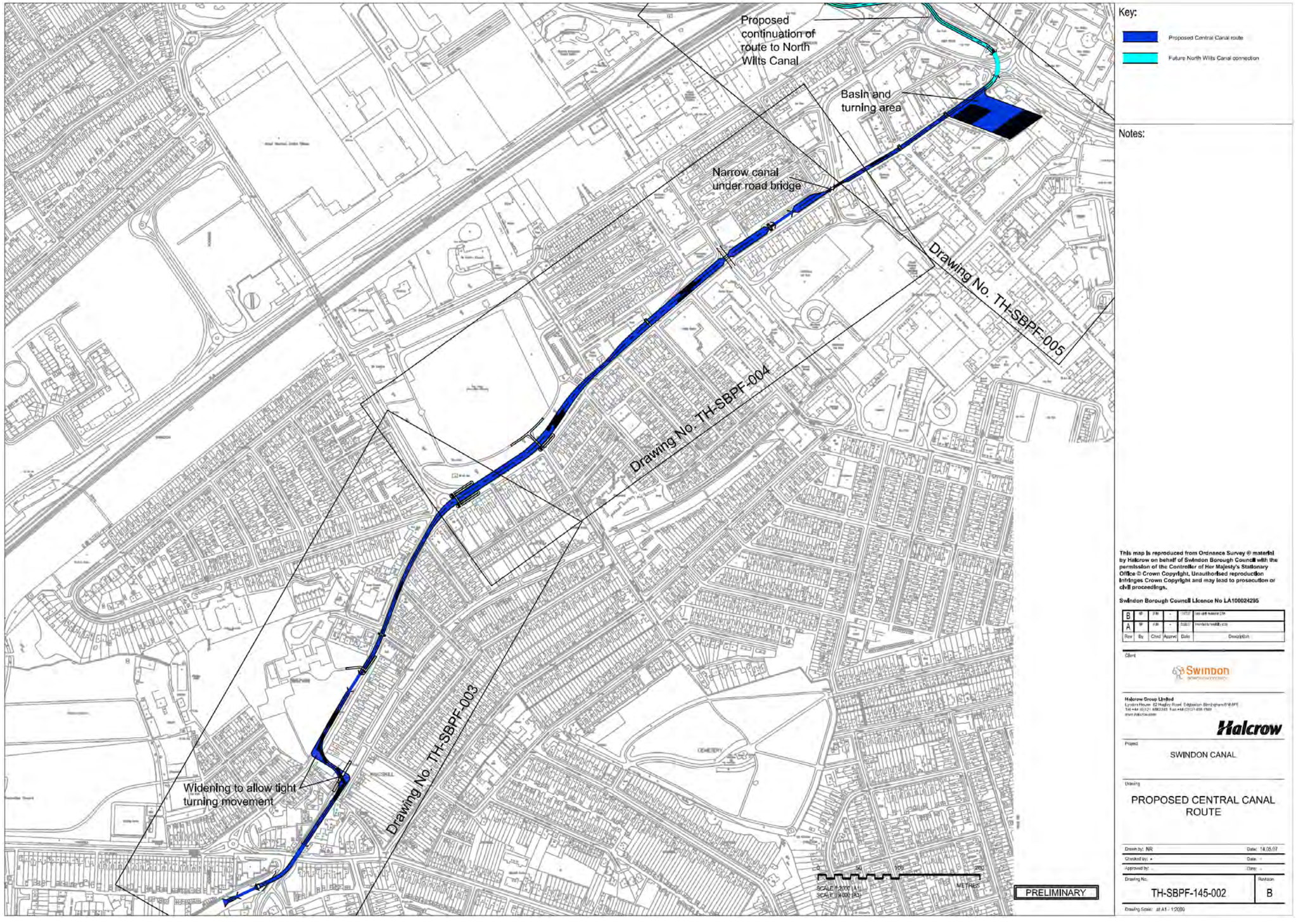
Halcrow

Project: SWINDON CANAL

Drawing: OUTLINE CANAL ROUTE

Drawn by: NR	Date: 18.04.07	
Checked by: -	Date: -	
Approved by: -	Date: -	
Drawing No.: TH-SBPF-145-001	Revision: C	

Drawing Scale: at A1 - 1:5000


Proposed continuation of route to North Wilts Canal
Basin and turning area
Narrow canal under road bridge
Drawing No. TH-SBPF-005
Drawing No. TH-SBPF-004
Drawing No. TH-SBPF-003
Widening to allow tight turning movement
0
50
100
200
METRES
SCALE 1:2000 (A1)
SCALE 1:4000 (A3)
PRELIMINARY
Key:
Proposed Central Canal route
Future North Wilts Canal connection
Notes:
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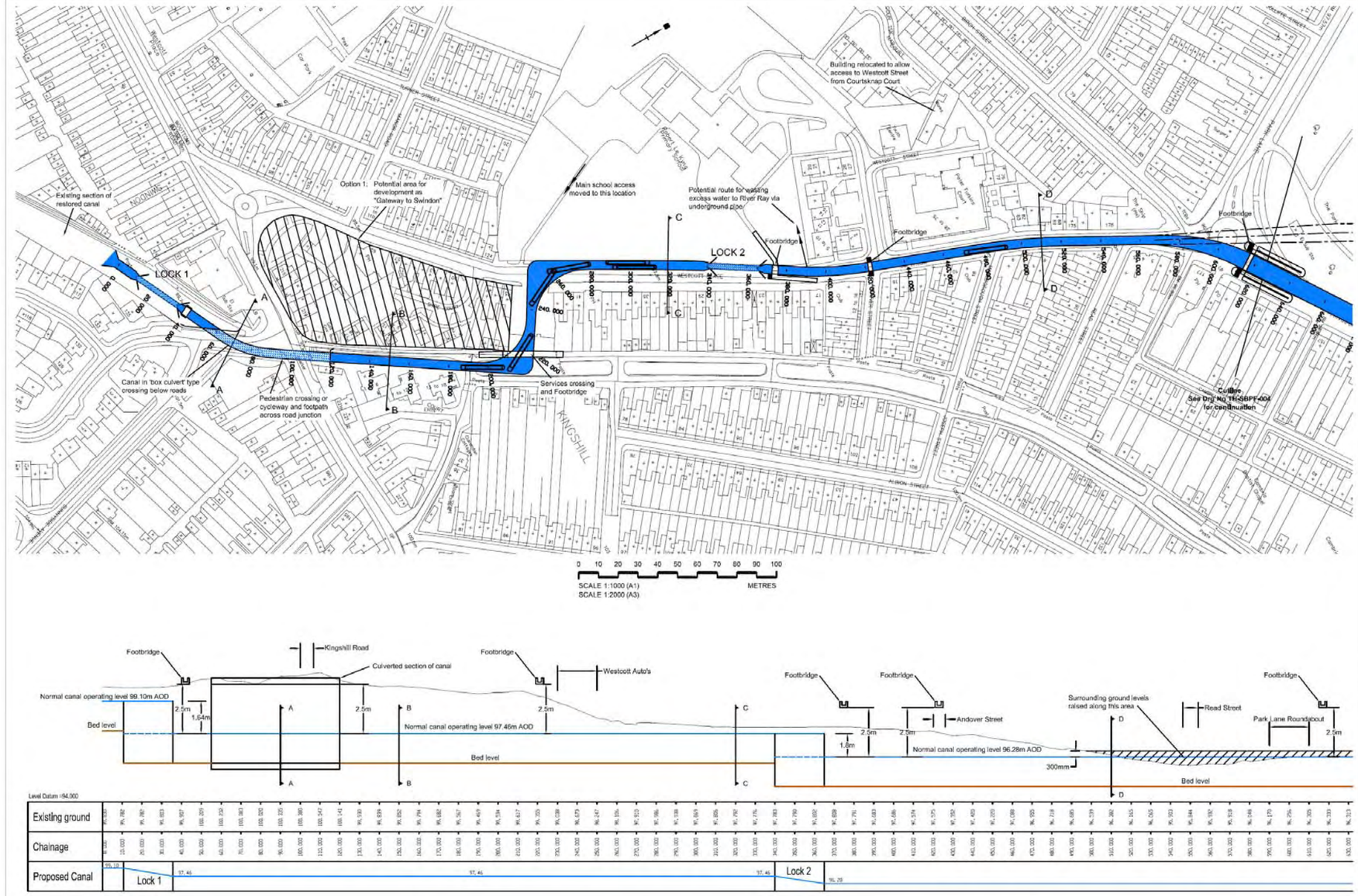
B
A
Rev
By
Chkd
Apprvd
Date
Description
Client
Swindon
Halcrow Group Limited
Halcrow
Project
SWINDON CANAL
Drawing
PROPOSED CENTRAL CANAL ROUTE
Drawn by: NR
Date: 14.05.07
Checked by: -
Date: -
Approved by: -
Date: -
Drawing No.
TH-SBPF-145-002
Revision
B
Drawing Scale: at A1 - 1:2000



SCALE - 1:1000 HORIZONTAL, 1:100 VERTICAL

PRELIMINARY

Key:

Proposed Central Canal route

Notes:

1. For cross sections see Drg No's TH-SBPF-006 AND 007

Rev	By	Chkd	Apprvd	Date	Description
C	MF	FM	-	13.07	Lock widths revised to 3.5m
B	MF	FM	-	31.05.07	Alterations to feasibility study
A	MF	-	-	16.05.07	Bridge highways comments incorporated

Client

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Halcrow

Project

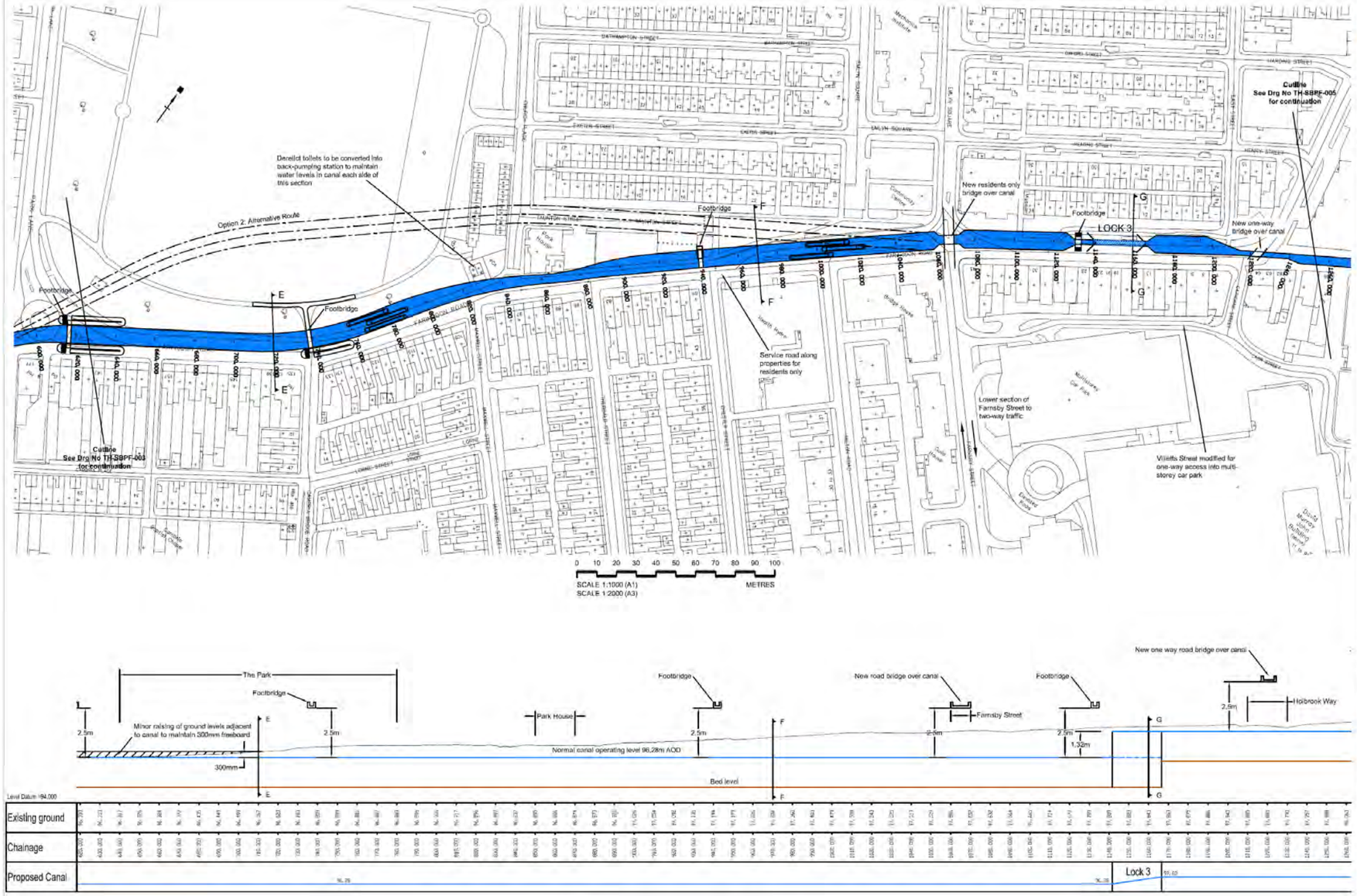
SWINDON CANAL

Drawing

PLAN AND LONGITUDINAL SECTION (sheet 1 of 3)

Drawn by: NR	Date: 17.04.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No. TH-SBPF-145-003	Revision C

Drawing Scale: at A1 - 1:1000



Key:

Proposed Central Canal route

Notes:

1. For cross sections see Drg No's TH-SBPF-006 AND 007

Rev	By	Chkd	Appvd	Date	Description
C	IP	PM	-	12/07	Bridge details
B	IP	PM	-	11/07	Revised to suit
A	IP	-	-	-	First issue

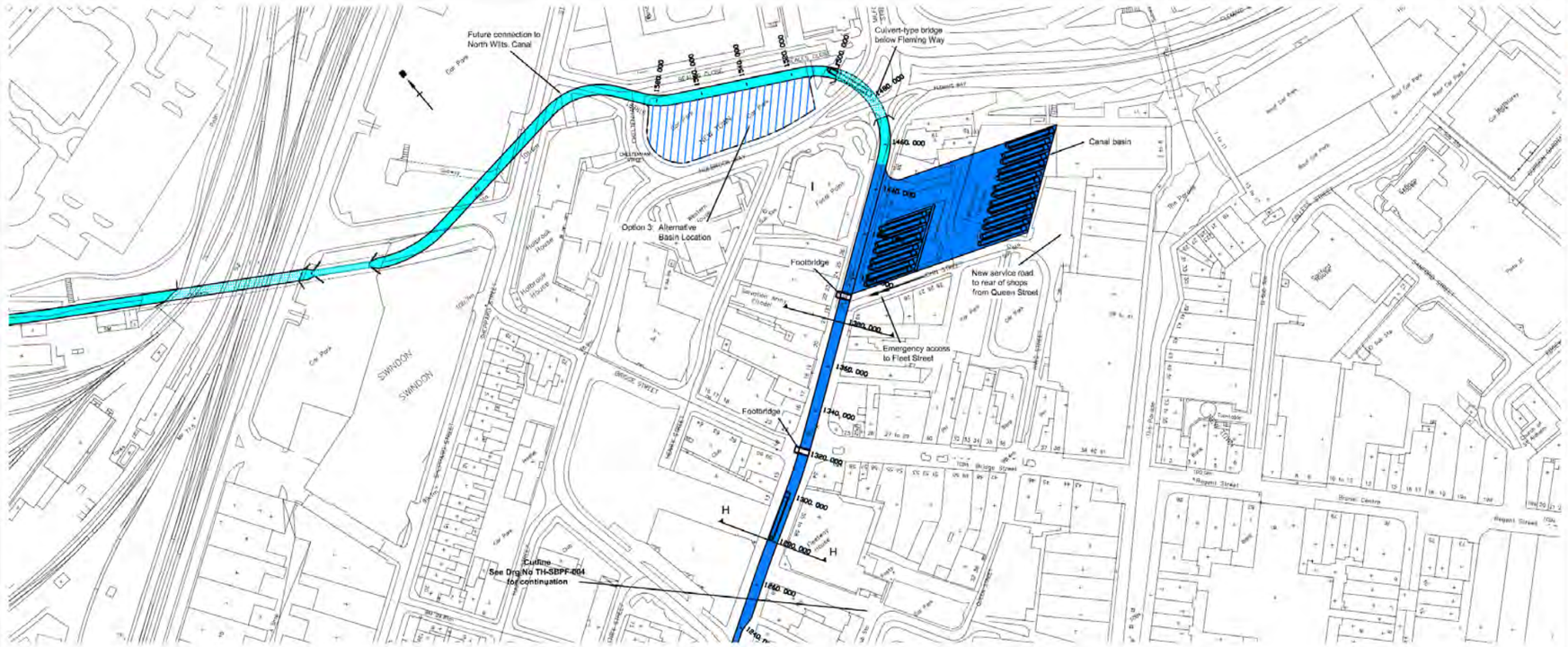
Client: Swindon

Halcrow Group Limited

Project: SWINDON CANAL

Drawing: PLAN AND LONGITUDINAL SECTION (sheet 2 of 3)

Drawn by: NR Date: 17.04.07
Checked by: - Date: -
Approved by: - Date: -
Drawing No. TH-SBPF-145-004 Revision C
Drawing Scale: @ A1 - 1:1000



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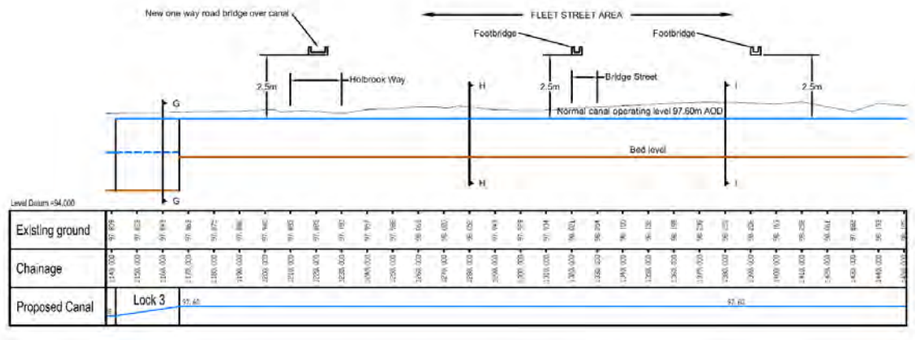
SCALE 1:2000 (A3)
METRES



