THE DEPARTMENT OF THE ENVIRONMENT

THE WATERWAYS
OF THE
BRITISH WATERWAYS BOARD

A STUDY OF
OPERATING AND MAINTENANCE COSTS

VOLUME 2

DECEMBER 1975

PETER FRAENKEL & PARTNERS
PLANNING & DESIGN CONSULTANTS
LONDON & GLASGOW

VOLUME TWO

CONTENTS

GENERAL DESCRIPTIONS

PROFILES

1a River Lee Navigation

Category: Commercial 49.5 km
Map: Plate 1 Profile: Figure 1

1. From the head of navigation at Town Mill, Hertford, the navigation gradually falls to Bow Locks in East London, from which point there are two separate routes to the Thames. One is via the artificial Limehouse Cut to the Limehouse Basin of the Regents Canal (2a); the other is via the tidal lower reaches of the River Lee, more commonly known as Bow Creek. On this latter route, the Board's jurisdiction includes several creeks, known as the Bow Back Rivers, but on the main river it does not extend below Barking Road Bridge. En route from Hertford, the navigation is joined by the River Stort Navigation (1b) and the Hertford Union Canal (2b), which provides another link to the Regent's Canal. Part of the navigation is artificial cut and part natural river, and these are supplemented by various flood relief channels which are the responsibility of the Thames Water Authority.

2. Development of the river dates back to the 15th Century or earlier. The original lock at Waltham Abbey (circa 1574) is reputed to have been the first lock in this country to be fitted with mitre gates. The Lee Conservancy Board was formed in 1869 and its navigation responsibilities were transferred to the British Transport Commission in 1948. Water pollution and drainage aspects of the canal are now the responsibility of the Thames Water Authority. A further body, the Lee Valley Regional Park Authority, has been set up to develop the recreational aspects of the navigation and the reservoirs in the valley.

3. Below Enfield, the locks are of minimum size of 28.8 m by 5.6 m with 2.2 m over the sill. Above this point, the width of the locks is reduced to 4.9 m and the available depth over the sill to 1.8 m. Slightly larger craft can use the length below Old Ford Locks, but there are further restrictions in the Back Rivers. Headroom is only 2.3 m as far as Enfield, with a slight reduction beyond this point.

4. There is a total of nineteen locks on the navigation. Below Enfield the locks are generally duplicated and mechanised, except for Picketts Lock which is still single and manually operated. Ware Lock is operated and maintained by the Thames Water Authority, (Lee Division), who have an intake on the pound above the lock.

5. The Board is responsible for forty one of the total of over 100 bridges across the navigation, but only five are public road bridges. Some of the accommodation bridges are in need of replacement or extensive repair.

6. Water supply is derived entirely from the natural catchment of the River Lee and its tributaries. It is more than sufficient for navigational purposes and there are considerable abstractions for domestic and industrial usage. The major intake for the former purpose is in the pound above Ware Lock, where water is passed up to the New River and eventually to the reservoirs adjacent to the navigation. Most of the industrial users are situated on the lower reaches of the navigation and include several large power stations, which abstract and return cooling water. Many factories adjacent to the navigation also use water for their fire sprinkler systems. At times of heavy rainfall there is a considerable excess of flood water and there are a number of flood weirs which can be operated to control water levels. The Thames Water Authority, in conjunction with the Board, are engaged in a programme of improvement to further reduce the danger of flooding. Works include new flood channels and weirs and the widening of the navigation near Ware.

7. The Section Inspector controlling maintenance of the navigation is based at the yard at Enfield Lock. The Section is equipped with three hydraulic dredgers, one crane dredger and eleven hoppers. Dredging is hampered by a lack of tips, and the resulting long haul leads to increased costs and a shortfall in tonneages dredged.

8. Normally, the Board only accept responsibility for maintenance of the towpath bank. Most of the protection installed has been steel piling of one kind or another and the general state of the banks is good. Where the L.V.R.P.A. undertake improvements to the channel they provide and maintain the protection.

9. Commercial traffic is now confined to the length of navigation below Enfield, the main flow being to the Board's depot at Grimsdown. Cargoes include raw materials like copper plus some general freight. Most traffic now gains access to the navigation via Bow Creek.

10. Despite the fact that the navigation does not run, for the greater part, through rural surroundings, it is easily accessible for recreational pursuits. Most of the activity is concentrated between Old Ford Locks and the confluence of the River Stort. A marina at Clapton and several boatyards cater for pleasure craft, and rowing boats can be hired at various locations. The number of pleasure craft on the navigation is such that the Section has a motor patrol boat, which is manned by uniformed staff, and used to supervise traffic and check licences. Angling, mainly for coarse fish, is also concentrated on this stretch which has been restocked in recent years. The L.V.R.P.A. has undertaken considerable development of leisure facilities in recent years. These facilities include a Sports Centre, information centres, car parks, etc. and the development of adjacent gravel pits and reservoirs.

11. Maintenance work on the navigation is somewhat complicated by the separate activities of the Board, the Thames Water Authority and the L.V.R.P.A. Briefly the situation can be summarised as follows: The Board is generally responsible for navigation works and also water sales to industry; the T.W.A. is responsible for flood channels and domestic water supplies; the L.V.R.P.A. is responsible for amenity developments adjacent to the navigation. There are however exceptions to this rule and areas where responsibilities overlap. Thus, for example, although the Board provide towpath side bank protection, some bank protection is undertaken by the L.V.R.P.A. as part of its developments and the T.W.A. also provides and maintains bank protection, where it widens the channel as part of its flood prevention scheme.

1b River Stort Navigation

Category: Cruising 22 km
Map: Plate 1 Profile: Figure 1

1. From Bishops Stortford the navigation falls through fifteen locks to a confluence with the River Lee Navigation (1a) near Feilde's Weir, some 22 km from the head of navigation.

2. Parts of the river have been navigable for over two hundred years. Various companies and private individuals owned it until it was sold to the Lee Conservancy Board for a nominal sum in 1911.

3. The locks take vessels of the same length as the River Lee, but the beam is restricted to 4.0 m and there is a minimum of 1.0 m over the sill. All the locks are manually operated.

4. The Board are responsible for forty one of the fifty four bridges across the navigation. None of the Board's bridges carry public highways and some are only minor footbridges. A bridge at Roydon restricts headroom to 2.1 m.

5. Water supply is from the natural catchment of the river and there are no major abstractions. The Thames Valley Water Authority are responsible for the flood channels and make a contribution to the cost of operating flood weirs. Old mills exist at many of the locks and in some cases the mill rights remain with the owners. These owners have a duty to maintain the water at a statutory level and to help with the passage of flood water.

6. The navigation comes under the River Lee Section of the London Area. Dredging is generally adequate to deal with shallow spots, but the high density of locks increases the cost considerably. Bank erosion is not, in general, serious, but there are several locations where piling will be required in the near future.

7. Commercial traffic ceased in 1949, but many pleasure craft use the waterway. Except for the final stretch through Bishops Stortford, the navigation flows through extremely pleasant countryside and is yet within 50 km of London. This stretch would seem to offer scope for improvement and amenity development.

2 - 6 Grand Union Canal

Introduction

Although its constituent waterways were (with one exception) more than one hundred years old at the time, the Grand Union Canal did not come into being until 1929, so that it was the youngest waterway undertaking taken over by the British Transport Commission on nationalisation in 1948. It was formed by an amalgamation of the Regents Canal, the Grand Junction Canal, and three other companies linking the latter to Birmingham.

The Grand Junction Canal, formed in 1793, had taken over in 1894 the two canals connecting it with the River Soar at Leicester, and in 1932 the Grand Union Canal extended its interest beyond Leicester by absorbing the Leicester and Loughborough Navigations (canalisations of the Soar, to the River Trent), and the Erewash Canal from the Trent northwards.

The Leicester section from Market Harborough to Leicester and the Trent is described under 27a and 27b in this series; the other sections of the Grand Union Canal, from London to Birmingham and Norton Junction to Foxton, with a number of branch canals, are covered by 2, 3, 4, 5 and 6 herein. Each is described in detail under the respective reference numbers, but the sequence of construction and connections is first reviewed here by way of introduction.