SCALE - 1:1000 HORIZONTAL, 1:100 VERTICAL

PRELIMINARY

Key:

- Proposed Central Canal route
- Future North Wilts Canal connection

Notes:

1. For cross sections see Drg No's TH-SBPF-006 AND 007

Rev	By	Chkd	Approv	Date	Description
C	IP	NN	-	10/07	Issued for Planning
B	IP	NN	-	04/07	Issued for Client Review
A	IP	-	-	-	First issue for comment

Client

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Project

SWINDON CANAL

Drawing

PLAN AND LONGITUDINAL SECTION (sheet 3 of 3)

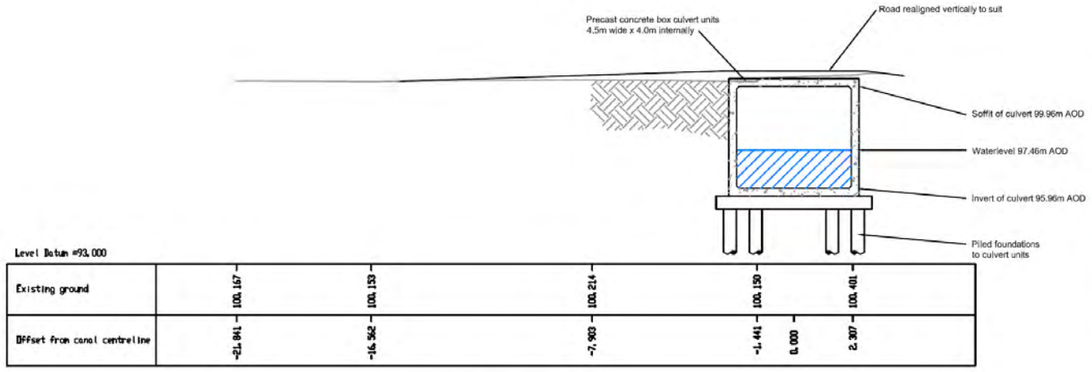
Drawn By: NR	Date: 17.04.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No. TH-SBPF-145-005	Revision C

Drawing Scale: at A1 - 1:1000

16.5 Appendix E – Cross Sections of Central Canal Route

The following drawings are included in this appendix;

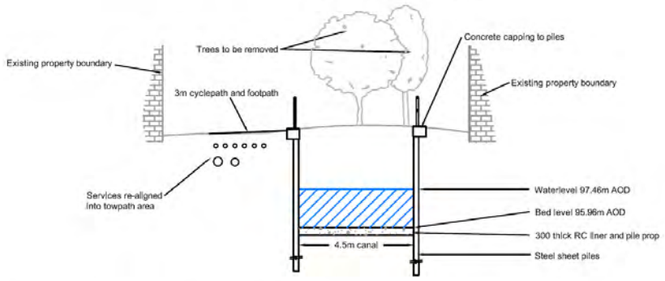
- TH-SBPF-145-006A – Cross Sections A-A, B-B & C-C, Sheet 1 of 3
- TH-SBPF-145-007A – Cross Sections D-D, E-E & F-F, Sheet 2 of 3
- TH-SBPF-145-008B – Cross Sections G-G, H-H & I-I, Sheet 3 of 3



Level Datum =93.000

Existing ground	100.167	100.133	100.214	100.150	100.491	
Offset from canal centreline	-21.944	-16.362	-7.903	-1.441	0.000	2.307

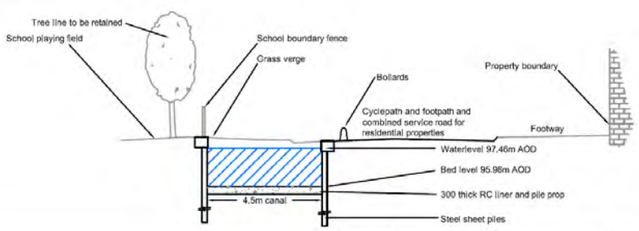
SECTION A-A KINGSHILL



Level Datum =93.000

Existing ground	99.634	99.666	
Offset from canal centreline	-6.1518	-3.4532	0.000

SECTION B-B OLD CANAL ROUTE KINGSHILL



Level Datum =94.000

Existing ground			97.827	97.748	97.957
Offset from canal centreline	0.000	5.0479	8.9887	13.5314	

SECTION C-C WESTCOTT ROAD

0 10 20 30 40 50 60 70 80 90 100
METRES
SCALE 1:1000 (A1)
SCALE 1:2000 (A3)

PRELIMINARY

Key :

Existing features

Proposed features

Notes:

Rev	By	Chkd	Apprvd	Date	Description
A					

Client

Swindon Borough Council

Halcrow Group Limited
Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE
Tel +44 (0)121 4562345 Fax +44 (0)121 456 1569
www.halcrow.com

Halcrow

Project

SWINDON CANAL

Drawing

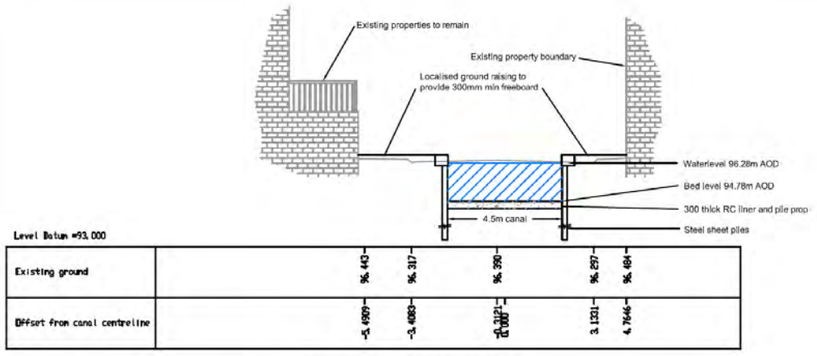
CROSS SECTIONS
A-A, B-B & C-C
(sheet 1 of 3)

Drawn by: NR Date: 05.06.07
Checked by: - Date: -
Approved by: - Date: -

Drawing No. TH-SBPF-145-006

Revision A

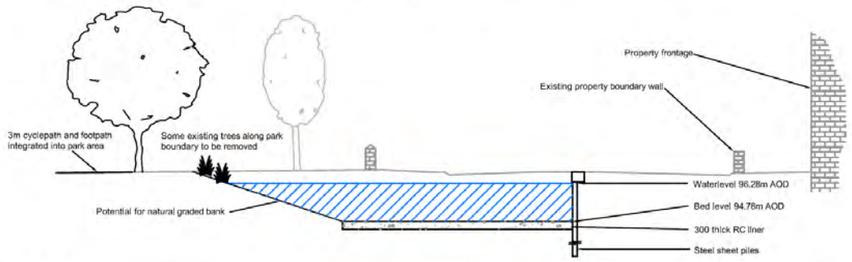
Drawing Scale: @ A1 - 1:1000



Level Datum =93.000

Existing ground	96.443	96.317	96.390	96.297	96.484
Offset from canal centreline	-5.4909	-3.4083	0.0000	3.1231	4.7646

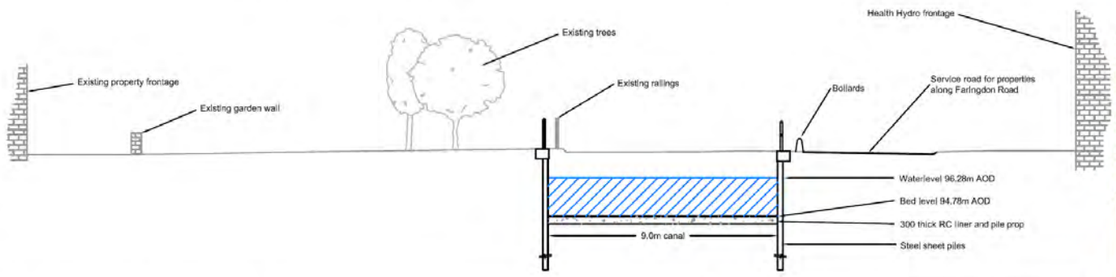
SECTION D-D WESTCOTT ROAD



Level Datum =92.000

Existing ground	96.803	96.709	96.611	96.723	96.596	96.710
Offset from canal centreline	-9.9954	-11.4849	-10.2831	5.5140	10.6472	13.8641

SECTION E-E FARINGDON PARK



Level Datum =92.000

Existing ground	97.198	97.207	97.285	97.433	97.288	97.311	97.342	97.253	97.319	97.349
Offset from canal centreline	-20.4214	-19.7993	-13.4714	-3.9359	-3.7831	0.000	1.6399	3.2777	8.6479	11.3937	12.8384

SECTION F-F RAILWAY VILLAGE

0 10 20 30 40 50 60 70 80 90 100
SCALE 1:1000 (A1)
SCALE 1:2000 (A3)
METRES

PRELIMINARY

Key :

Existing features

Proposed features

Notes:

Rev	By	Chkd	Apprvd	Date	Description
A	IP	FM	-	31.8.07	Amended for feasibility study

Client: Swindon Borough Council

Halcrow Group Limited
Lyndon House, 62 Hagley Road, Edgbaston, Birmingham B16 8PE
Tel +44 (0)121 4562345 Fax +44 (0)121 456 1589
www.halcrow.com

Halcrow

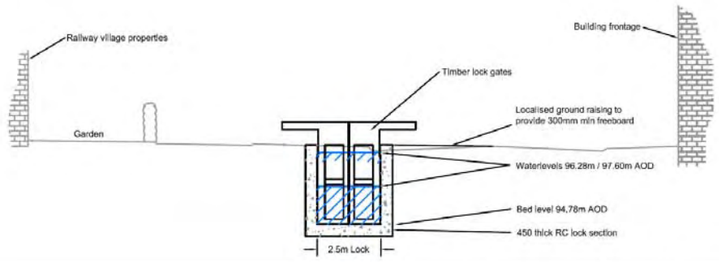
Project: SWINDON CANAL

Drawing: CROSS SECTIONS D-D, E-E & F-F (sheet 2 of 3)

Drawn by: NR Date: 05.06.07
Checked by: - Date: -
Approved by: - Date: -

Drawing No.: TH-SBPF-145-007
Revision: A

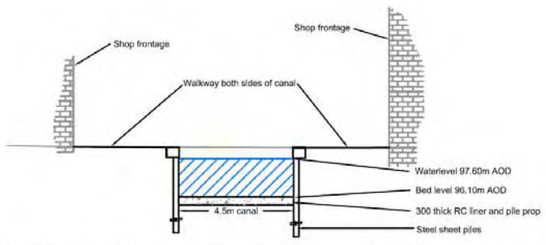
Drawing Scale: at A1 - 1:1000



Level Datum =93.000

Existing ground	97.679	97.680	97.711	97.657	97.665	97.655
Offset from canal centreline	-1.5163	0.000	0.7638	1.9768	5.6319	9.9431	12.5062

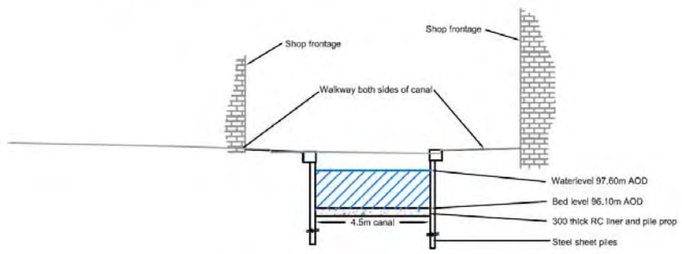
SECTION G-G RAILWAY VILLAGE (LOCK No. 3)



Level Datum =94.000

Existing ground	96.116	96.090	96.068	96.032	96.062
Offset from canal centreline	-5.9632	-7.3564	-4.4000	0.000	5.2011	6.6760

SECTION H-H FLEET STREET



Level Datum =93.000

Existing ground	96.28	96.25	96.38
Offset from canal centreline	-5.00	0.000	5.000

SECTION I-I FLEET STREET

0 10 20 30 40 50 60 70 80 90 100
SCALE 1:1000 (A1)
SCALE 1:2000 (A3)
METRES

PRELIMINARY

Key :

Existing features
Proposed features

Notes:

Rev	By	Chkd	Apprvd	Date	Description
B	RD	RJB	-	12/07	Add cliff retention line
A	RP	RJB	-	7/06/07	Alternative building outline

Client

Swindon Borough Council

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Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE
Tel +44 (0)121 4562345 Fax +44 (0)121 456 1569
www.halcrow.com

Halcrow

Project

SWINDON CANAL

Drawing

CROSS SECTIONS
G-G, H-H & I-I
(sheet 3 of 3)

Drawn by: NR Date: 06.06.07
Checked by: - Date: -
Approved by: - Date: -

Drawing No. TH-SBPF-145-008

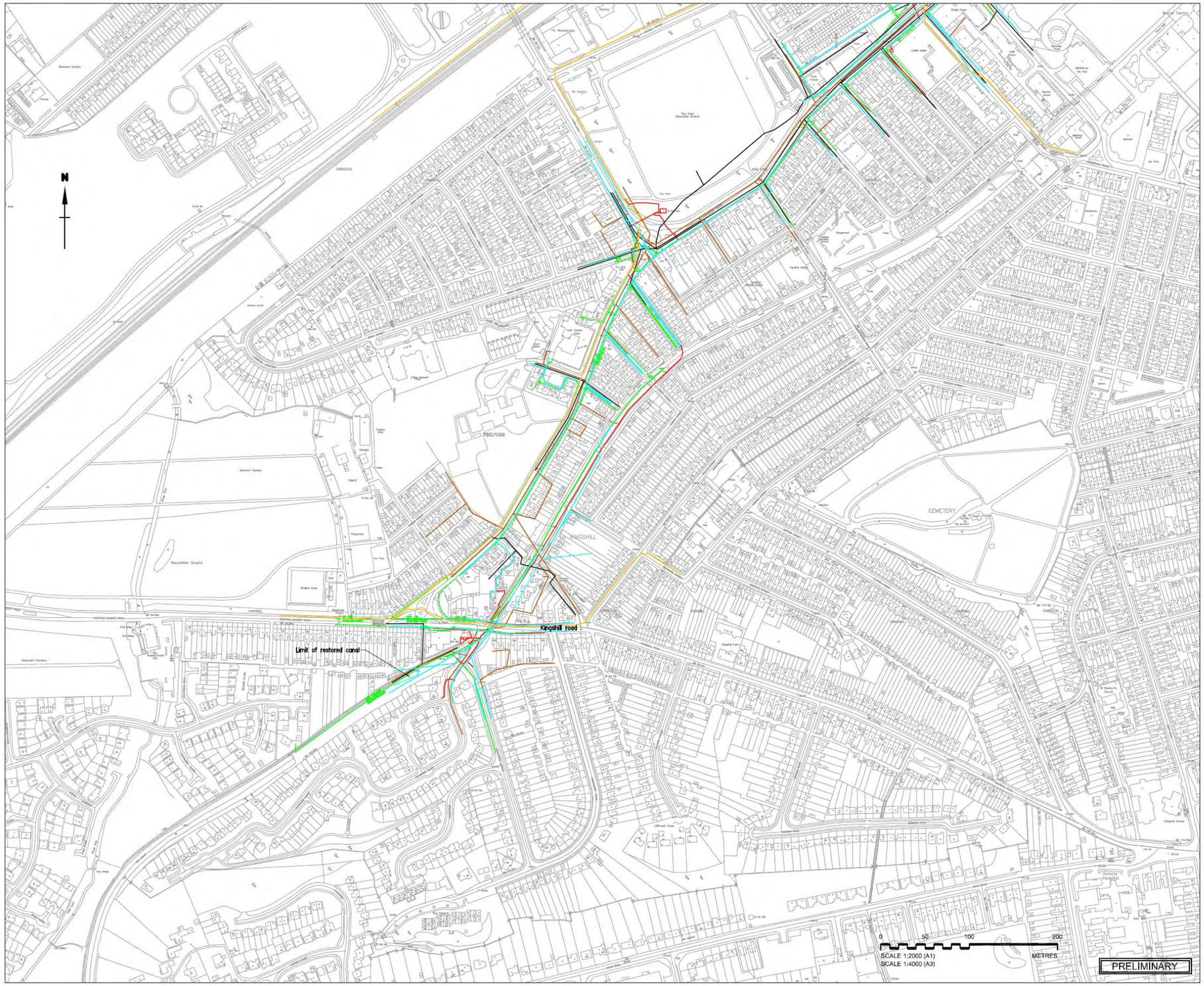
Revision B

Drawing Scale: at A1 - 1:1000

16.6 Appendix F - Service Details

The following drawings are included in this appendix;

- TH-SBPF-145-011A – Central Canal Statutory Service Details Sheet 1 of 2
- TH-SBPF-145-012A - Central Canal Statutory Service Details Sheet 2 of 2



Notes:

IMPORTANT WARNING

The information concerning the location of the public utility apparatus is furnished as a general guide only, and no warranty as to their correctness is given or implied . These drawings should not be relied upon in the event of excavations or other works made near to the apparatus , which may exist at various depths and may deviate from the marked route.

It should be noted that a line shown on the plan may indicate the presence of more than one cable.