The Grand Junction Canal was authorised in 1793 as a wide gauge waterway from the Oxford Canal at Braunston to the Thames at Brentford, thus affording a more direct route between the Midlands and London than that given by the narrow canal to Oxford and the uncertain facilities then available on the upper Thames. It was mainly an artificial canal but incorporated sections of canalised river on the Gade and Colne between Berkhamsted and Uxbridge, and on the Brent below Hanwell. It was opened for traffic throughout in 1805 with the completion of the long Blisworth tunnel, a railway having been used to by-pass the tunnel workings for a few years previously. Branch canals were constructed from time to time to link the Main Line with Paddington, Slough, Wendover (not now navigable), Aylesbury, Newport Pagnall (long since closed), Buckingham (closed) and Northampton; those to Aylesbury and Northampton included a number of locks, all of narrow gauge. The Paddington Branch was constructed in 1801 from the Main Line at Southall and continued all on one level to a large basin adjoining the site of the present Paddington Station.

The Regents Canal was authorised as a separate undertaking in 1812 and extended from what is now called Little Venice, on the Grand Junction Canal, to the River Thames at Limehouse. At Limehouse a basin was provided to accommodate shipping from the river and this was subsequently enlarged, with successive additional larger lock entrances, to become Regents Canal Dock in which a large volume of commercial activities was carried on until quite recently. The canal was opened throughout in 1820 and included a number of short but commodious branch basins, the largest being at City Road, Islington.

The Hertford Union Canal was a short canal built in 1824 to link the Regents Canal with the Lee Navigation at Old Ford; it was taken over by the Regents Company in 1857.

The Warwick Canals. At the same time as the Grand Junction Canal was being constructed to give a more direct connection from the Oxford Canal to London, the Oxford Canal was also being provided with a direct link to Birmingham, as an alternative to the roundabout route via the Coventry and Birmingham and Fazeley Canals. This was effected by constructing two canals in tandem from Birmingham to Warwick, and from Warwick to Napton on the Oxford Canal. These were authorised in 1793 and 1794 respectively and both were given narrow gauge locks. It was the reconstruction of most of these locks to wide gauge in 1931-5 which the young Grand Union Company undertook in an endeavour to extend broad gauge facilities onwards from the Grand Junction section to Birmingham, making use of the short length of the Oxford Canal between Braunston and Napton as part of the through route.

In addition to taking over the Warwick and Birmingham and the Warwick and Napton Canals in 1929 the new Grand Union Company also absorbed the Birmingham and Warwick Junction Canal, dating from 1840. This was a short length of narrow canal linking the Warwick and Birmingham Canal near its northern end with the Birmingham and Fazeley Canal at Salford Bridge. Its main purpose was to provide a relief route for the heavily used locks of the Birmingham & Fazeley Canal but it also included pumping facilities for returning lockage water to the summit level of the Warwick and Birmingham Canal.

The Union Canals. In the same year, 1793, that saw the authorisation of the Grand Junction and the Warwick and Birmingham Canals, powers were obtained for a quite separate canal to link Leicester with Northampton. This was the Leicestershire and Northamptonshire Union Canal, usually called the Old Union Canal, which eventually reached Market Harborough from Leicester (see No. 27) but there construction stopped. The Grand Junction Canal had plans for a branch from Blisworth to Northampton and after the Main Line was opened an alternative scheme was brought up for a new canal (the original Grand Union Canal) to connect the Old Union at Foxton with the Grand Junction at Norton. This canal was opened in 1814 and the next year the Northampton branch of the Grand Junction, which had initially been built as a railway, was replaced by a canal. All locks on both the Northampton branch and on the Grand Union Canal were made narrow, primarily to conserve water, but with statutory provision for widening all the locks simultaneously if either canal were to be enlarged in the future. By such means the original aim of providing a broad gauge link between Leicester and Northampton might have been achieved. Both the Grand Union and the Old Union Canals were purchased by the Grand Junction Canal in 1894.

The Grand Union Canal with all its constitutent canals and their branches were entirely independent undertakings until nationalisation in 1948.

2 Grand Union Canal

a. REGENTS CANAL
Category: Cruising 14km & Remainder 0.5km
Map: Plate 2 Profile: Figure 1
b. HERTFORD UNION CANAL
Category: Cruising 2km
Map: Plate 2 Profile: Figure 1
c. PADDINGTON ARM
Category: Cruising 21km & Remainder 0.5km
Map: Plate 2 Profile: Figure 1

1. These waterways, which are artificial, comprise the metropolitan sections of the Grand Union Canal, joining the original Main Line from Brentford to the north at Bulls Bridge Junction, Southall. The Junction with the Thames at Limehouse Basin (formerly Regents Canal Dock) also serves the Limehouse Cut branch of the Lee Navigation; a ship lock gives access to the tidal river for about three hours before each high water. After rising through four locks from the basin the Hertford Union Canal branches off to the east; the Regents Canal then continues past four more locks and two large basins to Islington Tunnel, thence past two more basins and four final locks to the summit at Camden Town. Proceeding on the London "Long Level" past Regents Park and the zoo the canal traverses Maida Hill tunnel to join the Paddington Arm at Little Venice. Paddington Basin, 0.7 km long was formerly lined with wharves for commercial traffic but is now subject to redevelopment.

2. The Paddington Arm extends mainly westwards from Little Venice, all on the one level, past Acton and Greenford where numerous industrial premises adjoin the canal, and then turns southwards to Bulls Bridge Junction. Near Stonebridge Park it crosses the North Circular Road and River Brent by aqueducts. Between Greenford and Bulls Bridge a number of private docks, now disused, formerly gave access to factories, brickfields, etc. The last to have been opened was Lyon's dock at Greenford, in 1922.

3. There are one hundred and fifty bridges including six on the Hertford Union Canal and twenty five over the feeder from Brent Reservoir which joins the Paddington Arm at Harlesden. Of these only twenty two highway bridges are now the responsibility of the Board and eleven accommodation or foot bridges.

4. On the Regents Canal, Islington Tunnel is 1.48 km long and Maida Hill 250m. The aqueduct over the River Brent is the Board's responsibility but the reinforced concrete aqueduct constructed over the North Circular road nearly fifty years ago is the responsibility of the Greater London Council.

5. The locks on the Regents Canal have a usable length of 23m and a width of 4.4m; those on the Hertford Union Canal are slightly narrower at 4.35m, but there are no locks on the Paddington Arm. The twelve sets of locks on the Regents Canal are all in duplicate, side by side, but are now being singled, one of each pair being replaced by a weir so as to allow for bypassing of water and thus enabling the pounds to be self-regulating. The three locks on the Hertford Union Canal are all singles.

6. Water is supplied from the Main Line of the Grand Union Canal (4a) at Bull's Bridge and also from the Brent Reservoir through a feeder channel 5km long which is mainly open, but partly culverted. The reservoir formerly was the main source of supply of these canals, having been constructed by the Regents Canal Company in 1835, by agreement with the Grand Junction Company, into whose Paddington Arm the feeder discharged. The catchment area has been largely built up over the last few decades and, by arrangement with the G.L.C, alterations have been made to the head bank and spillway for the purpose of giving flood relief to the River Brent. This reservoir provides one of the earliest instances in this country of siphon spillways having been constructed for the disposal of flood water. These siphons, which were installed in 1936, are still available in case of need, but with the lowering of the normal reservoir level are not called upon to deal with average flood conditions.

7. The reservoir at Ruislip, originally constructed by the Grand Junction Company about 1805 to augment supplies to the long level, ceased to be used when greater reliance was placed on Brent reservoir, and after the 1939-45 War was developed as a recreational centre. It was sold to the local authority in 1951.

8. There are numerous abstractions of water for industrial purposes on the Regents Canal, Paddingtom Arm and Brent feeder, including some of a major character for power station cooling supplies.

9. In the vicinity of London, bank protection is virtually continuous and on the Paddingtom Arm generally it is adequate. A large programme of bank protection was carried out a few years ago and although erosion is noticeable in places and there has been some leakage at the aqueducts, no major works are called for in the near future.

10. Neither of the tunnels has a towing path; elsewhere the towing path is generally in good condition and some lengths are being developed and maintained for amenity purposes by local authorities. Public access is not however permitted to the Hertford Union Canal. The greater part of these waterways is enclosed by walls and fences but there are a few remaining lengths of hedging at the western end of the Paddington Arm.

11. Although bank erosion is no longer a major problem, siltation and dumping of rubbish continue to occur so that regular dredging is necessary. In particular, dredging on the Regents Canal presents difficulty and special measures are now being tried in order to do what is necessary at minimum cost. There is only one dredging tip on this waterway situated near Bulls Bridge Junction which means that the cost of disposal is high. On the Regents and Hertford Union Canals disposal is effected by barging out to tips on the Thames.

12. There are no instances of mining subsidence, but industrial pollution occurs from time to time particularly in the built up areas. The deposition of rubbish and to a certain extent vandalism, are continuing problems. These waterways are under the control of the Area Engineer (London) at Watford with Section Inspectors located at Limehouse and Southall.

13. There is very little commercial traffic now in evidence on these waterways, being confined mainly to timber barges on the Hertford Union and the lower end of the Regents Canals. There is, however, quite considerable cruising activity with a marina at Camden Town and many boats using the various basins. Three boat clubs are established on

the Regents Canal and a floating restaurant is moored in Cumberland Basin at Regents Park. A water bus service operates in summer between Little Venice and Regents Park Zoo. There is also considerable boating activity on the Brent Reservoir. Angling rights are exercised by the London Angling Association.

14. The canal passes around the north side of Regents Park including the Zoo and in this area it has been developed as an amenity for walkers, and others. Elsewhere there is not a great deal of scope for such developments but parts such as Little Venice and the various mooring sites present an attractive appearance.

15. The special problems for these canals include, as in other urban areas, dealing with vandalism and deposits of rubbish etc.; these in turn, have an effect on dredging needs which with the high cost of disposal makes dredging generally an expensive item. Water supply is another problem, but as discussed elsewhere, redeployment of resources should enable all normal needs to be met.

3 Grand Union Canal — Main Line (Brentford to Napton)

Category: Cruising 159km & Remainder 13km
Map: Plates 2 to 5 Profile: Figures 2 & 3

1. This section of the Grand Union Canal comprises the whole of the original Main Line of the Grand Junction Canal authorised in 1793 from Brentford to the Oxford Canal at Braunston (151km), together with the 8km section of the Oxford Canal from Braunston to Napton used as part of the Grand Union through route to Birmingham, established in the early 1930's.

2. Access to the canal from the tidal River Thames is obtained through Thames Lock at Brentford which was duplicated and mechanised in 1961. The principal wharves and warehouses at Brentford (formerly a busy traffic centre) are reached through Brentford gauging lock which is also in duplicate. The course of the River Brent is then followed for some 5km with two more locks (single), one on either side of the new bridge carrying the M4 Motorway.

3. The River Brent is left behind when the canal climbs through eight more locks to reach the long level at Norwood. This 10km length to Cowley lock is entirely artificial, after which the valley of the River Colne and its tributaries is followed nearly all the way to the summit at Tring. The river and canal have separate channels but use is made of the river water throughout. There still remain, between Southall and West Drayton, vestiges of numerous private docks, some up to 1½km long, constructed to give access to brickfields and other industrial premises. Between Uxbridge and Rickmansworth sand and gravel pit workings have continued to extend in recent years, but no longer bring traffic onto the canal.

4. At the north end of the Tring summit the canal drops down the Chiltern escarpment by locks into the valley of the Ousel but, except for two tributary streams, does not tap its water and eventually crosses the Ouse itself by a two span cast iron aqueduct near Wolverton (constructed in 1811), after which there is a level pound skirting the valley of the River Tove. The flight of locks at Stoke Bruerne takes the canal up to Blisworth tunnel and the Blisworth pound, some 24km in length. It then rises again by the seven Buckby locks to the Braunston summit where the Leicester section leaves at Norton Junction. After traversing Braunston tunnel the canal drops down through six locks to meet the Oxford canal, whose 8km section brings the Grand Union route up to Napton and the end of this section. The formerly navigable branch to Buckingham is now closed except for a 2km section from the Main Line at Cosgrove to Old Stratford used for moorings (Remainder category).

5. There is a total of one hundred and two locks on this section, all 23m long by 4.4m wide, and all except for the two pairs at Brentford are single. The rises of the locks vary considerably, the deepest being at Denham, 3.4m, and the shallowest at Fenny Stratford, 0.3m, but for the most part they are between 2.0 and 2.5m. The Tring summit at 118m above ordnance datum is the highest point reached between London and Birmingham, but the Braunston summit is not much lower at 109m. The depth of water on the lock sills averages about 1.7m and apart from some shallow places the dredged depth is maintained at about 1.5m.

6. There are many bridges of which seventy three highway and ninety seven foot and accommodation bridges are the responsibility of the Board. The older bridges are mainly of brick arch construction, but some of cast-iron girder construction and timber (mostly fixed) still remain.

7. The largest earth work is the Tring cutting, 3km long and more than 10m deep in the centre. There are, however, numerous lengths where the canal is carried by embankments, the largest being at Wolverton and Braunston on the approaches to the aqueducts over the Rivers Ouse and Leam respectively. The Wolverton aqueduct comprises two spans of cast iron troughing between brick abutments, Braunston aqueduct is of brick with a triple arch. There are several small aqueducts. The two tunnels at Blisworth, 2.81km, and Braunston, 1.86km, are both wide enough to take craft of 4.4m beam if necessary and are generally in good condition.

8. As regards water supplies, the more important features relating to the Long Level, the Tring summit and the Braunston summit are mentioned in Chapter 9, Volume 1, the Tring arrangements being reviewed in some detail in Chapter 6, to which attention is directed. The formerly navigable Wendover branch serves now only as an important feeder channel to the Tring summit and reservoirs. Other sources of supply include feeders leading from railway cuttings, streams and springs, at various places. Between Rickmansworth and Harefield a large supply of purified sewage effluent is received from the Colne Valley sewage works. Controversy about the use of water in the River Gade led in 1819 to realignment of a section of canal at Apsley and the substitution of five shallower locks for four of the original — hence the renumbering of the next lock downstream as 69A.

9. Water for the Tring summit is also obtained at its southern end from two boreholes, the one at Cowroast being situated alongside the top lock and discharging directly into the summit pound. The other is at Northchurch, alongside the third lock below the summit and the water is used partly for making good losses in the upper pounds and the rest lifted into the summit by pumps at the three top locks.

10. The River Tove crosses the canal immediately below Stoke Bruerne locks, by means of both culverts and sluices, thus affording a supply that can be used by back lockage pumps but which is liable to be troublesome by flooding in wet weather. Pumps are available at the Stoke Bruerne locks and also at Buckby locks so that water may be lifted if required into the Braunston summit. The water can also be passed down into the Fenny Stratford pound at Cosgrove lock and pumped up into the Tring reservoirs by the chain of pumps existing at all the locks between Fenny Stratford and Marsworth. A pump also existed formerly at Cosgrove and this could readily be reinstated if it were required to lift water from the Fenny Stratford pound northwards. Many of the locks throughout the canal are equipped with side ponds, but not all are now in working order.

11. Water is abstracted for sale at numerous places, mainly at the south end of the section as far north as about Wolverton. In some river sections it is not considered possible to obtain payment for such water.

12. Bank protection works were carried out on a fairly extensive scale in the development period of the 1930's and a considerable amount of further work has been carried out within the last few years. Generally the position is satisfactory but on many remaining unprotected lengths erosion is continuing on account of wash caused by cruising vessels.