KEY

- Cable and Wireless
- Colt Telecommunications
- Fibernet Cables
- SSE Power Distribution
- Thames Water abandoned pipe
- Thames Water Mains
- Thames Water Private combined sewer
- Thames Water public foul sewer
- Thames Water public surface water drain
- Wales And West Utilities Gas Intermediate Pressure
- Wales And West Utilities Gas Low Pressure
- Wales And West Utilities Gas Medium Pressure

Rev	By	Chkd	Apprvd	Date	Description
A	NR	PJM	-	25.07.07	Amended for feasibility study

Client

Swindon Borough Council

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Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE
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Halcrow

Project

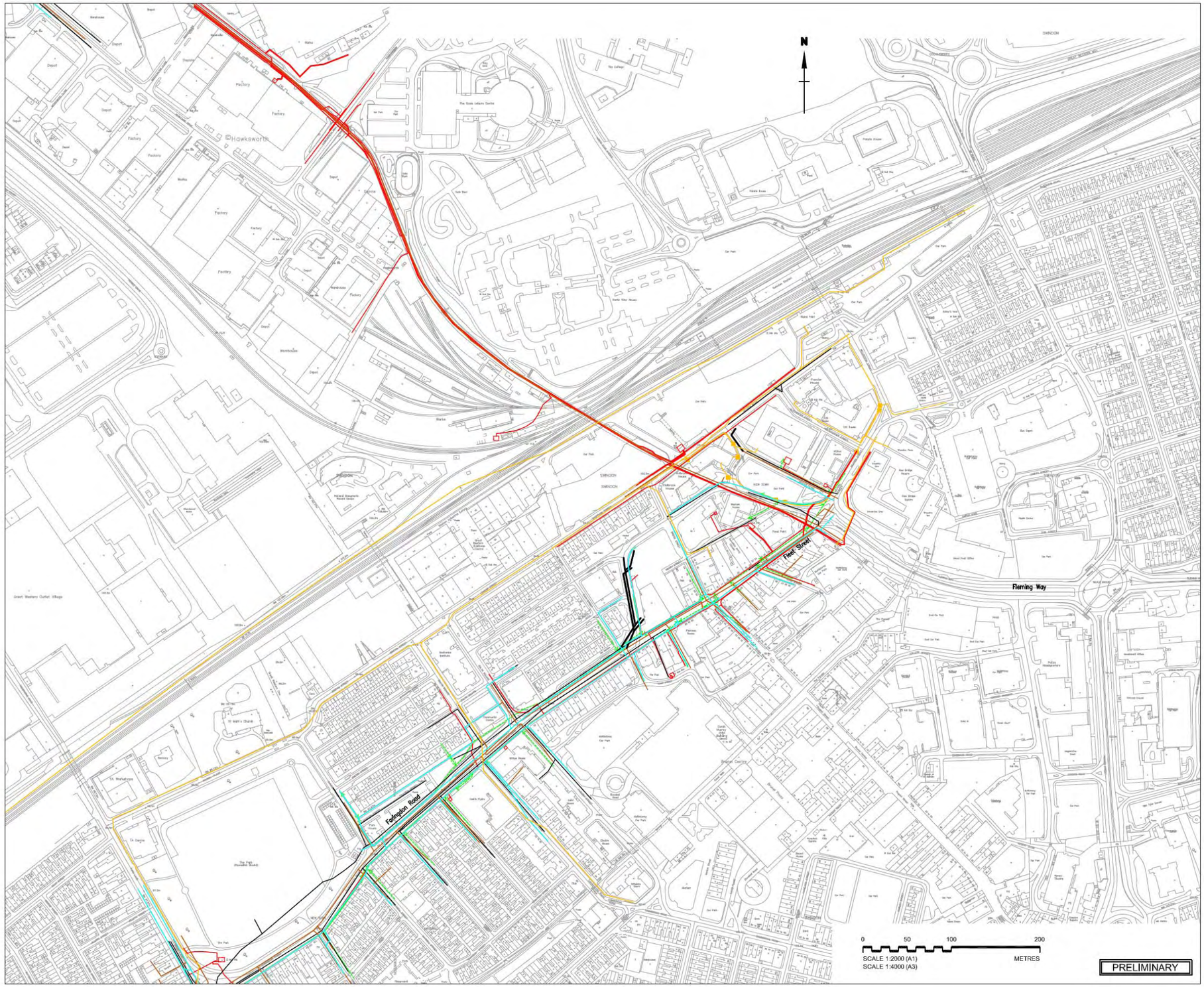
SWINDON CANAL

Drawing

CENTRAL CANAL
STATUTORY SERVICE DETAILS
SHEET 1 OF 2

Drawn by: NR		Date: 16.04.07	
Checked by: -		Date: -	
Approved by: -		Date: -	
Drawing No.	TH-SBPF-145-011	Revision	A

Drawing Scale: at A1 - 1:2000



Notes:

IMPORTANT WARNING

The information concerning the location of the public utility apparatus is furnished as a general guide only, and no warranty as to their correctness is given or implied . These drawings should not be relied upon in the event of excavations or other works made near to the apparatus , which may exist at various depths and may deviate from the marked route.

It should be noted that a line shown on the plan may indicate the presence of more than one cable.

KEY

- Cable and Wireless
- Colt Telecommunications
- Fibernet Cables
- SSE Power Distribution
- Thames Water abandoned pipe
- Thames Water Mains
- Thames Water Private combined sewer
- Thames Water public foul sewer
- Thames Water public surface water drain
- Wales And West Utilities Gas Intermediate Pressure
- Wales And West Utilities Gas Low Pressure
- Wales And West Utilities Gas Medium Pressure

Rev	By	Chkd	Apprvd	Date	Description
A	NR	RM	-	31/07	Amended to initial study

Client

Swindon Borough Council

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Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE
Tel +44 (0)121 4582345 Fax +44 (0)121 456 1569
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SWINDON CANAL

Drawing

CENTRAL CANAL
STATUTORY SERVICE DETAILS
SHEET 2 OF 2

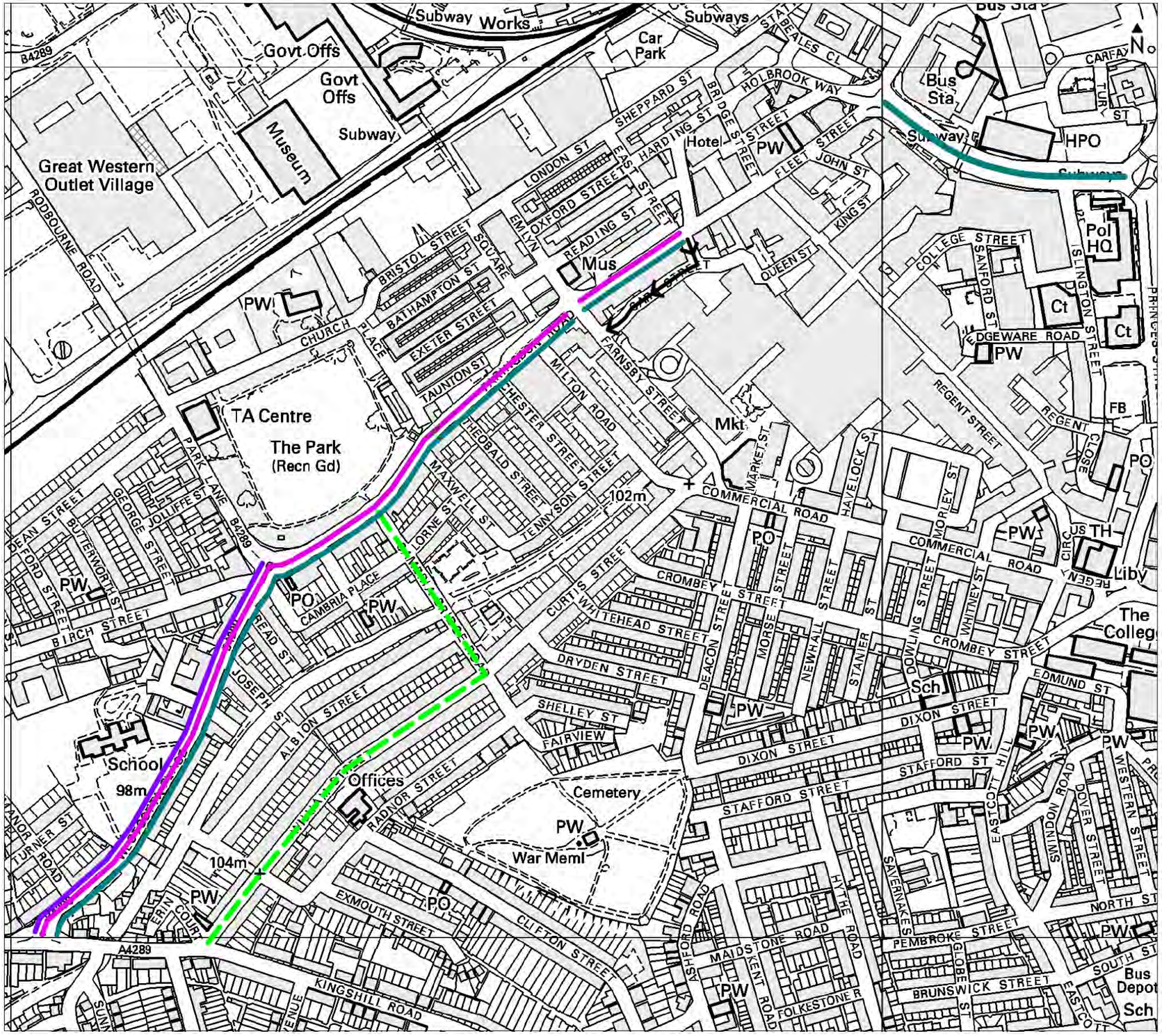
Drawn by: NR	Date: 16.04.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No. TH-SBPF-145-012	Revision A

Drawing Scale: at A1 - 1:2000

16.7 Appendix G – Traffic Review Plans

The following drawings are included in this appendix;

- TH-SBPF-145-017 - Plan of options
- TH-SBPF-145-018 - Local access issues around Faringdon Road and Westcott Place
- TH-SBPF-145-019 - Option 1 compared to 2006 AM base model
- TH-SBPF-145-020 - Option 1 compared to 2006 PM base model
- TH-SBPF-145-021 - Option 2 compared to 2006 AM base model
- TH-SBPF-145-022 - Option 2 compared to 2006 PM base model
- TH-SBPF-145-023 - Option 2 Sensitivity test compared to 2006 AM base model
- TH-SBPF-145-024 - Option 2 Sensitivity test compared to 2006 PM base model



Legend:

- Option 1 - Road closed to through traffic
- Option 2 - Road closed to through traffic
- Option 3 - Road closed to through traffic bus only route
- Route made less attractive to through movements
- Direction of traffic reversed

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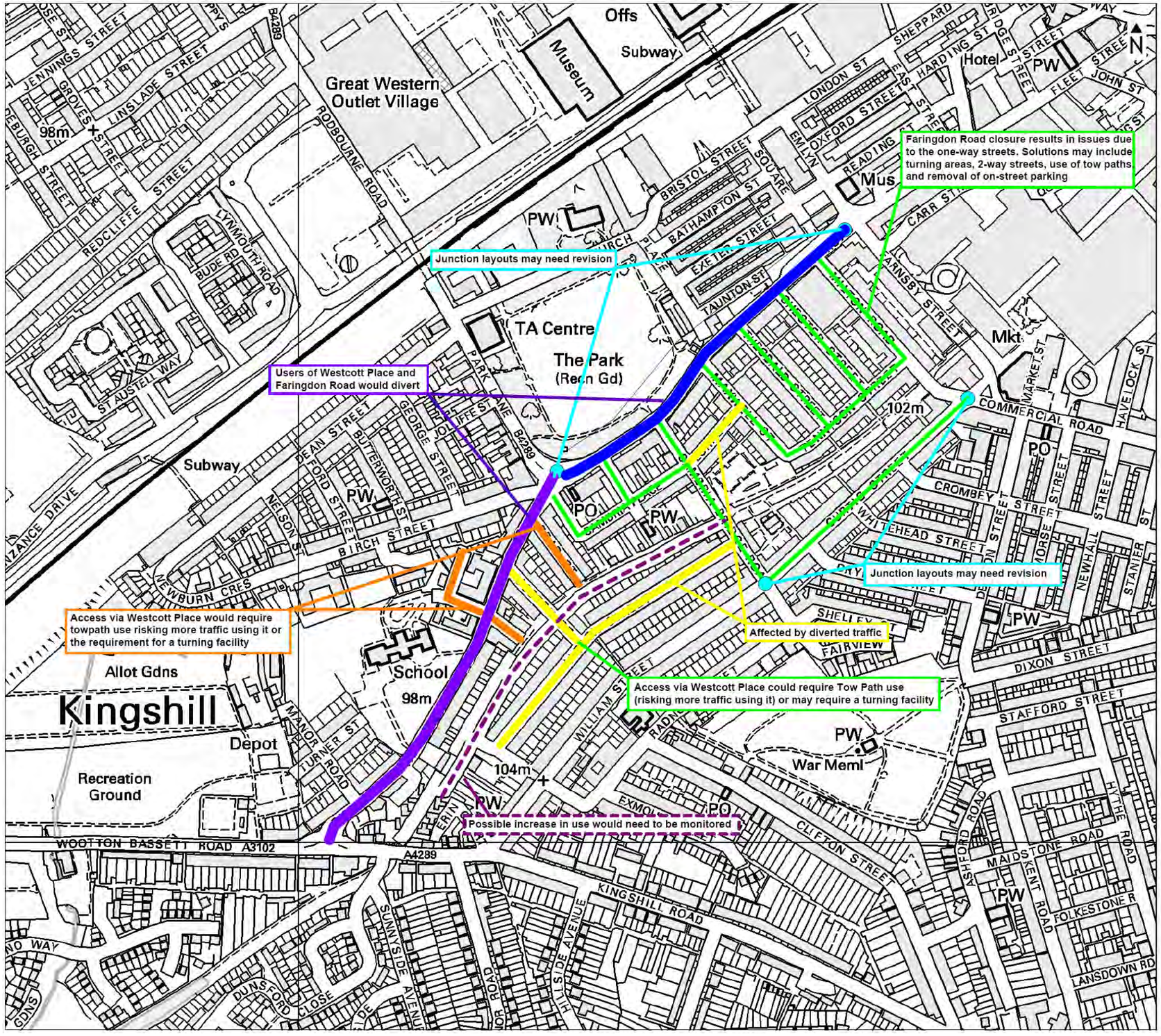
Project:

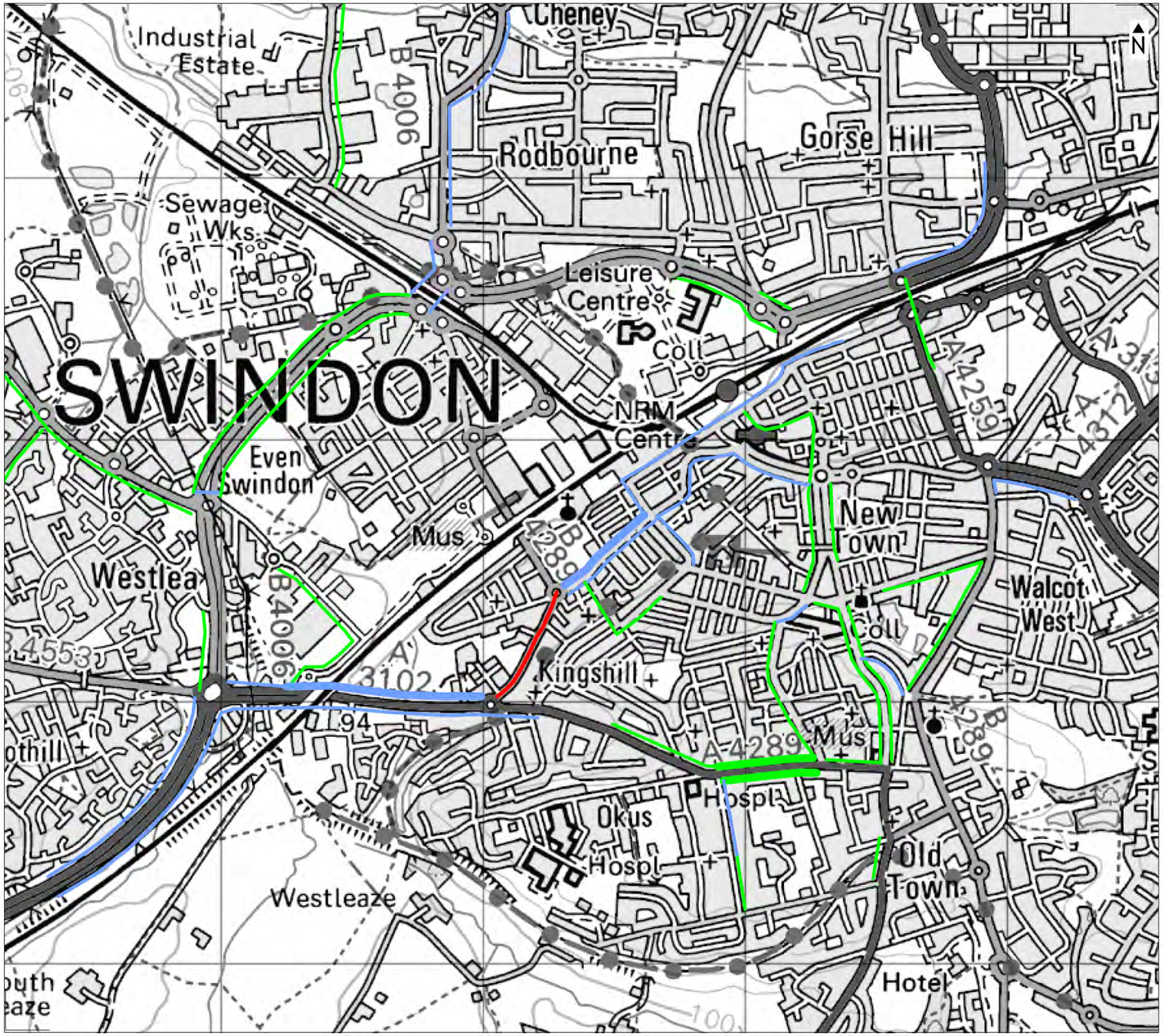
Swindon Canal Central Route Study

Figure Title:

Plan of Options

Drawn by:	Paul Collyer
Checked by:	Tom Metcalfe
Approved by:	Helen Spackman
Figure Number:	TH/SBPF/145/017
Revision:	-
Scale:	Not to Scale
Date:	June 2007





Legend:

- Increase of 300 or more vehicles/hour
- Increase of between 100 - 299 vehicles/hour
- Decrease of 300 or more vehicles/hour
- Decrease of between 100 - 299 vehicles/hour
- Road closure to Westcott Place

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Halcrow

Project:

Swindon Canal Central Route Study

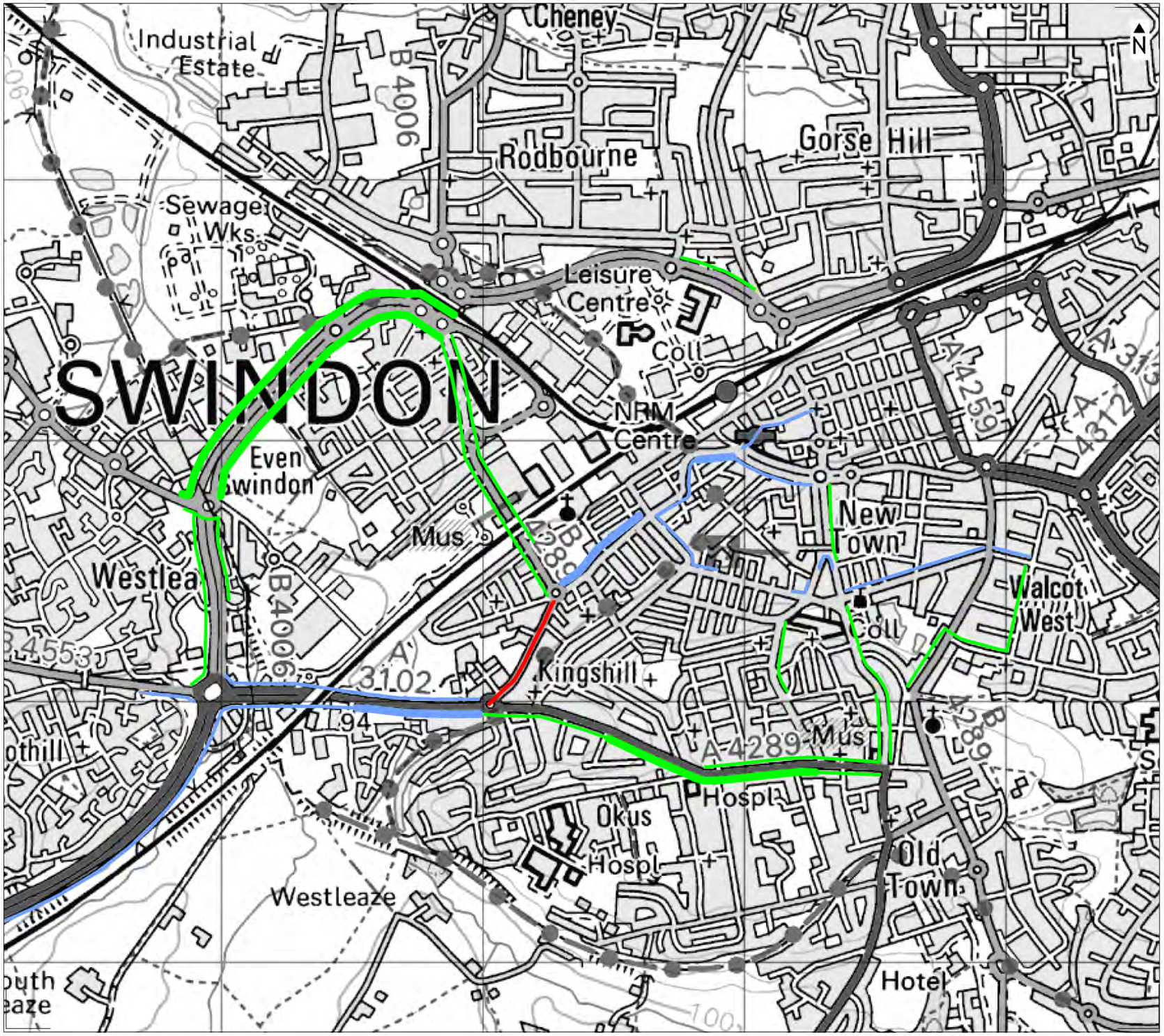
Figure Title:

Option 1 compared to 2006 AM base model

Drawn by:	Paul Collyer
Checked by:	Tom Metcalfe
Approved by:	Helen Spackman

Figure Number:.	Revision:
TH/SBPF/145/019	-

Scale:	Date:
Not to Scale	June 2007



Legend:

- Increase of 300 or more vehicles/hour
- Increase of between 100 - 299 vehicles/hour
- Decrease of 300 or more vehicles/hour
- Decrease of between 100 - 299 vehicles/hour
- Road closure to Westcott Place

Swindon Borough Council

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Halcrow

Project:

Swindon Canal Central Route Study

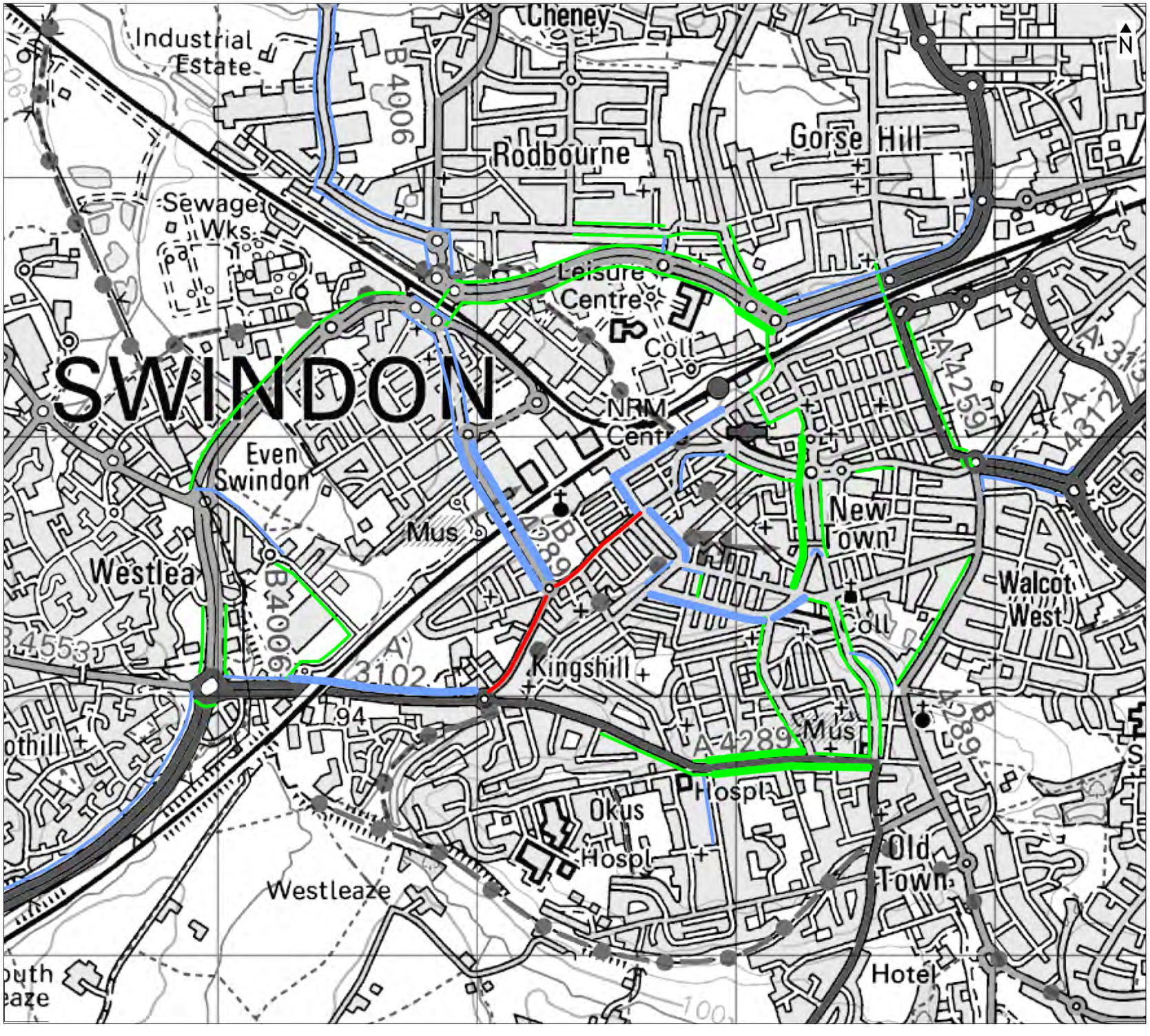
Figure Title:

Option 1 compared to 2006 PM base model

Drawn by:	Paul Collyer
Checked by:	Tom Metcalfe
Approved by:	Helen Spackman

Figure Number:.	Revision:
TH/SBPF/145/020	-

Scale:	Date:
Not to Scale	June 2007



Legend:

- Increase of 300 or more vehicles/hour
- Increase of between 100 - 299 vehicles/hour
- Decrease of 300 or more vehicles/hour
- Decrease of between 100 - 299 vehicles/hour
- Road closures to Westcott Place and Faringdon Road

Swindon Borough Council

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Halcrow

Project:

Swindon Canal Central Route Study

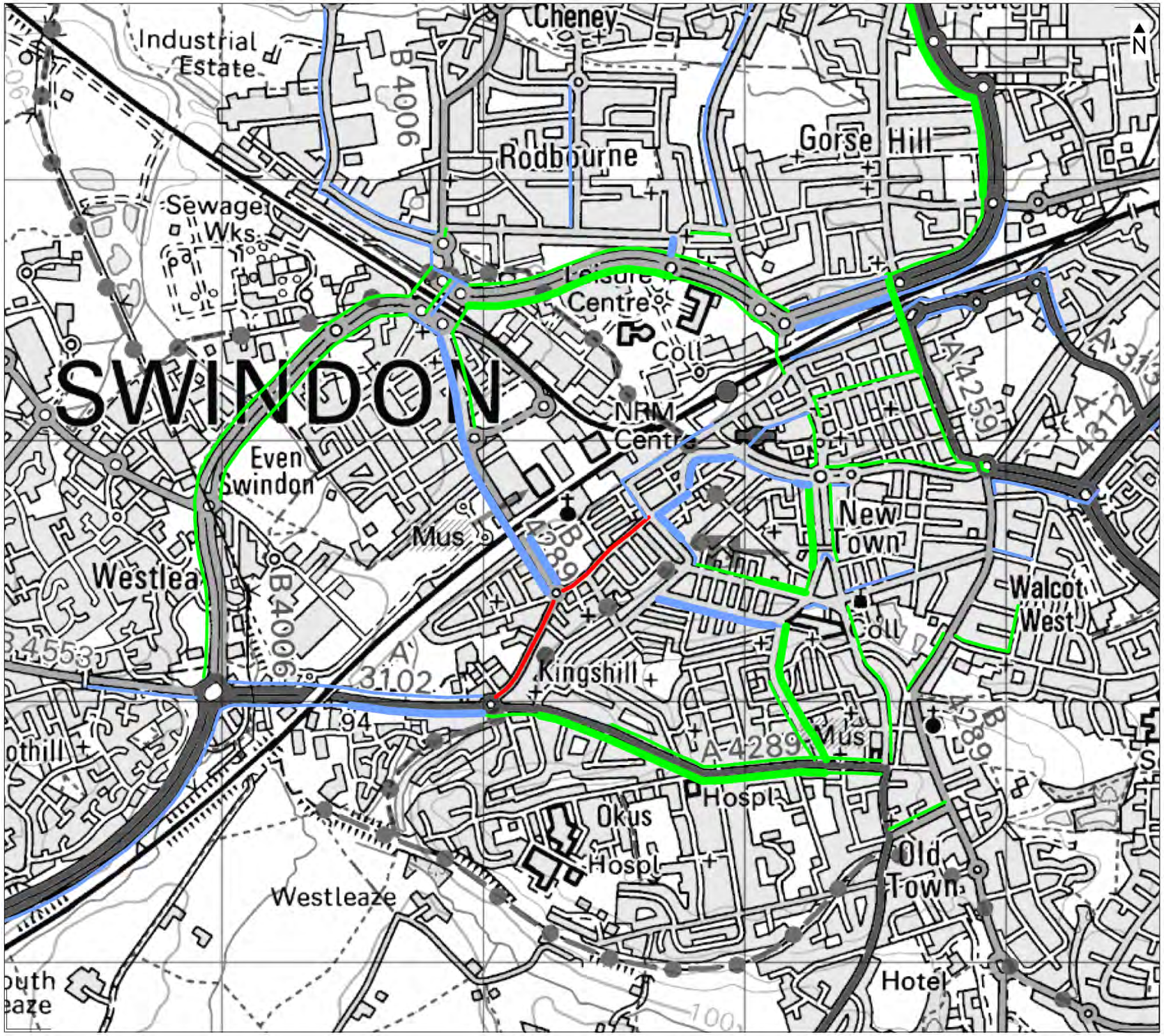
Figure Title:

Option 2 compared to 2006 AM base model

Drawn by:	Paul Collyer
Checked by:	Tom Metcalfe
Approved by:	Helen Spackman

Figure Number:.	Revision:
TH/SBPF/145/021	-

Scale:	Date:
Not to Scale	June 2007



Legend:

- Increase of 300 or more vehicles/hour
- Increase of between 100 - 299 vehicles/hour
- Decrease of 300 or more vehicles/hour
- Decrease of between 100 - 299 vehicles/hour
- Road closures to Westcott Place and Faringdon Road

Swindon Borough Council

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Project:

Swindon Canal Central Route Study

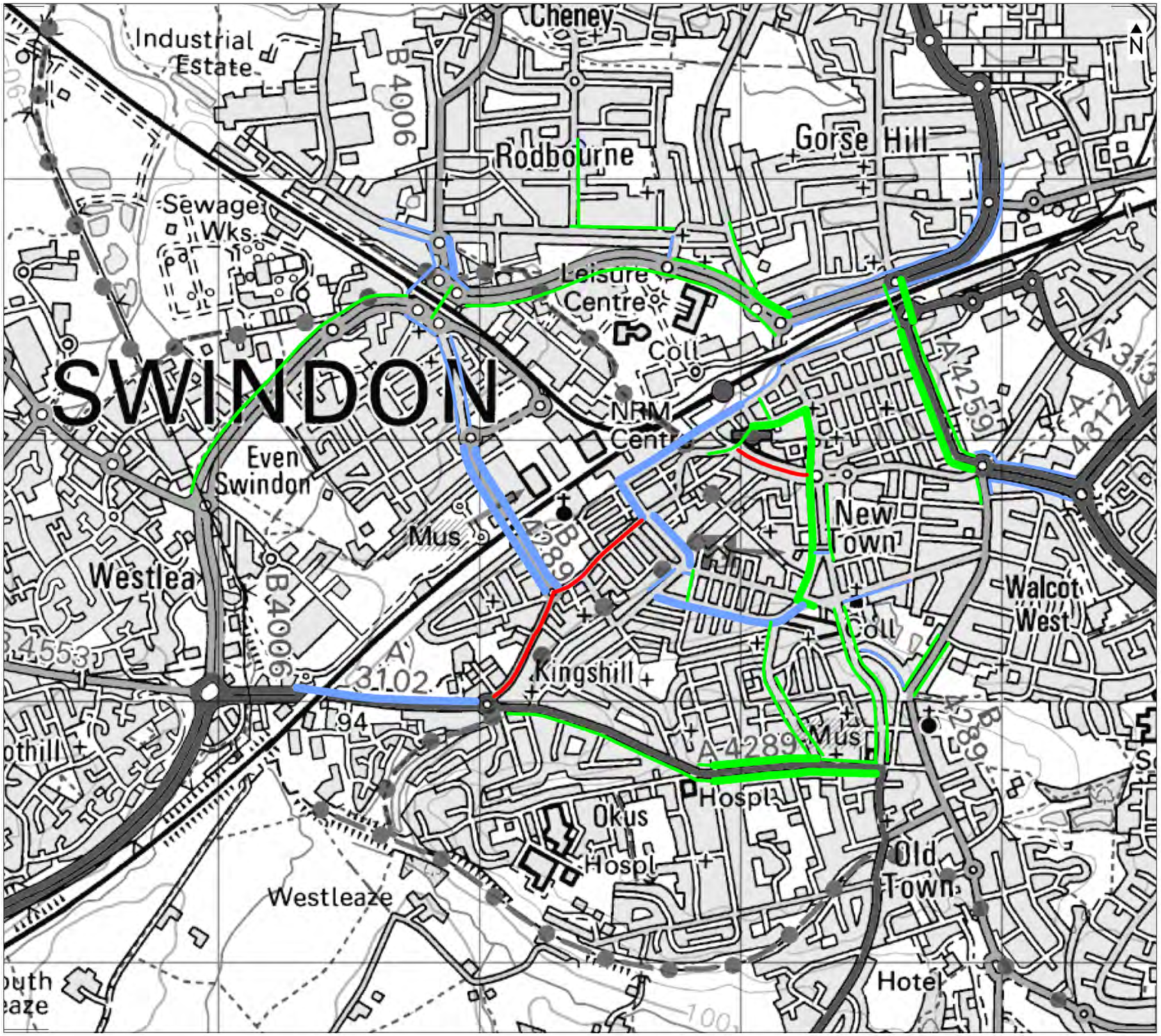
Figure Title:

Option 2 compared to 2006 PM base model

Drawn by:	Paul Collyer
Checked by:	Tom Metcalfe
Approved by:	Helen Spackman

Figure Number:.	Revision:
TH/SBPF/145/022	-

Scale:	Date:
Not to Scale	June 2007



Legend:

- Increase of 300 or more vehicles/hour
- Increase of between 100 - 299 vehicles/hour
- Decrease of 300 or more vehicles/hour
- Decrease of between 100 - 299 vehicles/hour
- Road closures to Westcott Place, Faringdon Road and Fleming Way