13. There are no serious problems from bed or bank leakage but leaks do occur from time to time, particularly on embanked sections. There have been several instances, in recent years, of bank failures from such causes, including a large slip in a length of embanked canal adjoining a housing estate near Wolverton. In this case, the waterway had a revetment of concrete piled walling which remained intact but the water had to be drained off as a precaution.

14. There is no towing path provided through either of the two tunnels (see paragraph 7) nor along the canal between Brentford and Thames locks, elsewhere it is generally in good order. Hedges exist over most of the route but in many cases have become much overgrown.

15. Dredging problems are normally worse in the London area from the dumping of rubbish and siltation from the river sections. Suitable sites for tipping spoil are not easily found so that dredging can be costly in some cases. Two floating dredgers with tugs and hoppers are available, also one land-based excavator.

16. The part of the canal from Brentford to Lock 13 at Buckby is under the jurisdiction of the Area Engineer (London) stationed at Watford. There are Section Inspectors with maintenance yards at Norwood, Apsley, Marsworth and Gayton. From Buckby to Napton is in the Birmingham area, being in the Hillmorton section. There is an extensive repair yard at Bulls Bridge, mainly concerned with the construction, repair, servicing and utilisation of floating and mechanical plant, there is also a satellite yard at Bulbourne which specialises in the construction of lock gates.

17. Several structures and buildings are listed as being of historical interest, including Hanwell Locks, cottages at Cowley Lock and a bridge at Watford. Mention should also be made of the unique British Waterways Museum at Stoke Bruerne which attracts visitors from far and wide. Also of note is the "Tring Improvement" exercise in which the Board have undertaken a programme of special maintenance work on the length between Northchurch and Ivinghoe on either side of and including the Tring summit.

18. A certain amount of commercial traffic still continues in the London area, but practically nothing north of Uxbridge. Cruising activities are however to be seen everywhere and in addition to numerous moorings there are marinas and larger centres at Bulls Bridge, Uxbridge, Denham, Harefield, Tring, Leighton Buzzard, Bletchley, Cosgrove, Whilton and Braunston. The two last named in particular are large modern developments.

19. Angling, walking, etc., are very popular outside the industrial area and there are nature reserves near Watford and on the Tring reservoirs.

4 Grand Union Canal

a. SLOUGH ARM
Category: Remainder 8km
Map: Plate 2 Profile: Not applicable
b. AYLESBURY ARM
Category: Cruising 10km
Map: Plate 3 Profile: Figure 2
c. NORTHAMPTON ARM
Category: Cruising 8km
Map: Plate 4 Profile: Figure 2

1. These three arms are the only remaining navigable branches of the former Grand Junction Canal; the Slough Arm being the youngest having been constructed in 1882 to tap the sand, gravel and brickearth deposits then being exploited in the Iver and Langley areas. For many years very profitable, it fell into disuse, until in recent years it has provided moorings for cruising craft and a home for builders and hiring firms specialising in such craft. It has no locks, being part of the London Long Level, and extends in nearly a straight line from Cowley Peachey Junction to a dead end terminus at Slough Basin.

2. The Aylesbury and Northampton Arms were both authorised in the earliest Acts of the Grand Junction Canal but for various reasons were not opened until 1815. The Aylesbury Arm leaves the main line at Marsworth Lock 38, below the summit level, and extends in nearly a straight line due west to a dead end terminus at Aylesbury. Unlike the Slough Arm, however, it falls nearly 29m in its course, by sixteen narrow locks of which the first two at Marsworth form a "riser". Both the delays and the use of narrow (2.13m) locks were due in part to an initial anxiety about water supplies; construction was enabled to proceed only when additional reservoirs were authorised to feed the branch and to provide compensation water for the benefit of the mills affected. Tringford and Startopsend reservoirs were completed in 1817.

3. The Northampton Arm leaves the main line at Gayton Junction, near Blisworth, and falls by 32.5m through seventeen narrow locks to the navigable River Nene at Northampton, thus providing a link with Peterborough, Wisbech and the Wash. Water is supplied from the Blisworth pound of the Main Line; mainly because of the anticipated demand for water the construction of a branch canal to Northampton was deferred until supplies could be augmented, and from 1805 until 1815 the town was served by a temporary railway. (The materials for the line were obtained from the one used at Blisworth to by-pass the tunnel workings until completion in 1805).

4. None of these branch canals has a tunnel but the Slough Arm has fairly deep cuttings and embankments together with three aqueducts over the River Colne and its branches at the eastern end. There are bridges at normal intervals in each case, those on the older canals being mainly of brick arch construction but the Slough Arm bridges are mostly of steel girders or cast-iron beams. Strengthening to suit present day needs is being carried out where necessary.

5. Bank protection standards are not, in general, up to those of the Main Line; the Slough Arm in particular requires attention over considerable lengths of both banks if it is to remain open. Leakage through the banks is persistent on some parts of the Aylesbury Arm. Dredging is required at various places on all three canals in order to restore the average navigational depths. There are no special problems with regard to towing paths and hedges except that conditions on the Slough Arm are generally less satisfactory than on the other two.

6. Water is abstracted for sale in small quantities at a number of points on each of the three canals but there are no very large users. These canals are all used for angling and walking, but there are no listed buildings or other items of special interest.

7. All three canals are used extensively for cruising, but only the Northampton Arm is a through route with access to another waterway. The terminal basin at Slough has been suggested as suitable for incorporation in a local scheme of amenity development, to which there would appear to be no objection provided that an alternative means of turning the longer craft can be found.

5 Grand Union Canal — Leicester Section (South)
(Norton Junction to Foxton)

Category: Cruising 37.5km & Remainder 3km
Map: Plate 5 Profile: Figure 4

1. This section of the Grand Union Canal is identical with the original Grand Union Canal, opened in 1814 to connect the Grand Junction Canal with the Leicestershire and Northamptonshire Union Canal and taken over by the Grand Junction Company in 1894 as part of its Leicester section.

2. Very soon after leaving Norton Junction, on the Braunston summit level of the Grand Union Main Line, this canal rises by the seven Watford locks to its own summit level 125m above O.D. and continues at that level for 32km. It then descends by the ten Foxton locks to the junction with what is now the Market Harborough Arm, once the Main Line of the Leicestershire and Northamptonshire Union Canal. The Welford Arm (Remainder 2.9km) joins the canal about halfway along the summit level, bringing in water from the nearby Sulby and Welford reservoirs and the larger Naseby reservoir some 4km distant from the end of the Arm. Although always serving as a feeder channel the Arm was originally made navigable to serve the village of Welford and remained so until recent times. It then fell into disuse and became unnavigable in 1967 but was shortly afterwards restored for cruising purposes. No doubt its temporary eclipse as a navigable waterway accounted for its being classified as Remainder in 1968.

3. The whole canal is entirely artificial, of narrow gauge, and follows a contour course among the hills forming watersheds between the valleys of the Nene, Warwick Avon and Welland.

4. The ten narrow locks at Foxton are in two staircase flights of five, separated by a short pound, with side ponds arranged to ensure maximum conservation of water. They are listed as Structures of Historic Interest. From 1900 to 1910 an inclined wide gauge lift, operated by steam power, replaced the locks but it was found to be too expensive in operation for the small amount of traffic and the locks were reinstated. The lift was finally dismantled in 1928 and only the earthworks now remain, but these are now scheduled as an Ancient Monument. The locks at Watford comprise three single locks and a staircase of four, with side ponds as at Foxton. There is one lock on the Welford Arm, about 800m before the terminal basin.

5. There are eighty two bridges, three being on the Welford Arm, more than half of which are accommodation or footbridges; two are swing opening bridges. Only seven of these bridges are not the responsibility of the Board. Most of them are of brick arch construction. There are two tunnels, at Crick (1.4km) and at Husbands Bosworth (1.08km), both wide enough to allow two narrow boats to pass. Apart from the cuttings at tunnel approaches major earthworks are few but there are several embankments, including those on either side of four aqueducts.