Swindon Borough Council

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Project:

Swindon Canal Central Route Study

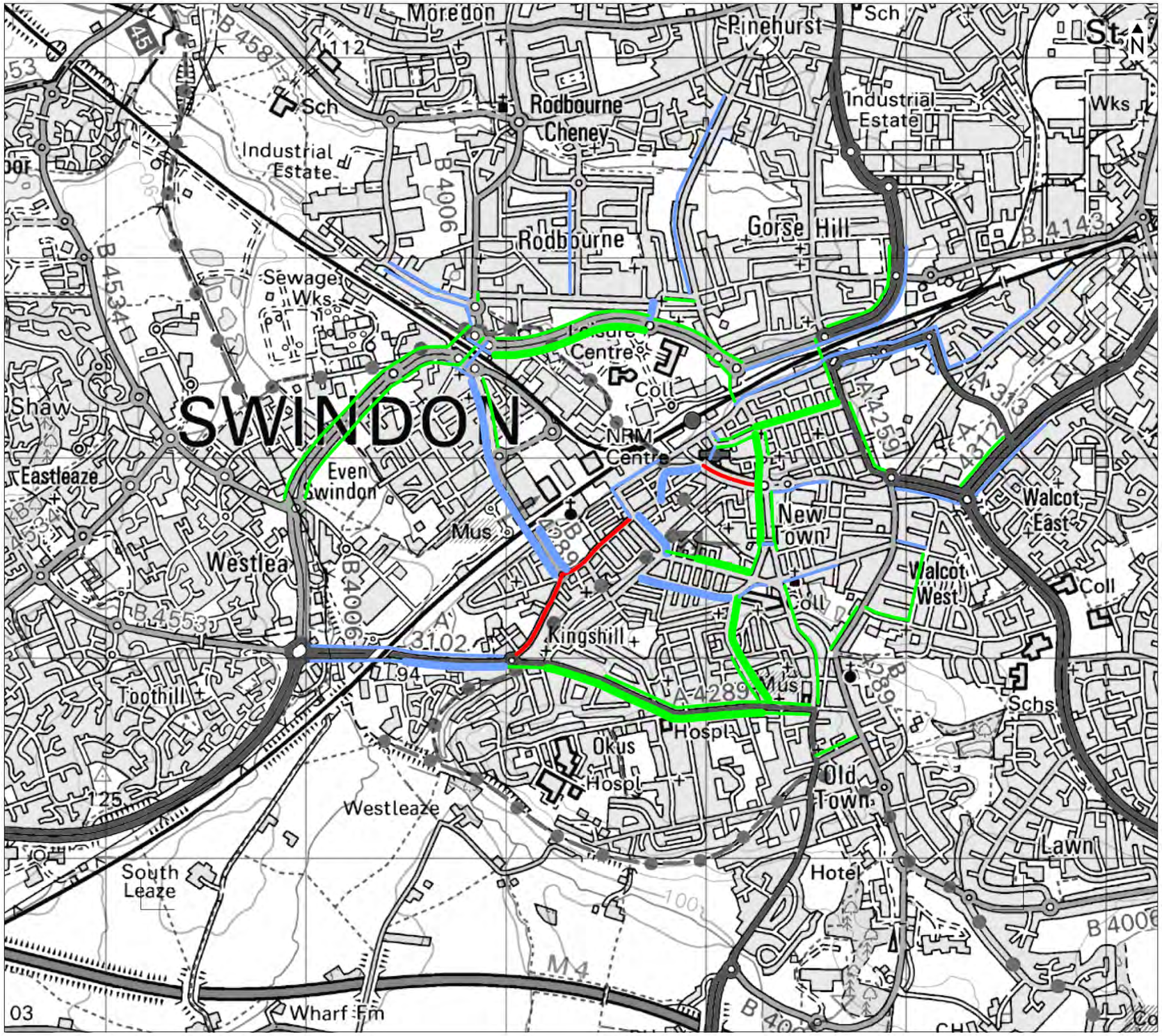
Figure Title:

Option 2 - Sensitivity Test compared to 2006 AM base model

Drawn by:	Paul Collyer
Checked by:	Tom Metcalfe
Approved by:	Helen Spackman

Figure Number:.	Revision:
TH/SBPF/145/023	-

Scale:	Date:
Not to Scale	June 2007



Legend:

- Increase of 300 or more vehicles/hour
- Increase of between 100 - 299 vehicles/hour
- Decrease of 300 or more vehicles/hour
- Decrease of between 100 - 299 vehicles/hour
- Road closures to Westcott Place, Faringdon Road and Fleming Way

SWINDON BOROUGH COUNCIL

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Burderop Park, Swindon, Wilts, SN4 0QD
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Project:

Swindon Canal Central Route Study

Figure Title:

Option 2 - Sensitivity Test compared to 2006 PM base model

Drawn by:	Paul Collyer
Checked by:	Tom Metcalfe
Approved by:	Helen Spackman

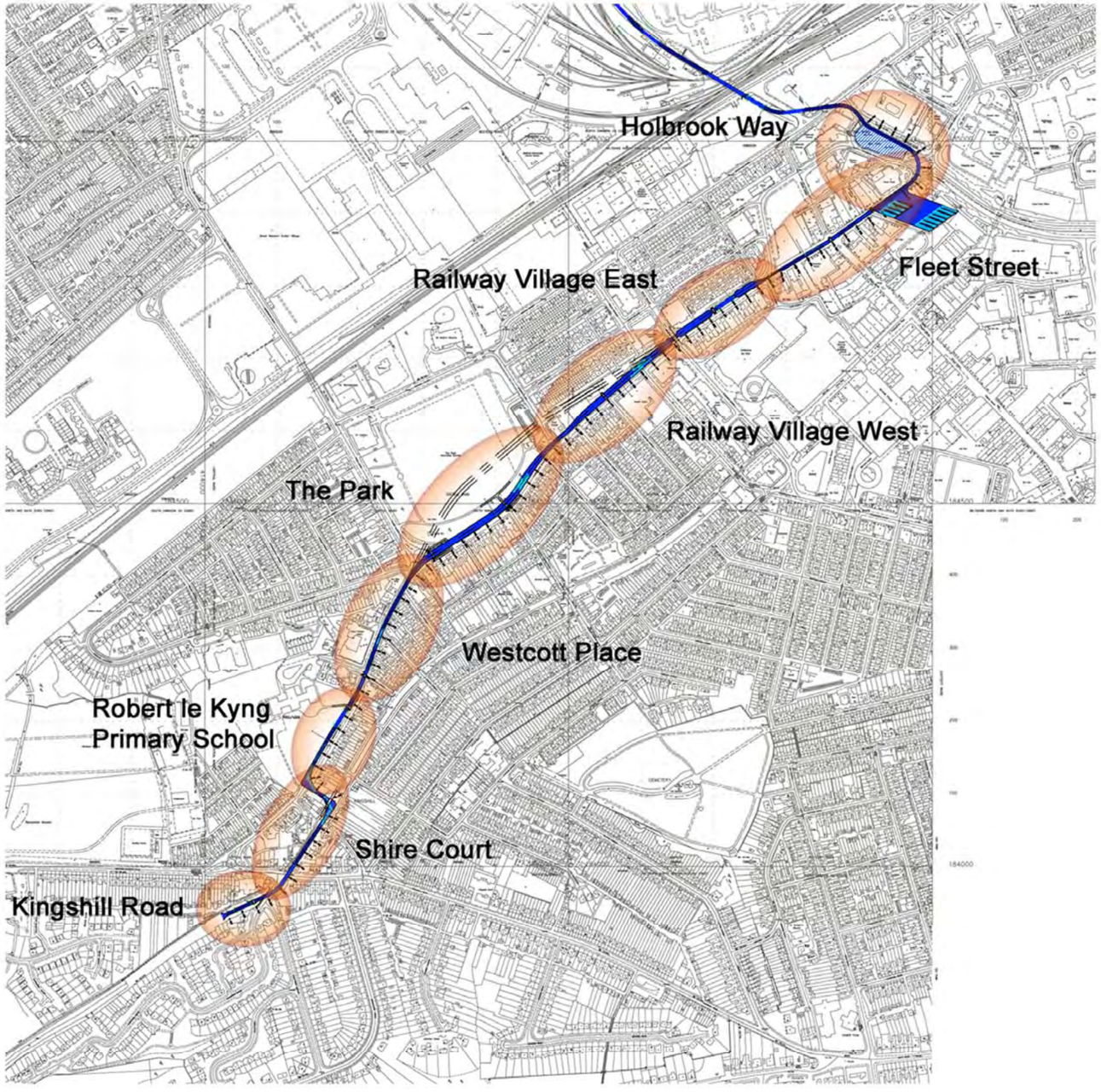
Figure Number:.	Revision:
TH/SBPF/145/024	-

Scale:	Date:
Not to Scale	June 2007

16.8 Appendix H – Landscape Plans and Drawings

The following drawings are included in this appendix;

- TH-SBPF-145-025 – Urban Character Areas
- TH-SBPF-145-026 – Kingshill Road Gateway Photomontage
- TH-SBPF-145-027 - Shire Court and Erin Court Redevelopment Opportunities
- TH-SBPF-145-028 - Westcott Place Photomontage
- TH-SBPF-145-029 – The Park Photomontage
- TH-SBPF-145-030 – Railway Village Photomontage
- TH-SBPF-145-031 – Fleet Street Redevelopment Opportunity
- TH-SBPF-145-032 – Fleet Street Photomontges
- TH-SBPF-145-033 – Images



Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

Halcrow Group Limited
Burderop Park Swindon Wiltshire SN4 0QD
Tel +44 (0)1793 812479 Fax +44 (0)1793 812089
www.halcrow.com

Halcrow

Project

Swindon Canal

Drawing

Urban Character Areas

Drawn by: DTM	Date: 20/06/07
Checked by:	Date:
Approved by:	Date:
Drawing No. TH/SBPF/145/025	Revision
Drawing Scale: NA	

Drawing Signed & Name :
Drawing on the path
User and Plot Date

Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

Halcrow Group Limited
Burderop Park Swindon Wiltshire SN4 0QD
Tel: +44 (0)1793 812479 Fax: +44 (0)1793 812089
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Project

Swindon Canal

Drawing

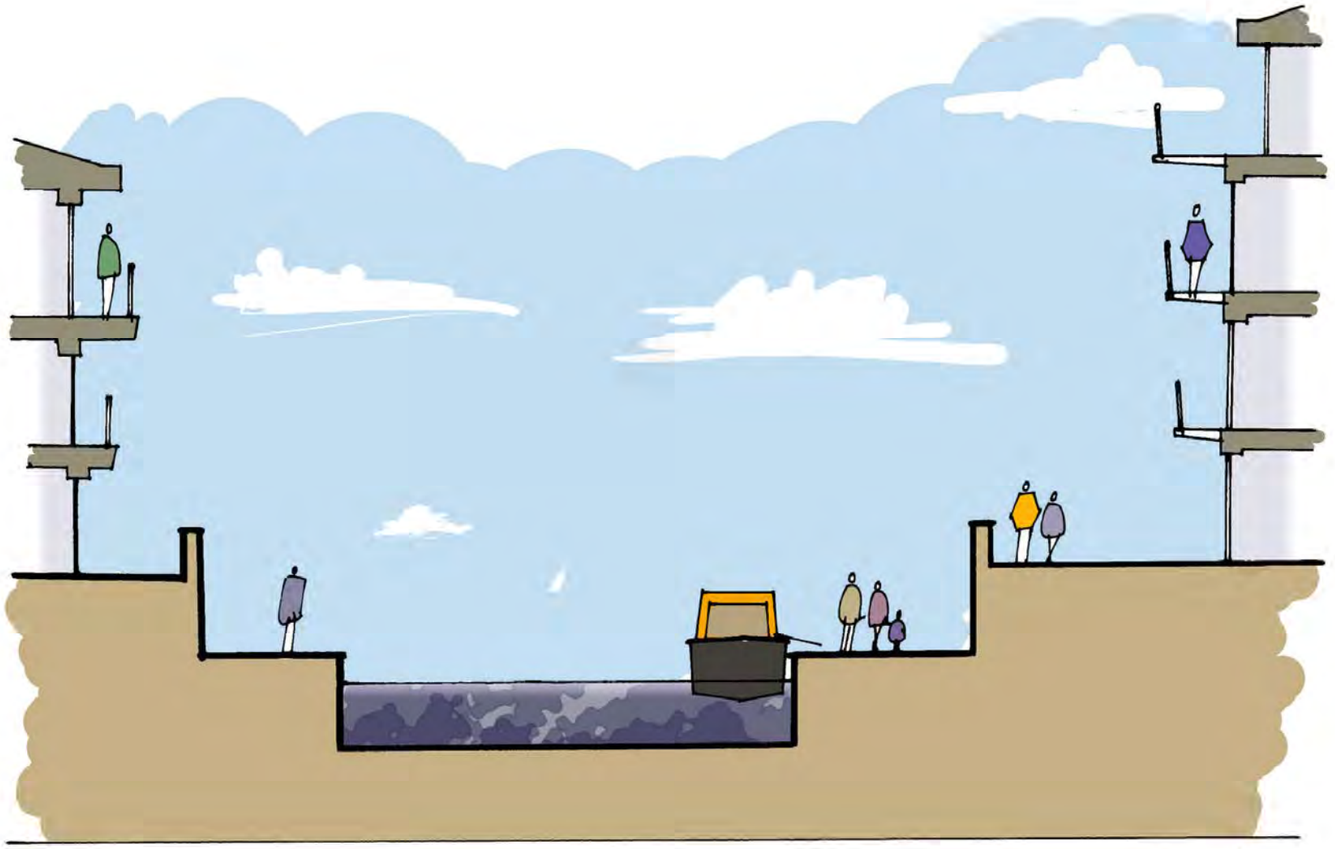
Kingshill Road Gateway

Drawn by: DTM Date: 12/06/07
Checked by: Date:
Approved by: Date:

Drawing No. TH/SBPF/145/026 Revision

Drawing Scale: NA

Drawing has path & camera centrelines for path balance & fly-thru



Key Plan:

Notes:

Rev	By	Chkd	Approv	Date	Description

Client

Swindon

Halcrow Group Limited
Burderop Park Swindon Wiltshire SN4 0QD
Tel +44 (0)1793 812479 Fax +44 (0)1793 812089
www.halcrow.com

Halcrow

Project

Swindon Canal

Drawing

Shire Court and Erin Court Redevelopment Opportunities

Drawn by: DTM	Date: 20/06/07
Checked by:	Date:
Approved by:	Date:
Drawing No: TH/SBPF/145/027	Revision:

Drawing Scale: NA

Drawing file path & name Reference for path Use external data

Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

Halcrow Group Limited
Burdrop Park Swindon Wiltshire SN4 0QD
Tel +44 (0)1793 812479 Fax +44 (0)1793 812089
www.halcrow.com

Halcrow

Project

Swindon Canal

Drawing

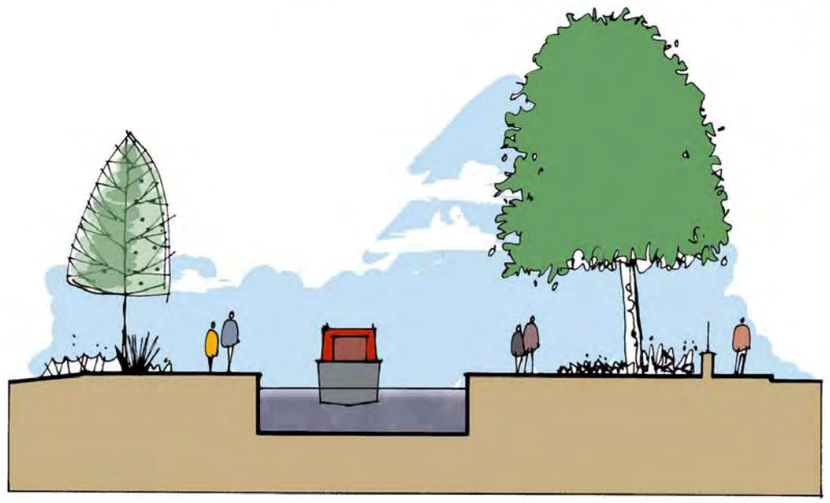
Westcott Place

Drawn by: DTM Date: 13/06/07
Checked by: Date:
Approved by: Date:

Drawing No. TH/SBPF/145/028 Revision

Drawing Scale: NA

Drawing for path & kerb maintenance for path between school and Falcon Inn



Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

Halcrow Group Limited
Burderop Park Swindon Wiltshire SN4 0QD
Tel +44 (0)1793 812479 Fax +44 (0)1793 812089
www.halcrow.com

Halcrow

Project

Swindon Canal

Drawing

The Park

Drawn by: DTM Date: 15/06/07

Checked by: Date:

Approved by: Date:

Drawing No. TH/SBPF/145/029 Revision

Drawing Scale: NA

Drawing file path & name
Reference file path
Name and Path

Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

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Burderop Park Swindon Wiltshire SN4 0QD
Tel +44 (0)1793 812479 Fax +44 (0)1793 812089
www.halcrow.com

Halcrow

Project

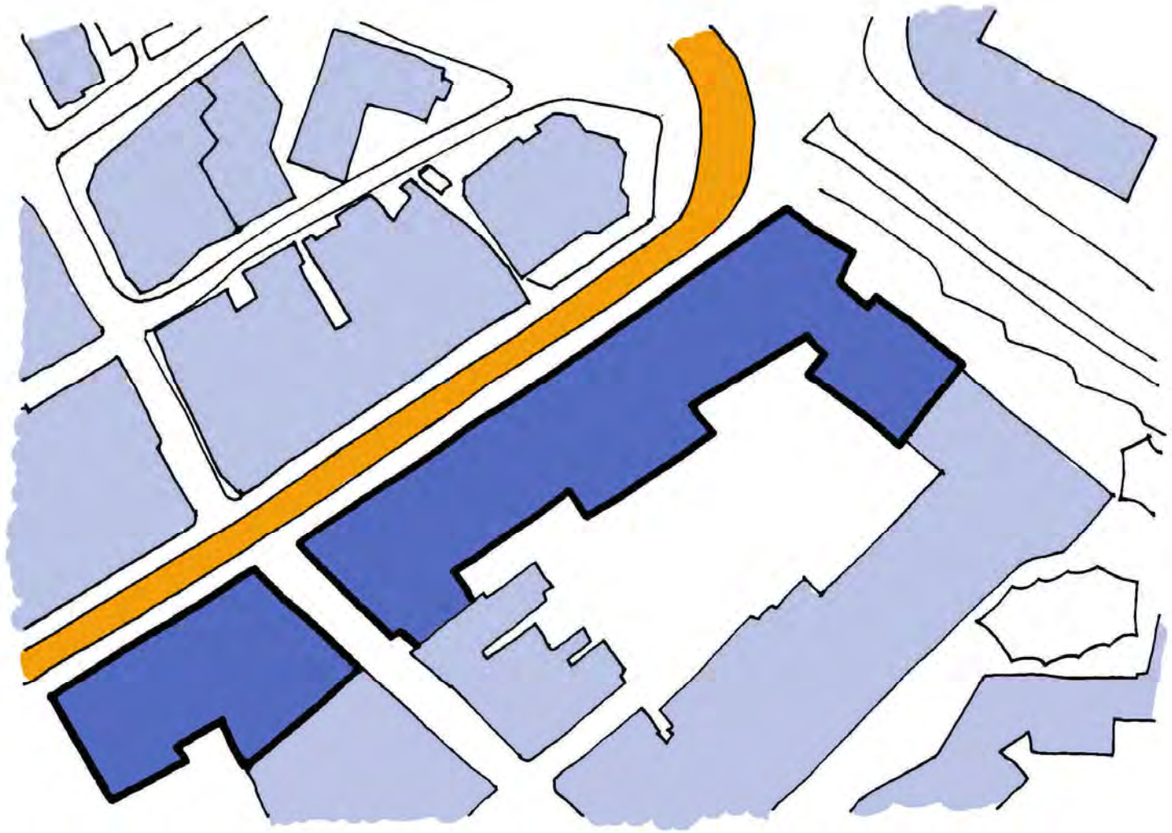
Swindon Canal

Drawing

The Railway Village

Drawn by: DTM	Date: 19/06/07
Checked by:	Date:
Approved by:	Date:
Drawing No. TH/SBPF/145/030	Revision
Drawing Scale: NA	

Drawing Typeface & Name
Xreferences file path
Plotted Date



Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

Halcrow Group Limited
Burderop Park Swindon Wiltshire SN4 0QD
Tel +44 (0)1793 812479 Fax +44 (0)1793 812089
www.halcrow.com

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Project

Swindon Canal

Drawing

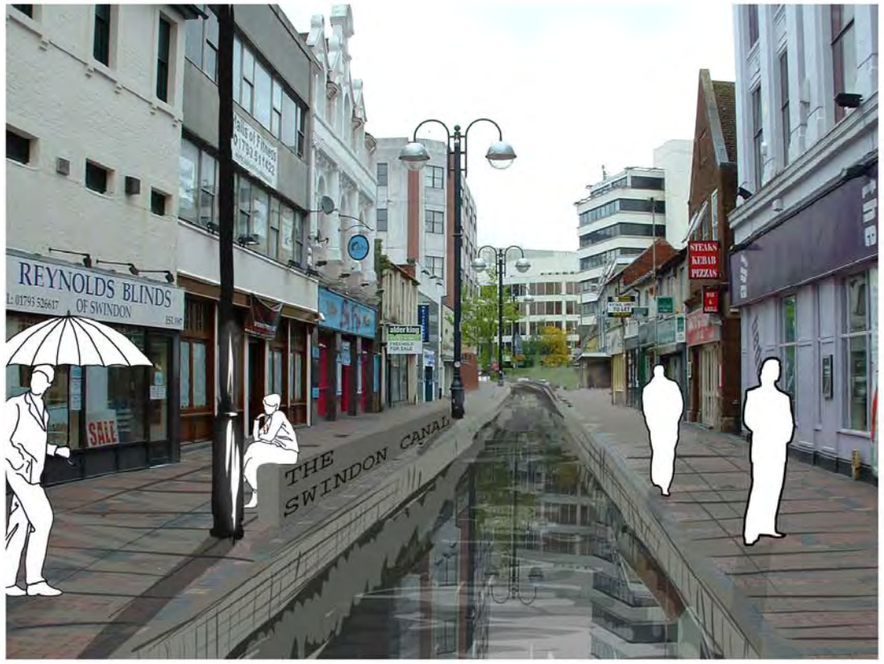
Fleet Street Redevelopment Opportunity

Drawn by: DTM	Date: 20/06/07
Checked by:	Date:
Approved by:	Date:

Drawing No. TH/SBPF/145/031

Revision

Drawing Scale: NA



Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

Halcrow Group Limited
Burderop Park Swindon Wiltshire SN4 0QD
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Halcrow

Project

Swindon Canal

Drawing

Fleet Street

Drawn by: DTM	Date: 15/06/07
Checked by:	Date:
Approved by:	Date:

Drawing No. TH/SBPF/145/032

Revision

Drawing Scale: NA

Drawing has been A-Name Defined as per Client User and Print Date

Key Plan:

Notes:

Rev	By	Chkd	Apprvd	Date	Description

Client

Swindon

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Halcrow

Project

Swindon Canal

Drawing

Images

Drawn by: DTM Date: 20/06/07

Checked by: Date:

Approved by: Date:

Drawing No. TH/SBPF/145/033 Revision

Drawing Scale: NA

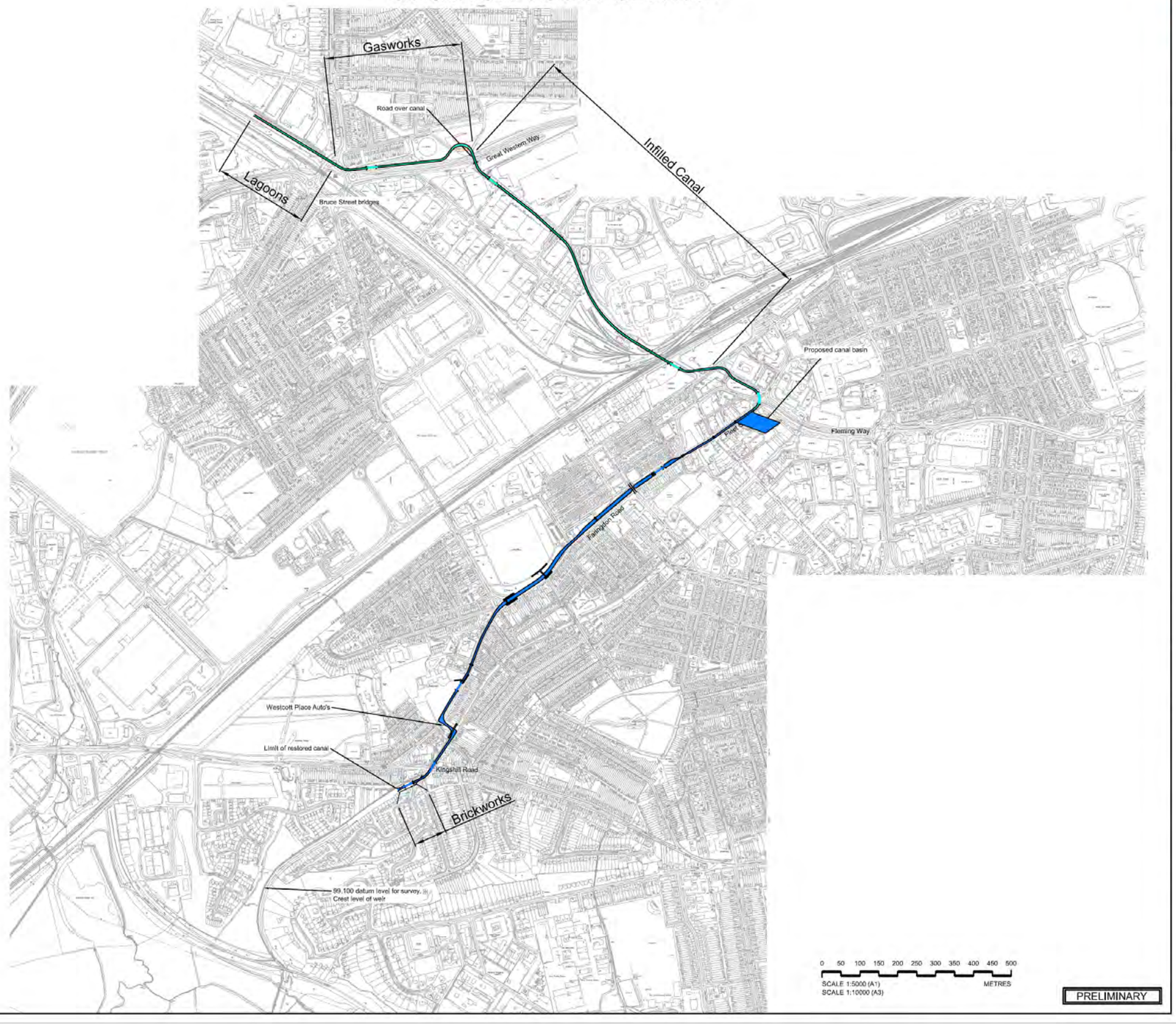
Drawing file path & name
Reference for path
Users and Files

16.9 Appendix I - Potential Contamination Areas

The following drawing is included in this appendix;

- TH-SBPF-145-016A – Potential Contamination Areas

SWINDON TOWN CENTRE



Key:

- Proposed Central Canal route
- Future North Wilts Canal connection

Notes:

Rev	By	Chkd	Apprvd	Date	Description
A	IR	FJH	-	11/07	Text shifted to 0.2m

Client: Swindon Borough Council

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Project: SWINDON CANAL

Drawing: POTENTIAL CONTAMINATION LOCATIONS

Drawn by: NR	Date: 21.06.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No.: TH-SBPF-145-016	Revision: A

Drawing Scale: at A1 - 1:5000

16.10 Appendix J - Cost Breakdown

	SWINDON CENTRAL CANAL				
	ESTIMATE OF COST				
This cost estimate is based upon initial outline route drawings as included in the other Apeendices of this report					
SCCCP2					
	Unit	Quantity	Unit Cost	Sum	Total
			£k	£k	£k
Site Clearance	ha	4	11.25	45.00	45.00
Canal Pounds and Basin					
Pound 1 - Existing canal to Lock 1	m	10	8.00	80.00	
Pound 2 - Lock 1 to Kingshill Culvert	m	20	8.75	175.00	
Pound 3 - Kingshill Culvert to Lock 2	m	200	7.25	1450.00	
Pound 4 - Lock 2 to footbridge at CH 620	m	244	6.00	1464.00	
Pound 5 - CH 620 to CH 820	m	200	5.50	1100.00	
Pound 6 - CH 820 to Lock 3	m	300	8.80	2640.00	
Pound 7 - Lock 3 to Fleming Way Culvert	m	296	5.25	1554.00	
Basin	sum			1500.00	
Safety exit ladders	sum			50.00	10013.00
Locks					
Lock 1	sum			690.00	
Lock 2	sum			675.00	
Lock 3	sum			685.00	2050.00
Culverts					
Kingshill culvert	sum			1050.00	
Fleming Way culvert	sum			625.00	1675.00
Footbridges					
Footbridge at chainage 220	nr	1	180.00	180.00	
Footbridge at chainage 420	nr	1	140.00	140.00	
Footbridge at chainage 615	nr	1	160.00	160.00	
Footbridge at chainage 740	nr	1	160.00	160.00	
Footbridge at chainage 840	nr	1	160.00	160.00	
Footbridge at chainage 1320	nr	1	160.00	160.00	
Footbridge at chainage 1390	nr	1	160.00	160.00	1120.00
Road Bridges					
Farnsby Street bridge	nr	1	600.00	600.00	
Holbrook Way bridge	nr	1	650.00	650.00	1250.00
Roads and paving					
New service roads, footpaths and paving to sides of canal	sum			3500.00	
Removing existing illuminated bollards and street furniture	sum			100.00	
New signage to existing roads	sum			50.00	
Modifying lighting along length of canal	sum			400.00	
Removing and modifying traffic lights and pedestrian crossings	sum			100.00	4150.00
			Carried Forward		£20,303.00

			Brought Forward		£20,303.00	
Pumps and Pipework						
Convert existing toilets into back-pumping						
station	sum			150.00		
Construct inlet chamber	sum			30.00		
Install pumps to pipe serving Pound 1	sum			120.00		
Install pumps to pipe serving Pound 7	sum			120.00		
Pipework from pumping station to Pound 1	sum			500.00		
Pipework from pumping station to Pound 7	sum			250.00		
Gravity overflow from lowest pound to River						
Ray	sum			400.00	1570.00	
Service and Sewer Diversions						
New foul drains	sum			4000.00		
New surface water drains	sum			2750.00		
Alterations to existing road drainage	sum			400.00		
Water main diversions	sum			2250.00		
Gas main diversions	sum			2000.00		
Electric main diversions	sum			1800.00		
BT cable diversions	sum			1300.00		
Fibrenet cable diversions	sum			600.00	15100.00	
Site set up / Miscellaneous items	%	20			£7,394.60	
Total Measured Cost (£k)					£44,367.60	
Indirect Costs						
Supervision, admin & management	%	5		£2,218.38		
Design				£1,307.50	3525.88	
Total Construction Out-turn Cost (£k)					**£47,893.48**	
Sheet piling to canal pounds has been installed using silent piling methods						
Costs are as at today rates with no allowance for increased costs						
No land purchase costs etc are included						
George Brownlee & Partners						
Chartered Quantity Surveyors						
17th July 2007						

16.11 Appendix K – Risk Register

RISK REGISTER (risk pot using MonteCarlo analysis)