6. Water supplies come mainly from the three reservoirs via the Welford Arm, but there are supplementary feeders at Welton, Watford, Winwick, Elkington and North Kelworth; water can also be taken from the stripling Avon at Welford. Water passing down the Watford locks goes into the Braunston summit and so assists the Main Line position; at Foxton the water passes down eventually to the River Soar (see 27a).

7. There are no abstractions or water sales of any magnitude and no intakes of sewage or industrial effluent.

8. The original dry stone walling on the towing path side still exists in many places but lack of repair and erosion are evident. Bank protection works have not been carried out on any considerable scale so that attention is now needed over quite long lengths. Seepages through embankments occur in places but do not appear to constitute a serious threat to safety.

9. The towing path is generally adequate but does not extend through the tunnels; the hedges are in reasonably good condition. Dredging is needed generally throughout the waterway but there is at present only one unit at work.

10. The whole section comes under the control of the Area Engineer, Birmingham, the Section Inspector being located at Wigston, near Leicester, where there is a maintenance yard.

11. There is no commercial activity of any kind on this section but cruising is gaining in popularity year by year. The large modern marina on the Main Line at Whilton Locks is only 3km from Norton Junction and there are boating centres at Crick, North Kilworth and Foxton.

12. Angling is also popular, especially between Crick and Husbands Bosworth.

13. The canal passes entirely through agricultural country with no towns and few villages nearby. It is unlikely, therefore, to attract more than very local interest in any scope for amenity activities that it may possess, so that its potential is really limited to that of medium and longer distance cruising.

6 Grand Union Canal — Main Line
(Napton to Birmingham)

Category: Cruising 63km & Remainder 1km
Map: Plate 6 Profile: Figure 3

1. Comprising the former Warwick Canals taken over in the formation of the Grand Union Canal in 1929, this section extends from a junction with the Oxford Canal at Napton in a generally westerly direction to Leamington and Warwick, falling steadily through locks to the Avon valley, and then rising steeply through the Hatton flight before turning north and north west to Birmingham. The summit pound, extending for 16km past Solihull, is reached after rising through the Knowle Locks and terminates at Sampson Road depot in Birmingham where there are extensive warehouses.

2. This part of the Grand Union Main Line was the subject of a major redevelopment in the 1930's when all the fifty two original narrow locks between Napton and Knowle were replaced by fifty one new wide ones. Several bridges were reconstructed and extensive improvements by way of bank protection and dredging were carried out at the same time.

3. There is a short branch at Kingswood Junction, 5km south of Knowle, giving a connection with the Stratford on Avon Canal; the length of that canal between Kingswood and Stratford on Avon is now owned by the National Trust but the remaining length to King's Norton is in BWB ownership and is described under No. 7 of this series. The short Saltisford Arm (0.8km) is partly used for moorings, but some of it is derelict and overgrown.

4. Beyond Sampson Road depot the original narrow Camp Hill locks, taking the canal down to Bordesley Junction, remain; in a short distance a junction is made with the Digbeth branch of the Birmingham and Fazeley Canal (20b). From Bordesley Junction the former Birmingham and Warwick Junction Canal runs north for 4½km to meet the Main Line of the Birmingham and Fazeley Canal near its junction with the Tame Valley Canal at Salford Bridge. In doing so it falls through the five narrow Garrison locks and a shallow stop lock, all in a heavily industrialised and built up area.

5. The whole of this section is entirely of artificial construction. Although the locks are now of wide gauge as far as Sampson Road, there are still restrictions in the waterway limiting its use to craft not exceeding 3.8m beam — in practice, this means that the traditional narrow boats of 22m x 2.13m are the largest normally using the section. The number of locks is fifty one wide and eleven narrow gauge, together with the stop locks at Digbeth and Salford Junctions.

6. There are one hundred and fifty nine bridges, of which thirty road bridges and fifty seven accommodation and footbridges are the Board's responsibility. There is one tunnel at Shrewley (400m). above the Hatton locks, which is unusual in having a short (40m) tunnel above it carrying the towing path, and there are fourteen aqueducts, none of which is very large. As is usual, these aqueducts are approached by embankment sections; there are cuttings at the tunnel approaches in the Leamington area and at a few other places. The main railway line to Birmingham passes under the canal in tunnel west of Leamington.

7. The eastern part of this section receives its water from the Oxford Canal at Napton Junction, where there are balancing reservoirs, being taken down through the three Calcutt locks a short distance from the junction. Neither these, nor the next fourteen locks at Stockton and Bascote, are equipped with back lockage pumps but the last six locks down to the Leamington pound have electrically operated units for returning lockage water. The Knowle — Birmingham summit is supplied from Olton reservoir and by pumping up from the River Tame at Salford Bridge. One electric pump brings the river water into the canal above the stop lock, another, at Bowyer Street, is supplied from the canal through a long culvert and discharges above the Camp Hill locks.

8. There are flood weirs and sluices at a number of places. Large abstractions of water for industrial purposes take place at Leamington and to a smaller degree in the Birmingham area.

9. In general the standards of bank protection are satisfactory, a great deal of work having been carried out in connection with the 1930's development scheme. Since then however, erosion has taken place and the towing path has completely disappeared at a number of points; bank leakage is also evident in some areas. There is a considerable growth of weeds in many places, especially where dredging has not been carried out to the full extent of the developed waterway. There is an adequate depth of water generally in the main channel but it is often much narrower than the surface width would suggest. One floating grab dredger is employed on this section.

10. Pollution from corrosive liquid wastes in the industrial areas has occurred in the past, and constant attention is required in these areas to prevent recurrences.

11. This waterway is controlled by the Area Engineer, Birmingham; the eastern end down to the bottom lock into the Leamington pound comes under the Section Inspector at Hillmorton (on the Oxford Canal, North) and the remainder under the Section Inspector at Hatton, where there is a maintenance depot.

12. Cruising and angling are the main activities and there are several sites for boat moorings, but no marina type establishments.

7 Stratford-on-Avon Canal

Category: Cruising 20km
Map: Plate 6 *Profile: Figure 3*

1. The Stratford-on-Avon Canal connects with the Worcester and Birmingham Canal (17) at King's Norton Junction and with the Grand Union Canal (6) at Kingswood Junction, Lapworth. After a pound of almost 16km, the canal falls through a flight of nineteen locks to the Grand Union Canal. From just above the bottom lock the canal continues southwards to the River Avon, but this length belongs to the National Trust.

2. Authorised in 1793, the intention of the promoters was to give Stratford access to the developing canal network. Financial troubles delayed the completion of the northern part until 1805. The southern part took even longer and was not opened until 1816. In 1850, the canal was sold to the Oxford, Worcester and Wolverhampton Railway Company and remained in railway ownership until nationalisation. Traffic ceased on the southern length in 1933 and it became derelict and overgrown. In 1959 this length was leased to the National Trust, who commenced restoration with the aid of volunteer labour. It was re-opened in 1964 and a year later the canal was vested in the National Trust, with certain obligations remaining on the Board to supply water.

3. The twenty locks are all standard narrow locks, built to minimum dimensions of 22.9m by 2.23m with 1.33m over the sill. The stop lock at King's Norton has an unusual guillotine gate design (not now in use); there was formerly a small fall to Worcester & Birmingham Canal. Although the levels were equalised some years ago, the lock which is now scheduled as an Ancient Monument remains in situ.

4. Between King's Norton and Kingswood, there are forty six bridges across the canal. Of thirty five which are the Board's responsibility twenty carry public highways. Most are of brick arch construction, but there are three drawbridges and one swing bridge maintained by the Board. The Board are responsible for one public road bridge and six footbridges across the Earlswood Pools Feeders.

5. There is only one aqueduct and one tunnel on this length of the canal. The aqueduct is across the River Cole and has been subject to extensive repairs in the past. Brandswood Tunnel (320km long) is lined with brick and has no towpath.