Swindon Central Canal Risk Register

Draft Risk Register - Rev 3 dated 20th July 2007

D= Avoid, A = Accept, R = Reduce, T = Transfer

Serial No.	Item	Description	Initial Probability VH/H/M/L	Initial Consequence VH/H/M/L	Effect of Occurrence Cost/Time/ Quality/ Environment	DART Classification	Method of Control (Refer to Generic Risk Guidance)	Risk Owner	Risk Managed/Action by	Compensation Event (Y/N)	Residual Probability VH/H/M/L	Residual Consequence VH/H/M/L	Rating - Red, Amber, Green	Anticipated End date	@Risk Pert COST ANALYSIS						@Risk Pert TIME ANALYSIS			
															Min (£k)	Most Likely (£k)	Max (£k)	Cost (£k)	Cost (£k) 50% tile	Cost (£k) 95% tile	Min (Wks)	Most Likely (Wks)	Max (Wks)	Time (wks)
	Financial Risks																							
1	**Insufficient funding secured**	Project needs to be scaled down, lack of buy in from community	H	H	Cost	D	Devise fund raising strategies and appoint fund raising manager to oversee process	Client	Client	N	M	H			0	50	100	50.00	1.93	2.32	0	0	8	1.3
2	**Excavated material found to be contaminated**	Additional disposal costs	M	H	Cost / time	R	Site investigation to pinpoint any problems or hot spots	Client	Client	Y	M	M			0	150	750	225.00	1.93	2.32	0	2	6	2.3
3	**Cost increases / inflation**	Project needs to be scaled down to meet funding available	H	H	Cost	R	Use of engineering QS and estimator familiar with canal schemes	Client	Consultant	N	M	M			0	500	1000	500.00	1.93	2.32	0	2	6	2.3
4	**Operating and maintenance costs higher than envisaged**	Insufficient maintenance results in deterioration of canal	M	M	Cost / Quality	R	BW buy in to scheme to obtain experience of operation of canals. Maintenance free design as far as possible.	Client	Consultant	N	L	L			0	10	50	15.00	1.93	2.32	0	2	6	2.3
5	**Compensation to affected businesses during construction**	Loss of business during construction / longer term	H	H	Cost	R	Early engagement, plan construction to minimise disruption to business owners as far as possible. Losses need to be proven based on last 3 years results.	Client	Client	N	M	H			0	400	800	400.00	1.93	2.32	0	2	6	2.3
6	**Inaccurate cost estimates**	In accurate estimation of construction costs render scheme unviable in future	VH	H	Cost	R	Use of independant QS to undertake costings, benchmark against other similar schemes	Client	Consultant	N	M	H			0	200	750	258.33	1.93	2.32	0	2	6	2.3
7	**Additional bridges required**	More footbridges needed in Railway Village and Flint Street Areas	H	H	Cost / Quality	R	Identify needs early in project and allow for additional landmark bridges	Client / Consultant	Consultant	N	M	M			0	250	1000	333.33	1.93	2.32	0	2	6	2.3
8	**Unknown details of service diversions**	Service plans obtained but diversion costs may be greater than estimated. Cost of BT services assumed as no info to date.	VH	VH	Cost / Time	R	Identify major diversions early and benchmark against similar diversions for similar size services. Get service providers on board early in detailed design process.	Client / Consultant	Consultant	N	M	H			0	300	1000	366.67	1.93	2.32	0	2	6	2.3
	Management / Programme Risks																							
9	**Programme**	Failure to monitor and update programme and complete works as scheduled.	M	H	Cost/ Time/ Environment	R	Target dates have been developed for key activities. Early preparation and continuing monitoring of detailed project plan showing activities and timescales (including inter-dependencies). Ensure all parties are aware of the programme and time constraints.	Client/Consultant /Contractor	Consultant	Y	L	M			0	50	100	50.00	1.37	1.65	0	2	4	2.0
10	**Delays due to slow decisions**	Delays due to lack of agreement within members of project stakeholders	M	M	Cost / time / quality	R	Identify decision making process and key decision dates early in programme. Stick to decision making process, ensure decisions are made for the greater good of the scheme not to satisfy any one single party.	Client	Client	N	L	L			0	20	60	23.33	1.93	2.32	0	2	8	2.7
11	**Large number of consultees**	Delay due to inability to satisfy all consultees	M	M	Cost / time	R	Identify key roles at various points in the programme and ensure person in place at these times. Employ full time staff during peak workload periods	Client	Client	N	L	L			0	20	50	21.67	1.93	2.32	0	2	8	2.7
	Market / 3rd Party Risks																							
12	**Landowners / Residents**	Impact of construction and use on owners and occupiers. Failure to communicate terms and conditions of entry to landowners prior to commencement	M	M	Cost/ Time	R	Assess costs. Construction to be carried out during normal working hours. Ensure timely acquisition of land. Contractor to assess access to site and to plan movement of plant and materials accordingly. Agree working around roads with local Highways Author	Client/Consultant /Contractor	Client	Y	L	M			0	50	100	50.00	2.34	2.80	0	3	6	3.0
13	**Compulsory Purchase of Properties along route**	Failure to purchase property to allow canal to be built	M	H	Cost/ Time	R	Agreement in principle put into place with SBC and legal department	Client	Client	N	L	H			0	500	1000	500.00	2.34	2.80	0	1	4	1.3
14	**Approvals**	Third Party Approvals or Actions.	M	M	Cost/time	R	Allow sufficient time for consultations. Communication Plan and Action List in place. Make written file note of all consultations. Confirm understanding of significant consultations in writing. Inform third parties of named points of contact.	Client / Consultant	Consultant	Y	L	M			0	10	40	13.33	0.50	0.60	0	1	4	1.3
		Objections due to potential World Heritage site application for railway Village	M	M	Cost/time	D	Allow sufficient time for consultations. Communication Plan and Action List in place. Make written file note of all consultations. Confirm understanding of significant consultations in writing. Inform third parties of named points of contact.	Client / Consultant	Consultant	Y	L	M			0	20	50	21.67	0.50	0.60	0	1	4	1.3
15	**Public buy in**	Failure to engage the public, rejection of scheme	H	H	Cost / time	R	Public consultation, meetings, workshops etc	Client / Consultant	Consultant	Y	M	M			0	5	10	5.00	1.93	2.32	0	1	4	1.3
16	**Land drainage consents**	Approvals withheld.	M	H	Cost / time	R	Timely identification of approvals required. Due allowance for processing periods included in programme.	Client / Consultant	Consultant	N	L	M			0	5	10	5.00	0.55	0.64	0	0	4	0.7
17	**Planning permissions**	Approvals withheld. Restrictions may add costs or increase programme. Changes to planning policy	M	H	Cost / time	R	Engage with planning department prior to submission of detailed application	Client / Consultant	Consultant	Y	L	M			0	5	50	11.67	1.93	2.32	0	0	12	2.0
18	**Flood Risk Assessment**	Approvals withheld by Environment Agency.	H	H	Cost/time	R	Early agreement with the Environment Agency. Both pumped and gravity waste systems identified but need further development as part of flood risk assessment.	Client / Consultant	Consultant	N	M	M			0	5	15	5.83	1.93	2.32	0	0	12	2.0
19	**Tie in with adjacent regeneration developments**	Failure to allow for canal in current developments / loss of opportunity	H	H	Cost	R	Early agreement and tie in with development timings	Client	Consultant	N	M	H			0	50	200	66.67	1.93	2.32	0	1	5	1.5
20	**Need to construct in small sections to minimise disruption**	Results in inefficient working and additional costs	M	M	Cost / Time	R	Liaison with businesses to reach sensible compromise to balance output against disruption	Client / Contractor	Client / Consultant / Contractor	Y	L	M			0	50	500	116.67	1.93	2.32	0	1	5	1.5
21	**Change in political climate**	Loss of support for the canal	M	H	Cost / time / quality	R	Sell the benefits of the canal to all parties to ensure long term buy in and commitment to canal from all	Client / Consultant	Client	Y	M	M			0	0	0		1.93	2.32	0	0	12	2.0
22	**Communications**	Poor communication or interpretation, resulting in inadequate information, misunderstanding, delays or objections to the project	M	H	Cost/ Time/ Quality/ Environment	D	Adequate consultation, frequent reviews, effectively documented and communicated, ensure full understanding of issues.	Client/Consultant /Contractor	Consultant	N	L	M			0	5	20	8.67	0.40	0.48	0	0	1	0.2
	Technical Risks																							
23	**Unforeseen Services**	Hitting buried or overhead services during construction.	M	H	Cost/time	R	Consult all utility service providers and relevant client department. Check position of services in critical areas of construction. Early diversions to move services out of the way.	Client/Consultant /Contractor	Consultant	Y	M	M			0	100	350	125.00	1.93	2.32	0	4	8	4.0
24	**Fitting in appropriate road access to properties and car parks**	Risk that new access required, objections from residents or additional compensation payments.	H	H	Cost / Time	R	Early engagement of residents, appointment of a dedicated liaison officer/s to deal with the public in relation to the canal and impacts	Client / Consultant	Client	N	M	H			0	50	100	50.00	1.93	2.32	0	2	8	2.7
25	**Transport planning issues**	Scheme needs radical change to transport system which will raise objections	VH	H	Cost / Time	R	High profile media campaign and engagement with public about the benefits of the changes, detailed discussions with local residents.	Client / Consultant	Client	N	H	H			0	100	300	116.67	1.93	2.32	0	4	12	4.7

Swindon Central Canal Risk Register

Draft Risk Register - Rev 3 dated 20th July 2007

D= Avoid, A = Accept, R = Reduce, T = Transfer

Serial No.	Item	Description	Initial Probability V/H/M/L	Initial Consequence V/H/M/L	Effect of Occurrence Cost/Time/ Quality/ Environment	DART Classification	Method of Control (Refer to Generic Risk Guidance)	Risk Owner	Risk Managed/Action by	Compensation Event (Y/N)	Residual Probability V/H/M/L	Residual Consequence V/H/M/L	Rating: Red, Amber, Green	Anticipated End date	@Risk Pert COST ANALYSIS						@Risk Pert TIME ANALYSIS			
															Min (£k)	Most Likely (£k)	Max (£k)	Cost (£k)	Cost (£k) 50% tile	Cost (£k) 95% tile	Min (Wks)	Most Likely (Wks)	Max (Wks)	Time (wks)
26	Unforeseen Ground Conditions	Inability to drive piles or install foundations due to ground conditions or planned piling method.	M	H	Cost/ Time/ Environment	R	Appoint qualified ground specialist. SI to be undertaken along route. Use conservative design parameters to minimise effect of unforeseen conditions. Carry out condition survey of existing structures.	Client/ Consultant	Consultant	Y	L	M			0	100	250	108.33	3.41	4.09	0	1	2	1.0
		Inadequate Site Investigation. Contaminated ground / instability of embankments, cuttings, retaining walls or foundations	M	H	Cost/time	R	Use of known contractor familiar with the area and requirements. Investigation specified by a geotechnical engineer. Allow suitable budget and programme flexibility	Client / Consultant	Consultant	Y	L	M			0	30	100	36.67	2.39	2.95	0	1	2	1.0
27	Physical condition	Adverse weather conditions (eg high intensity rain fall or others) causing poor site conditions.	H	H	Cost/ Time/ Quality/ Environment	R	Appropriate references in contract specifications. Select appropriate construction periods and working sequences to optimise summer good weather windows.	Client/Consultant /Contractor	Consultant	Y	M	M			0	20	100	30.00	2.13	2.56	0	2	6	2.3
		Water supply and quality problems	M	H	Cost / time	R	Construction excavation works are programmed to go ahead during the summer months where ever possible. Check adequacies of temporary works. EA / MET Office weather warning programme.	Client/Consultant /Contractor	Client	Y	M	M			0	20	250	55.00	2.31	2.77	0	1	4	1.3
		Excessive groundwater gathering in excavations	M	M	Cost/ Time/ Quality/ Environment	R	Appoint appropriate ground specialist, assume conservative conditions, contingency planning to obtain discharge conditions	Client/Consultant /Contractor	Consultant	N	L	M			0	10	50	15.00	0.26	0.34	0	1	2	1.0
28	Changes in Scheme	Engineering and design changes	H	H	Cost/ Time/ Quality/ Environment	R	Early warning, appropriate design, assess likely impacts. Feasibility study complete and preferred option identified.	Client / Consultant	Consultant	Y	L	M			0	10	100	23.33	0.79	0.95	0	1	2	1.0
		Variations during site works	M	H	Cost	A	Use of standard designs where appropriate to minimise changes. Assess adequate contingency.	Client/Consultant /Contractor	Consultant	Y	L	M			0	200	500	216.67	0.35	0.42	0	1	2	1.0
		Unable to fit in suitable canal through Wescott Autos	H	H	Cost / Time/ Environment	D	Early detailed design and start of CPO process for adjacent properties. Route not ideal but will work, some difficulties with larger craft	Client/Consultant	Consultant	N	M	M			0	200	500	216.67	0.35	0.42	0	0	1	0.2
		Unable to raise level in Faringdon Park area	H	H	Cost / Time/ Environment	D	Early detailed design	Client/Consultant	Consultant	N	M	H			0	30	150	45.00	0.35	0.42	0	1	2	1.0
	Environmental Risks																							
29	Environmental Impact	Non-compliance with environmental legislation, sustainability policy, strategy or plans (client & External)	M	H	Cost/ Time/ Quality / Environment	D	Timely consideration of environmental requirements and identification in EAP. Use accredited EA consultants.	Client / Consultant	Consultant	N	L	M			0	5	10	5.00	0.86	1.03	0	0	1	0.2
		Unexpected Environmental impacts or sensitivities e.g. new designation	M	M	Cost/ Time/ Quality / Environment	A	Adequate andvance environmental surveys to identify problems.	Client/Consultant	Client	N	L	M			0	5	10	5.00	0.76	0.93	0	0	4	0.7
		Environmental matter stopping the project	M	M	Cost/ Time/ Quality / Environment	R	Reporting procedure. Works designed / planned to minimise such risk - contingency arrangements considered.	Client/Consultant /Contractor	Client	Y	M	L			0	10	50	15.00	0.31	0.37	0	0	1	0.2
		Discovery of buried (unknown) archaeological site	L	M	Cost/Time/Environment	R	Carry out further archaeological investigations before work commences	Client	Consultant	Y	L	M			0	10	50	15.00	0.95	1.14	0	1	4	1.3
30	Long Term Pollution / Environmental Health Risk	Low water quality / public perception of mucky smelly canals / increase in rats	H	H	Cost/ Quality/ Environment	A	Hard banks will be required through town centre will reduce habitat for rats. Recirculation system for maintaining water quality	Client	Consultant	Y	L	L			0	5	10	5.00	0.95	1.14	0	0	0	
31	Environmental Programme	Timing of environmental processes, approvals and work periods not appropriate	M	M	Cost/ Time/ Quality / Environment	D	Adequate advance planning / identification of programme interface and timely preparation of environmental documents and tree works.	Client/Consultant	Consultant	Y	L	M			0	5	15	5.83	0.95	1.14	0	1	4	1.3
32	Lack of Sustainability	Project not considered sustainable, additional measures to improve sustainability	M	M	Environment	R	Carry out and implement Sustainability Assessment/Appraisal, maximise schemes positive impacts on as many of Defra UK Government Strategy Indicators as possible	Client	Client	N	L	M			0	5	20	6.67	0.95	1.14	0	0	0	
	Landscape Risks																							
33	Acceptance of Asset by Client / Trust / British Waterways	Failure to meet demands for long term operation and maintenance of the scheme.	M	M	Cost/ Time	R	Ensure early buy in and develop proposals in conjunction with British Waterways and SBC Parks and landscape	Client/Consultant /Contractor	Consultant	Y	L	M			0	20	50	21.67	1.21	1.45	0	0	2	0.3
34	Inability to deliver exemplar landscape design	Poor perception from public	M	H	Cost / Quality	R	Ensure early buy in and develop proposals in conjunction with SBC and the public to identify requirements, design competition in local schools and colleges. Appoint landscape architect with proven track record	Client	Client	N	M	L			0	50	200	66.67	1.93	2.32	0	0	0	
	Health and Safety Risks																							
35	Health and Safety	Accidents - Trips & Falls, Fall from height (scaffoldings), working close to rivers and public highways, working with potentially contaminated land, see also Designer's Risk Assessment.	M	H	Cost/ Time	R	Health and safety at Work Act 1974. Construction Design and Management Regulations 2007. Team awareness of duties under the above and all other health and safety legislation relevant to the project. Regular health and safety reviews.	Client/Consultant /Contractor	Consultant	N	L	M			0	5	10	5.00	1.05	1.26	0	0	1	0.2
36	Objections from pubs and clubs in Fleet Street regarding risk of drowning	Limited space for wide walkways in this area, risk of drunk / intoxicated persons falling into canal	H	H	Cost / Time	D	Early engagement with local businesses as to opportunities for increased buiness and low health and safety risks	Client	Client / Consultant	N	M	M			0	30	150	45.00	1.93	2.32	0	0	0	
37	Security and Vandalism	Location of site presents possible theft & vandalism of works and equipment during construction.	M	M	Cost/ Time/ Quality/ Environment	R	Site is close to residential areas. Ensure design incorporates measures to minimise acts of vandalism. Ensure appropriate security measures are in place during the Construction period.	Client/Consultant /Contractor	Contractor	N	M	L			0	0	0		0.97	1.16	0	0	0.5	0.1
																		Sum of column	4280.00	29.09	34.91			Sum of cost	68.58
																		50% tile	4274.09					50% tile	68.41
																		95% tile	5092.03					95% tile	79.49

Note: To calculate the residual risk budget, review the risk register and the risk values on a regular basis and re-run the simulation.

16.12 Appendix L – Preliminary Hazard Elimination and Management (HEM) List

Swindon Central Canal
Hazard Elimination and Management List – Outline Feasibility Stage
Revision_0 20th June 2007

Construction				
Activity	***Hazard***	***Persons at Risk***	***Design Measures***	***Information to be Disseminated Regarding Residual Risks***
Movement of plant and labour around built up and constrained site.	Site traffic movements	Site pedestrians	Assess the required plant access to each element of the site. Consider ways of reducing quantities and traffic movements. Space required for travelling, working, manoeuvring, unloading etc to be considered. Phase construction areas. Routing of traffic and pedestrians. Ensure all traffic removed from site prior to works and Westcott Place and Faringdon Road are closed before construction.	Ensure space around canal for working areas and the space provided for access routes.
Interaction with public and residents in urban area.	Site traffic movements	Members of public	Use of letter drops and consultation. Footpath diversions to be clearly designated and sign-posted. Adequate demarcation fencing to be employed. Ensure adequate temporary diversions for residents.	Plan out detailed construction works and access arrangements.
Major service diversions	Service hazards, i.e. electrocution, gas explosion, flooding	Site personnel, members of the public	Ensure adequate consultation with service providers, allow time for diversions and co-ordinate to minimise conflict and excavation open periods. Ensure diversion is fully planned and programmed. Where possible undertake diversion prior to the main canal works to reduce risk of damage to services.	Early involvement of service undertakers, services already identified on plans in report.
Sheet piling close to residential properties.	Vibration, sudden collapse, noise.	Site personnel and public	Assess levels of vibration. Liaise with the public. Monitor operations. Piles lengths minimised by designing canal base as prop, reduces driven length. Alternative concrete walls considered but rejected as requiring open excavation close to residential properties for long periods.	Monitor vibration and working hours, use of silent piling techniques if required.

Contaminated material	Exposure of site operatives	Site personnel	Desk study undertaken which did not highlight any sources of major contamination along the proposed route. Undertake SI and testing if project taken forward.	SI and testing on future stages of the scheme.
Lifting operations	Falling materials i.e. piles, footbridges, culvert units etc.	Site personnel and public	Use of banksman, ensure sufficient space for crane and material stores. Firm foundations for siting crane.	Ensure weights and centres of gravity are shown on drawings and / or materials to be lifted.
Exposure to wet concrete.	Burns, ill health	Site personnel	Use of puddle clay considered in place of concrete bed but is difficult to place correctly and risk of leakage to property basements reduced if concrete bed, concrete also acts as a structural prop to sheet piles, see above.	Use of concrete represents best solution for long term safety of the scheme.
Increased construction traffic.	Road traffic accidents.	Injuries to personnel & Damage to vehicles	Coordinate and plan works, design attempts to minimise materials and waste to reduce construction traffic.	Use of designated routes to site and timings of deliveries to avoid rush hour traffic.
Collapse of excavations	Injuries to site personnel, entrapment.	Site personnel and public	Co-ordinate, permanent works design and the temporary works design to ensure stability. Site Investigation required during detailed design to confirm design of the piles. Monitor ground conditions as construction progresses.	Ensure piles are stable in temporary works situation before concrete bed prop is in place, possible use of temporary props.

Operation and Maintenance				
Cleaning canal	Fall from height / Drowning	Maintenance operatives	Use of designated access points and safe methods of working. Concrete bed of canal reduced risk of snagging and allows debris to be dragged with boat hooks and rakes.	Ensure correct equipment and training when cleaning canal.
Maintenance of locks	Fall from height / Drowning	Maintenance operatives	Simple design using tried and tested systems and layout to minimise maintenance requirements.	Ensure correct equipment and training when maintaining lock structure. No lone working,
High water levels / working / living near a watercourse	Drowning. Leptospirosis and other water borne diseases.	Maintenance operatives, general public falling in	Hand railing and bollards provided in key areas where public may congregate i.e. opposite pub doorways etc. Main runs of canal to be unfenced as traditional canals in other town centres are.	Design ensures vehicles are protected from falling into the canal or being dumped.
Maintenance of pumping station	Falling from height / water	Maintenance operatives	Electrical maintenance carried out by equipment supplier or use of electrician. No exposed electrical equipment can be accessed by unauthorised operatives. All works designed in accordance with current IEE regulations.	Warning signs erected. Instructions provided for authorised operatives.
Falling from drops and bridges	Lone working, delays for emergency services	General public	Fence large drops from footpath into canal i.e. immediately area of existing canal reopened at Kingshill and where bridges rise up above the canal.	All bridge parapets to be in accordance with requirements in public open spaces.
Water quality	Public health	Maintenance operative / general public	Pumped recirculation system to be included to ensure water is kept sweet. Investigate use of automatic water quality monitoring equipment. Hard banks avoid risk of rats etc	Monitor canal for pollution incidents.
Additional traffic hazard in other areas following closure of roads	Accidents and deaths	General public	Ensure future traffic scenarios are modelled and road system upgrades are implemented prior to road closures for canal construction.	Additional works required outside the immediate area of the canal.