6. The major water supply is now derived from the Worcester and Birmingham Canal. Formerly it was derived from the Earlswood Reservoir System, but this group of three Pools (Engine, Windmill and Terry's) is now little used. Only a small part of the total capacity can be supplied to the canal by gravity, the rest has to be pumped. Other supplies come from canalside springs and streams, and there is a small balancing reservoir at Lapworth. Little industrial abstraction occurs, but the Board has an obligation to pass 4.8 Ml/day to the National Trust length of the canal.

7. The canal comes within the Birmingham Area's Worcester Section, which is based at Tardebigge on the Worcester and Birmingham Canal. The Section's equipment is utilized on each canal as required.

8. Considerable lengths of steel sheet piling have been driven in recent years and most of the potential weak spots, such as the several high embankments, have been protected. Where there is no protection, erosion is now making inroads into the towpath and protection will soon be needed here.

9. Commercial traffic ceased many years ago, but cruising traffic is heavy. Through traffic from Birmingham can use this route to avoid the even heavier locked route via Aston Junction, and thus reach the Grand Union or the southern end of the Stratford Canal. The usual facilities are available for craft, a considerable number of which are based on this stretch. Other amenity pursuits are only moderately in evidence.

8 Coventry Canal

Category: Cruising 61km
Map: Plate 8 *Profile: Figure 5*

1. From a terminal basin near the centre of Coventry, a 27km summit pound leads in a northerly direction to Atherstone. Here the canal is lowered by elevan locks in 2.5km to an 11km pound. This leads to the final fall through two locks and a valley pound of over 20km leading to Fradley Junction and the Trent and Mersey Canal (23). A number of important connections are made: at Hawkesbury Junction with the Oxford Canal (North) (11); at Marston Junction with the Ashby Canal (9); at Fazeley Junction with the Birmingham and Fazeley Canal (20b). Formerly a connection was made at Huddlesford Junction with the Wyrley and Essington Canal of the B.C.N. (20c), but this canal is now closed and derelict to Ogley Junction, except that a short length adjacent to the Coventry Canal is used for moorings. The private arms which linked the collieries near Coventry to the canal are now all closed.

2. The original intentions of the promoters of this canal were twofold: to link Coventry to the Trent and Mersey Canal and to provide cheap transport for the collieries to the north of the city. The latter aim was achieved within a couple of years of Parliament passing the enabling Act in 1768. Financial strictures and intercompany wrangling, meant that the canal had only advanced to just beyond Atherstone by 1785. In that year the Trent and Mersey made an agreement with the Birmingham Canal Company (which had just absorbed the Birmingham and Fazeley) jointly to construct an 18km link between Fazeley and Fradley Junctions. The former company built the length from Fradley to Whittington Brook, the Birmingham Canal Company the remainder. A year later the Trent and Mersey conveyed the northern length to the Coventry company and the latter reached Fazeley finally in 1790. Subsequent attempts by the Coventry's owners to take over the length from Fazeley to Whittington Brook were frustrated. Thus the Coventry Canal, which remained independent and profitable up to nationalisation, continued to operate two separate lengths totalling 52km. For the purpose of this report, the whole length from Coventry to Fradley is regarded as one canal.

3. The locks are all standard narrow locks built to minimum dimensions of 22.25m by 2.20m with 1.5m over the sill.

4. The Board maintain eighty two of the total of about one hundred and fifty bridges across the canal. Public road bridges account for thirty six of the Board's number. The majority are of the common brick arch construction, but two are swing bridges. One of the latter is an unusual swivelling footbridge across the site of the former stop lock at Fradley Junction.

5. There are only three aqueducts on the canal. One is a single brick arch across the River Sow near Coventry, the other two occur near Fazeley Junction. Both these latter are composite brick and stone three-arch structures, one carrying the canal across the River Tame, the other providing flood relief arches through the approach embankment.

6. Hillside streams, whcih flow into the canal, are the main source of water for the canal. There is a small reservoir at Oldbury, but it has a limited catchment area. Additional supplies can be fed into the summit pound from the Oxford Canal and into the valley pound by the Birmingham and Fazeley Canal. The former practice of pumping mine water through the private arms into the canal has now ceased. In times of drought the canal can transfer water to the Ashby Canal. Water sales are concentrated towards the south of the canal. Several firms are supplied in Coventry and a quarry at Nuneaton draws its wash water from the canal. The water from this latter source is returned containing appreciable quantities of sand.

7. North of Huddlesford Junction, the canal is in the Northwich Area, Stafford Section, which is based at Fradley Junction. South of this point, it is in the Birmingham Area, the Section Inspector and his staff being based at Hartshill. There is also a small workshop and slipway near Fazeley Junction.

8. Dredging is a particular problem on the length between Nuneaton and Hartshill. The returned water from the quarry at Nuneaton leads to rapid siltation, requiring frequent cleaning.

9. Originally, the canal was built with stone or brick side walling, but much of this is now damaged or destroyed. The overall condition of the banks is fair, but further piling is needed with bank raising where subsidence has occurred.

10. The southern end of this canal has been subject to coal mining subsidence. This is presently confined to the area near Coventry and no major problems are anticipated.

11. Pleasure craft are the only traffic making use of the canal, the former heavy coal traffic having ceased some years ago. The canal is popular as a through route from the Trent and Mersey to other canals, and the more rural northern length has considerable amenity value in its own right. A marina and several boatyards offer the usual facilities for boat users. Angling is popular all along the canal apart from near Nuneaton, where the heavy sand suspension in the returned water has an adverse effect on the marine life.

9 Ashby Canal

Category: Cruising 34km
Map: Plate 7 *Profile: Not applicable*

1. The truncated remains of this canal run in a lock free pound from Snarestone to Marston Junction on the Coventry Canal (8). North of Snarestone the route to the original terminus at Moira has been abandoned due to extensive damage from mining subsidence.

2. Originally, the canal was intended to provide an outlet for the limestone quarries and coal mines around Ashby de la Zouch. The authorising Act of 1792 included branches from Moira, but these were replaced by tramways serving the mines and quarries. In 1846, the canal was transferred to the Midland Railway and remained in railway ownership until nationalisation. From 1954 onwards, the canal progressively shortened as it became affected by mining subsidence.

3. The only lock is the stop lock at Marston Junction which is no longer used. It does, however, restrict the width of craft entering or leaving the canal to 2.5m and a draught of less than 1.5m.

4. All but ten of the sixty six bridges across the canal are maintained by the Board and twenty of this number carry public highways. The majority are of brick or masonry arch construction and the overall condition of the bridges is poor, many of them needing extensive pointing or patching.

5. There are seven aqueducts, one of which carries the canal over a public road. The major structure is at Shackerstone, where the River Sence is crossed by five arches.

6. Snarestone Tunnel is the only one on the canal. It is 230m long and has no towing path, but its 4.88m width allows narrow boats to pass.

7. Closure of the upper length of the canal severed the supply from the original feeder reservoir at Moira. The remaining length depends for its supplies on land drainage and a small stream towards the Marston end of the canal. The absence of locks or major abstractions means that this supply is normally sufficient for present needs. In dry spells, supplementary supplies can be derived from the Coventry Canal.

8. The Ashby Canal is in the Hartshill Section on the Birmingham Area, which is based at Hartshill on the Coventry Canal.

9. As originally constructed, the canal was a puddled clay 'saucer' with no bank protection of any form. This was virtually the situation when the canal was vested in the Board. Since then, long stretches of steel sheeting have been driven (768m in 1974). There still remain long lengths where the towpath is narrow and eroded. A continuing effort will be required, particularly if usage of the canal increases. On some lengths the freeboard is also low.

10. Although severe subsidence caused the closure of the upper reaches of the canal, the present length has not been affected and is not likely to be.

11. A single barge is all that remains of the once heavy coal traffic on the canal. Patronage of the canal by pleasure craft is only moderate, although the Board's one day count figures indicate that traffic is increasing considerably. The canal is of rural character throughout and the long lockfree pound should prove attractive to pleasure boatmen. A boatyard is situated at Stoke Golding.

10 & 11 Oxford Canal

Introduction

From a junction with the Coventry Canal (8) at Hawkesbury Junction, the canal follows a southerly course to Braunston Junction. For the next 8km to Napton Junction, the canal shares its route with the Grand Union Canal (3) and then branches south, passing through Banbury to Oxford and the River Thames. An alternative route to the Thames is provided by the 1km Duke's Cut, some 6km north from Oxford.

Authorised by an Act of 1769, the canal was to remain an independent concern until nationalisation in 1948. It was intended to provide an outlet for coal from the Warwickshire Coalfield to the Thames and London and various large towns en route. Construction started at the northern end and proceeded slowly, Banbury being reached in 1778 and Oxford twelve years later.

As built by Brindley, the canal was the contour canal par excellence meandering for 146km across the countryside, whereas the distance as the crow flies is only about 80km. When an alternative route to London via Warwick and the Great Junction Canal was opened in the early 1800's, the fall off in traffic and revenue was dramatic. A scheme for shortening the northern length was commenced in the late 1820's and completed in 1834. The distance from Braunston to Hawkesbury Junction was shortened by 22km, the new cut having a number of major cuttings and embankments. For the Board's accounting of maintenance and for the purpose of this report, the length from Napton to Braunston is regarded as part of the Grand Union Canal. Thus the canal is split in two distinct parts which are reviewed separately.

10 Oxford Canal-North

Category: Cruising 38.5km & Remainder: 7km
Map: Plate 7 Profile: Figure 6

1. From Hawkesbury Junction, the canal rises through only four locks (one of which is a stop lock) to Braunston Junction and the Grand Union Canal (3). A number of arms join the canal (remnants of the old contour canal), some of which are still navigable for part of their length.

2. The Board is responsible for sixty three of the total of over eighty bridges across the main canal and its arms, including nineteen public road bridges. The majority are of brick arch construction, but there are four cast-iron towpath bridges. These date from the 19th Century realignment of the canal and carry the towpath over the entry to some of the arms. There has been a progressive replacement of bridges across the old arms by culverts or embankments.

3. Two of the thirteen aqueducts are cast-iron trough structures, the remainder being of brick arch construction. The crossings of the Rivers Swift and Avon are of three arches, the others being single spans.

4. The only tunnel dates from the reconstruction of the canal. It is at Newbold and, unusually, is provided with a towpath on both sides of a 4.72m channel. The tunnel is 190m long, lined in brick and has a generous headroom of 4.11m.

5. The locks are of narrow gauge, being built to dimensions of 22.6m by 2.21m with 1.35m over the sill. The three locks at Hillmorton are duplicated and some of the original cast-iron gates survive one hundred and forty years after installation.

6. Water supplies to the canal are derived from several sources. At Braunston Junction, water can be fed down from the Braunston Summit level of the Grand Union or, indirectly, from the reservoirs on the Oxford Canal (South). A further supply is fed into the 24km pound between Hillmorton and Hawkesbury Junction from the River Swift via the disused Brownsover Arm at Rugby. Several streams also feed the canal and at Newbold a supplementary supply can be pumped into the canal from a disused quarry. Supplies are abstracted by the C.E.G.B.'s Longford Power Station near Hawkesbury Junction and also by the Severn – Trent Water Authority. Bank-pumping facilities are installed at Hillmorton Locks to aid the conservation of water.

7. This length of the canal is in the Birmingham Area, the Section Yard being at Hillmorton. The Board also have a hire cruiser base at this location.

8. The standard of bank protection is very variable. When the canal was straightened, heavy stone pitching was provided on the towpath side of the new lengths. Generally, this protection is in a sound condition, although the freeboard of the towpath is low in several locations. However the situation regarding the original lengths is quite different; the light walling on the towpath side has been largely destroyed resulting in serious erosion, and on the offside it is necessary to stabilise the toe of some of the cuttings. Some of these weak points have already been protected but more will be required in the near future.

9. This canal is largely rural in character and is heavily patronised by pleasure craft, facilities for which are to be found in several locations. Angling is particularly popular towards the northern end of the canal, coarse fish being the quarry.

10. A particular feature of this canal is the number of arms, originating from the straightening of the canal and numbering eight in all. Of these, the Wyken Arm (owned by Coventry City Council) and Rugby Arm are partly used for moorings; the Brownsover Arm acts as a feeder from the River Swift; the others are largely derelict and overgrown.

11 Oxford Canal-South

Category: Cruising 80.5km
Map: Plate 9 *Profile: Figure 6*

1. From Napton Junction, the canal rises through nine locks to Marston Doles and a summit level almost 18km long. It then falls through thirty locks to the River Thames at Oxford. Except for a length of about 1km near Thrupp, where the canal uses the bed of the River Cherwell, it is of wholly artificial construction.

2. The locks are narrow, built to minimum dimensions of 22.6m by 2.21m with 1.27m over the sill. Some of the tail gates are of cast-iron construction and south of Banbury the locks are, unusually, provided with single timber tail-gates. At Aynho and Shipton Weir Locks, where the fall is small, the chambers are diamond shaped so that the water passed down is sufficient for the locks with greater falls downstream.

3. Over one hundred and forty bridges cross the canal, the Board being responsible for sixteen public road bridges, seventy seven accommodation bridges and fifteen footbridges. Lift bridges account for twenty six of the accommodation bridges and two of those maintained by other authorities. Bridge Number 239A is an electrically operated lift bridge giving access to a factory in Oxford and operated by their staff, whilst Bridge Number 205 at Lower Heyford is an unusual cast-iron drawbridge. Although the general condition of the remaining twenty four, which are of standard timber design, is fair, some could usefully be painted to prolong their working life. Eight of these bridges, including five maintained by the Board, are 'listed' structures. Most of the other bridges are of brick arch construction. Some need extensive pointing of the brickwork and at least one disused accommodation bridge calls for immediate attention. A steel trough carries the feeder to Wormleighton Reservoir across the canal.

4. There are no aqueducts or tunnels on the canal. Originally, there were two short tunnels of 307m and 413m separated by a gap of 142m at Fenny Compton. These were opened out in the 19th Century, but a constriction remains at the water line and this length now forms the only major cutting on the canal.

5. Water supply is derived principally from the summit reservoirs; Boddington Reservoir and the adjacent Byfield Reservoir, which are retained at the same level, are connected to the canal near Claydon by a 5.5km feeder channel. Clattercote Reservoir is situated on the opposite side of the canal and feeds through a 4km feeder, whilst Wormleighton Reservoir is immediately adjacent to the canal a few kilometres to the North. Some of the reservoirs have had their capacity reduced by siltation and the long feeder channels are in need of constant maintenance. The Oxford side of the summit receives additional supplies from several streams and from the River Cherwell, which runs alongside the canal for many kilometres. At times of heavy rainfall, flood control is a major task on this length. By contrast, the length north of the summit has no such supplementary supplies and the heavy use of the locks make this length particularly prone to water shortages in dry spells. Pumping equipment is now installed at Napton to pump water back up to the flight and ease this shortage.

6. The Section Inspector for this canal, which is in the London Area, is based at Kidlington.

7. Bank protection is a major problem on this canal. The original drystone walling on the towpath side has been largely destroyed by the wash from the large numbers of cruising craft using the canal. The situation on the summit level is worse than elsewhere. Here new protection is needed on long lengths to stem the serious erosion and prevent leakages onto the surrounding land which is generally below the canal on the towpath side.

8. Agricultural work is also somewhat in arrears and, again, the major backlog occurs on the summit level. Hedges on this length are so overgrown as to make the towpath virtually impassable and seriously inhibit access for maintenance purposes.

9. Cruising traffic on this canal is amongst the heaviest in the country with over two hundred boats a week on the move at the height of the season. There are marinas and boatyards both on the canal and on the Thames at Oxford. Boddington Reservoir is used for sailing and all the reservoirs provide coarse fishing. Most of the angling rights on the canal are let to angling organisations.