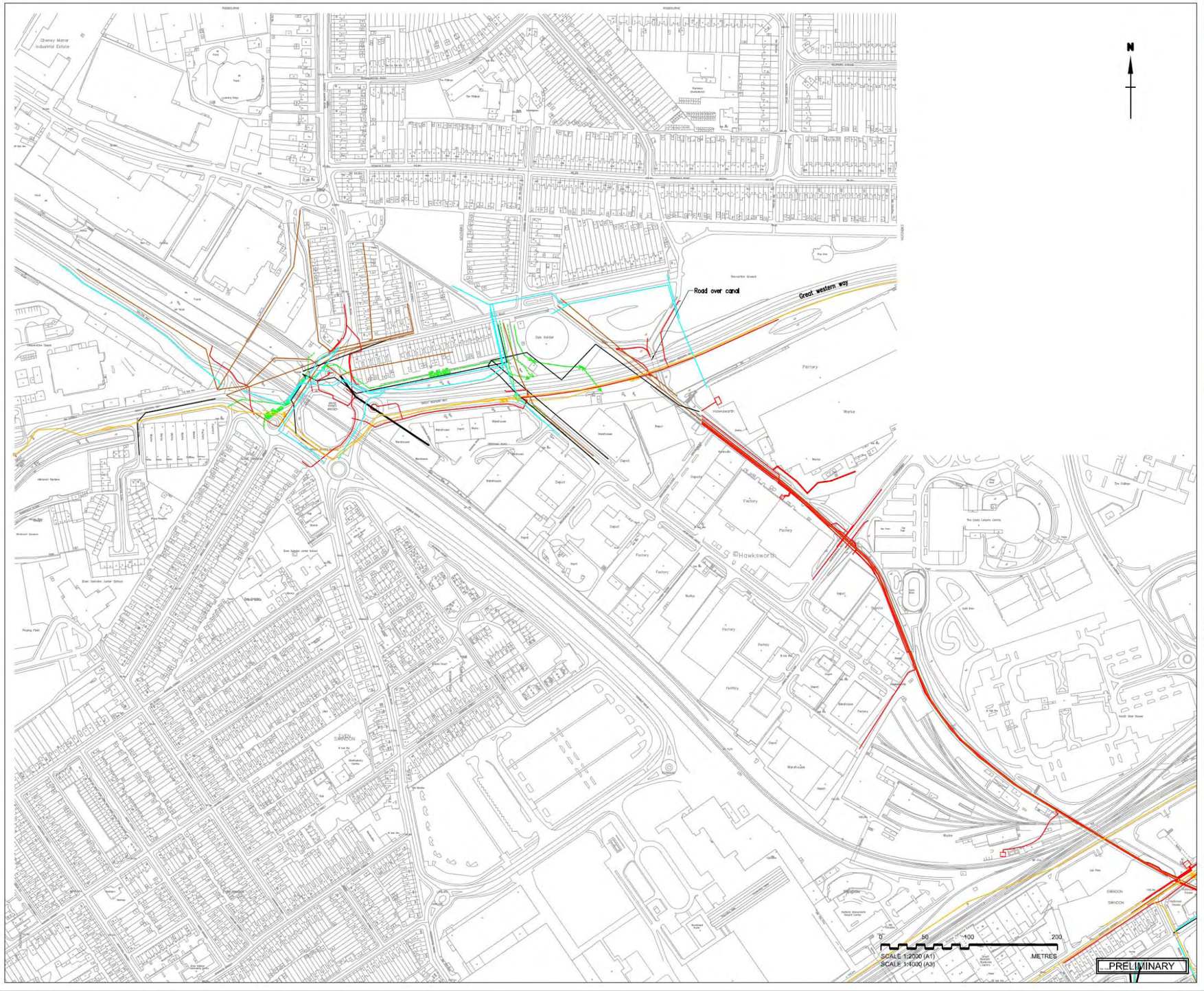
Confined spaces and underpasses	Asphyxiations / muggings	Boat users / general public	Culvert sized to be large enough not to be classified as confined space, short distances with large openings will provide suitable ventilation.	Footpaths routed around culverts rather than following canal to avoid potential mugging areas.

Demolition				
Removal of the canal and structures.	Working within canal, demolition operations.	Drowning, wall collapse	No hazardous materials specified in works, no pre or post tensioned elements in the works. No specific demolition sequences are required.	Ensure H&S File available when undertaking demolition works to all or part of the site.

16.13 Appendix M - North Wilts Arm Plans and Long Section

The following drawings are included in this appendix;

- TH-SBPF-145-013A – North Wilts Canal Connection Statutory Services Details Sheet 1 of 1
- TH-SBPF-145-014B – North Wilts Canal Connection, Plan and Long Section
- TH-SBPF-145-015B – North Wilts Canal Connection, Bruce Street Bridges Plan and Long Section



Notes:

IMPORTANT WARNING

The information concerning the location of the public utility apparatus is furnished as a general guide only, and no warranty as to their correctness is given or implied . These drawings should not be relied upon in the event of excavations or other works made near to the apparatus , which may exist at various depths and may deviate from the marked route.

It should be noted that a line shown on the plan may indicate the presence of more than one cable.

KEY

- Cable and Wireless
- Colt Telecommunications
- Fibernet Cables
- SSE Power Distribution
- Thames Water abandoned pipe
- Thames Water Mains
- Thames Water Private combined sewer
- Thames Water public foul sewer
- Thames Water public surface water drain
- Wales And West Utilities Gas Intermediate Pressure
- Wales And West Utilities Gas Low Pressure
- Wales And West Utilities Gas Medium Pressure

Rev	By	Chkd	Apprvd	Date	Description
A	**	PJM	*	25.05.07	Amended to feasibility study

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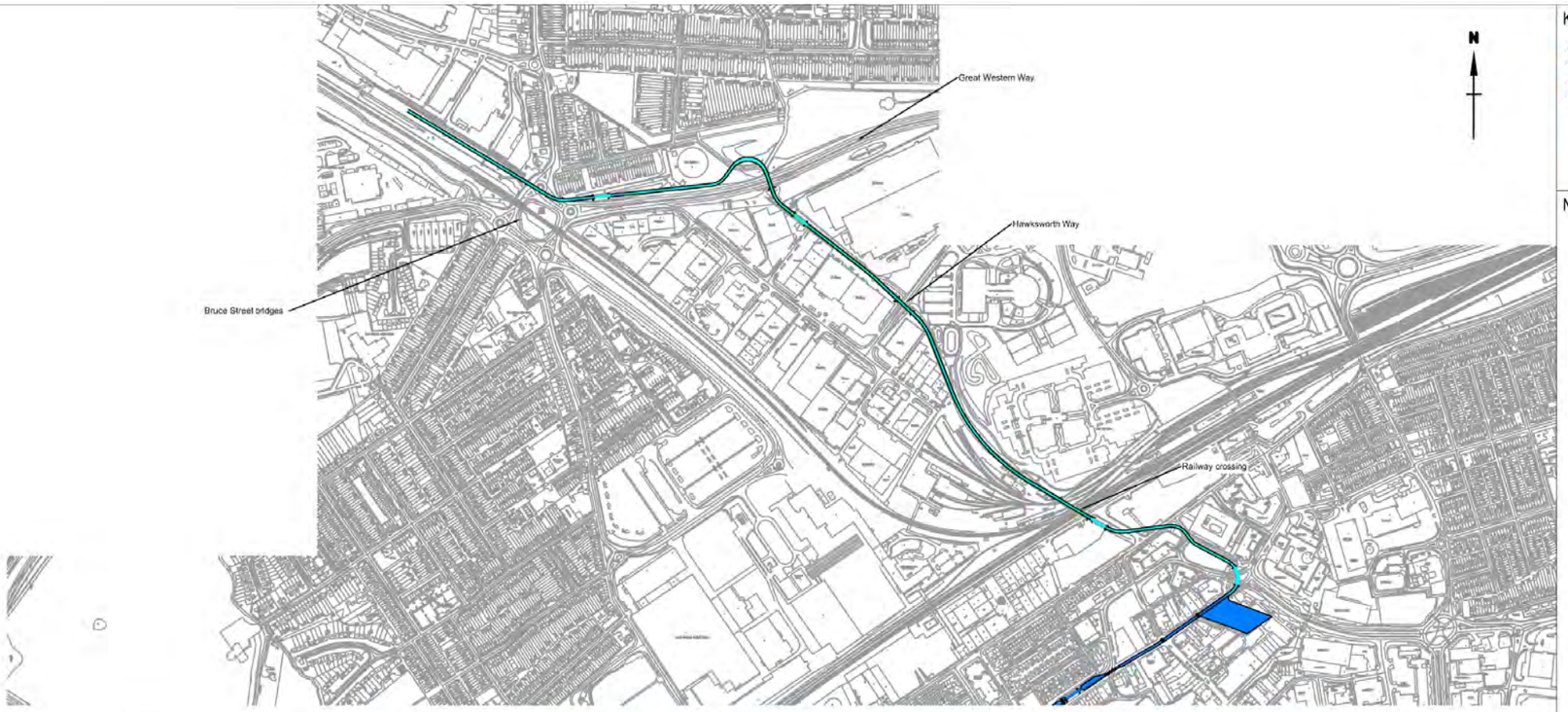
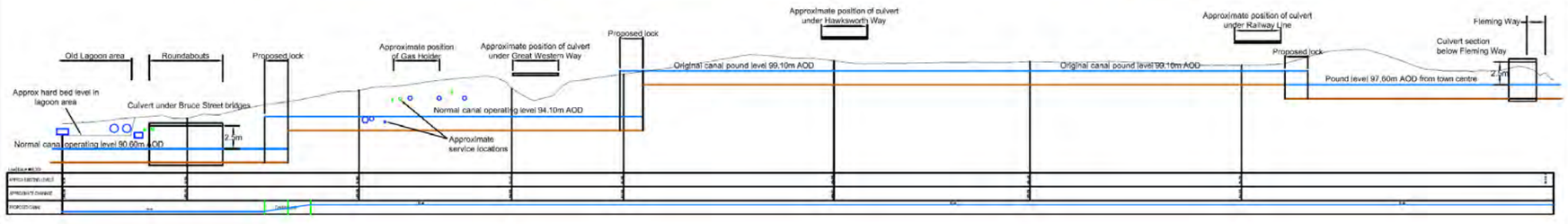
Project: SWINDON CANAL

Drawing: NORTH WILTS CANAL CONNECTION STATUTORY SERVICE DETAILS SHEET 1 OF 1

Drawn by: NR	Date: 16.04.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No.: TH-SBPF-145-013	Revision: A

Drawing Scale: at A1 - 1:2000





PRELIMINARY

Key :

- Proposed Central Canal route
- Future North Wilts Canal connection
- Water services
- Gas services

Notes:

Rev	By	Chkd	Apprvd	Date	Description
B	IP	KM	-	13/07	Issued for Information
A	IP	KM	-	11/07	Issued for Information

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Project

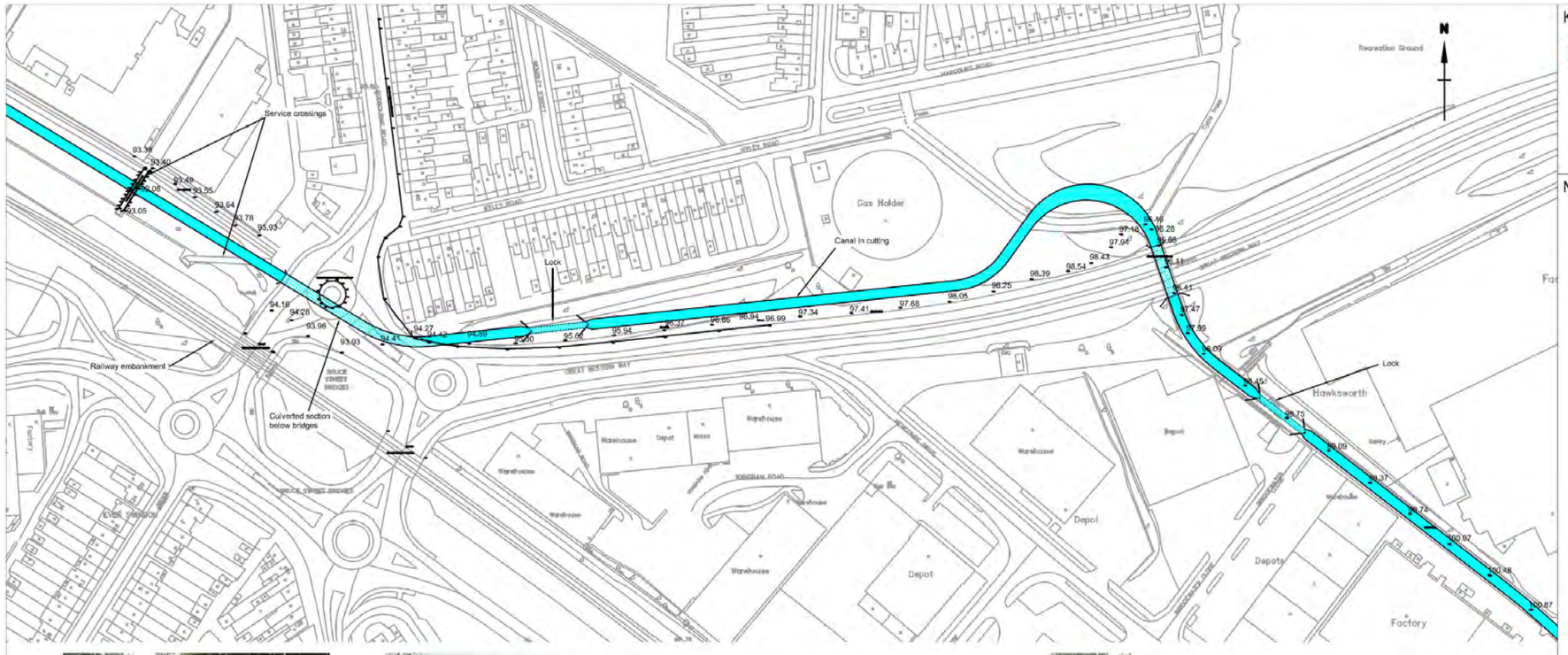
SWINDON CANAL

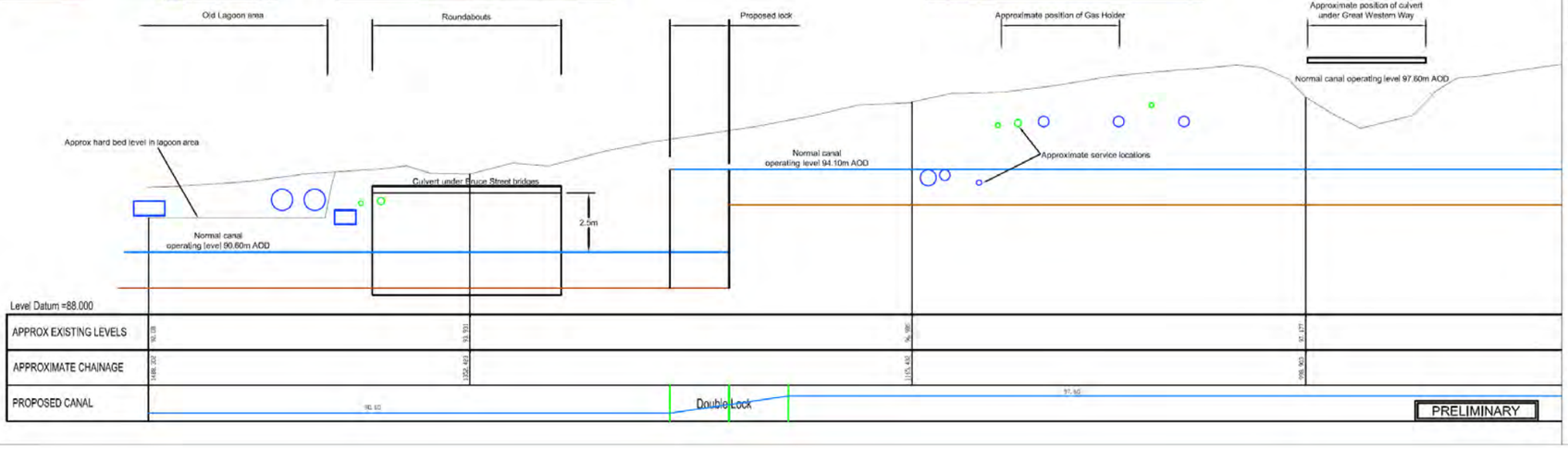
Drawing

NORTH WILTS CANAL CONNECTION PLAN AND LONG SECTION

Drawn by: NR	Date: 06.06.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No. TH-SBPF-145-014	Revision B

Drawing Scale: at A1 - 1:2500





Key :

- Future North Wilts Canal connection
- Water services
- Gas services

Notes:

Rev	By	Chkd	Apprvd	Date	Description
B	IP	RM	-	10/07	Job title added to Cl
A	IP	RM	-	7/07	Example for feedback

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Project: SWINDON CANAL

Drawing: NORTH WILTS CANAL CONNECTION BRUCE STREET BRIDGES PLAN AND LONG SECTION

Drawn by: NR	Date: 08.06.07
Checked by: -	Date: -
Approved by: -	Date: -
Drawing No: TH-SBPF-145-015	Revision: B

Drawing Scale: at A1 - 1:2500