12 Kennet and Avon Canal

Category: Cruising 39.5km & Remainder 99.5km
Map: Plates 10 & 11 Profile: Figure 7

1. The Kennet and Avon Canal is 139km long, extending from Reading on the River Thames 117km upstream of London Bridge, to Hanham on the River Avon 8km upstream of Bristol. When in use it thus formed an integral part of a 266km long waterway between London and Bristol. It extends generally in an east-west direction passing through Newbury, Hungerford, Devizes, Bradford on Avon, Bath and many smaller towns and villages.

2. The canal comprises three distinct sections, a 40km canalised section of the River Kennet from Reading to Kintbury, which includes 18km of artificial cut, an 81km wholly artificial canal section from Kintbury to Bath, and an 18km navigation of the River Avon from Bath to Hanham. From Reading the canal rises by a total of fifty two locks to the short Savernake summit 144.5m above sea level; twenty one of these locks are on the canalised river section, and apart from a flight of nine at Crofton near the summit they are spaced out fairly regularly. From the summit a fall of 122m to Bath is accomplished by means of forty seven locks. These are mostly grouped together in flights (four at Wooton Rivers, twenty nine at Devizes, five at Seend, two at Semington and seven at Bath) thus producing long pounds including one of 24km and another of 14.5km. The river navigation section of the canal west of Bath has a further six locks constructed in short lengths of canal cut adjacent to river weirs.

3. The canalised river sections comprise 21km classified as 'Cruising' and 19km classified as 'Remainder'. Except for a short length near Newbury classified as 'Cruising', the whole of the artificial canal section is 'Remainder'. Of the 99.5km of Remainder waterway, 8km is de-watered and 58.5km is in use for cruising. The whole of the section west of Bath is classified as 'Cruising'. Plates 10 and 11 show the above classifications, and also indicate those sections of Remainder canal which are de-watered and those which are in water. Two of the former are flights of locks (Crofton and Devizes),which are kept de-watered because of the dilapidated nature of the locks themselves; the third is a 4km section beyond Bradford on Avon which is kept de-watered because of bad leakage problems. Some sections of the canal, though classed as 'Remainder', are nevertheless in use largely because of the efforts of the Kennet and Avon Trust which has provided funds for renovating locks.

4. The canal was constructed in three separate units; the River Avon Navigation from Bath to Hanham was authorised in 1712 and was built between 1725 and 1727; the River Kennet Navigation from Reading to Newbury was authorised in 1715 but was the first section to be built between 1718 and 1728; the connecting link of artificial canal between these two navigations was not authorised until 1794 and was completed in 1810. The Kennet and Avon Canal Company acquired the shares both of the Kennet Navigation and the River Avon Navigation between 1813 and 1828; thereafter the canal was operated as one entity. In 1852, the whole canal was taken over by the Great Western Railway Company, and in 1948 by the British Transport Commission. Regular traffic left the canal in the 1930's and the last through passage was made in 1947.

5. The Kennet and Avon is a "broad" canal; the Kennet Navigation was provided with locks about 35.4m long and 5.49m wide and accommodated 120 tonne barges, whilst the Avon Navigation has locks about 30m in length and 5.49m wide. The canal section however, was constructed to a gauge of 22.9m by 4.27m with 1.21m over the sill; this became the ruling gauge, and some of the original Kennet Navigation locks were reconstructed to this gauge which was suitable for barges of about 60 tonnes.

6. There are over two hundred bridges of various kinds crossing the canal, but BWB are responsible for maintaining only fifty seven highway and one hundred and fifteen accommodation and footbridges; the rest are the responsibility of other authorities and riparian owners. Some carry weight restrictions of 5 or 15 tonnes. The greater number are of brick or masonry arch construction but some are steel and others timber. Between Reading and Hungerford, there are five timber swing bridges and four steel swing bridges all hand-operated by canal users. Some of them on the Remainder sections are unworkable, all are slow in action. There are three tunnels on the canal, two of these are at Bath and are little more than wide bridges, the other at Savernake is 459m long and does not have a towpath.

7. There are eleven aqueducts on the canal, the two most significant ones, Avoncliffe Aqueduct and Dundas Aqueduct, occurring on the length of canal that follows the steep-sided valley of the River Avon between Bradford on Avon and Bathampton. They carry the canal from one side of the valley to the other in turn, spanning the river and railway. Dundas Aqueduct is scheduled as an Ancient Monument.

8. The lock chambers on the River Kennet Navigation were originally constructed with sloping turfed sides, the head and tail works only being built in brickwork; many have now been reconstructed in brick to match the smaller Kennet and Avon Canal locks. The remaining locks on the canal have brick chambers except at Bath where Bath stone has been used and on the River Avon Navigation section where a different local stone was employed. The gates are of timber with wooden paddles; gates, paddles and side-sluices are hand operated. Softwoods were used for some gate replacements during the years of railway ownership, causing their subsequent collapse during years of non-use. They have now been replaced by hardwood on the Cruising sections and those lengths of the Remainder sections which are in use.

9. The steepest descent on the canal occurred at Caen Hill just west of Devizes where the main flight of sixteen locks involved a level change of 40m. The locks were located close together to facilitate this, storage pounds between locks being constructed at right angles to the canal. The locks and pounds are now de-watered and lock gates have mostly disappeared.

10. Water supply from the Reading to Kintbury section of the canal is plentiful and comes from the River Kennet, control being effected by means of weirs and sluices most of which are in a variety of private ownership, with no legal obligation to safeguard levels in the canal. A reservoir, Wilton Water is located just to the east of the summit at about mid-level of the Crofton flight of locks. It feeds the canal to the east of this point by gravity, being augmented by gravity supplies from two small streams between Crofton and Newbury. A pumping station at Crofton lifts water from the reservoir to the summit section to the west, thereby feeding a 42km length of canal from Froxfield to Seend, comprising 9km and sixteen locks to the east and 33km and thirty three locks

to the west. The reservoir is fed by springs in its bed; it is badly silted up and its present capacity is probably less than 4.5Ml. From Seend to Bath there are two small indifferent gravity supplies from streams, and a more plentiful pumped supply from the River Avon at Claverton. Water supply has always been a problem on this central section of the canal; it would again be so if more extensive lengths were put back into use. Although now replaced by electric and diesel pumps respectively the original pumps at Crofton and Claverton are preserved and are of industrial archaeological interest; both incorporate beam engines with Watts parallel linkage control, the former being driven by steam and the latter by a wooden water wheel.

11. The canalised river section east of Kintbury makes an important contribution to flood control in the area, canal outfall weirs and sluices being used in conjunction with river weirs and slucies for this purpose. Close liaison is maintained between BWB, the Water Authority and riparian owners for this purpose. The central section is in more hilly country, not subject to flooding; much of it is located on side-long ground and does assist natural overland drainage.

12. The biggest commercial water abstractor is the Colthrop Paper Mills near Newbury who return the water to the canal after use and treatment. 14 Ml/day is abstracted by the Water Authority for domestic use near Reading, and there are a small number of adjacent landowners who use small quantties for irrigation.

13. In general, the canal sections were constructed with earth banks; the eastern sections were unlined but those to the west were lined with clay and also provided with a clay 'gutter' on each side where the canal is on embankment. Despite this, leakage has always been a problem on the Western section particularly in the vicinity of Bradford on Avon where the canal is currently kept de-watered over a length of 4km for this reason. Otherwise, embankments and cuttings are generally in good condition although one slip has occurred in recent years in the steep hillside above the canal in the de-watered section mentioned above. This slip may have been caused by the activities of a building contractor, and material still fills the canal. In places the sides of the canal have been strengthened by steel sheet piling or trench sheeting, but this is infrequent, and mainly at places on canalised river sections where erosion has been caused by localised river currents. On the lengths in water, a bank of reeds is often left to protect the banks from erosion.

14. A towpath extends for the full length of the canal between Reading and Bath with the exception of the Savernake tunnel; in general there is no towpath on the River Avon Navigation although access to the river is not difficult anywhere along its length. The towpath is reasonably well maintained even on the unused and de-watered sections of the canal; it is suitable for maintenance vehicles over some sections and for pedestrians everywhere.

15. The whole of the canal is within the Gloucester Area. West of Mill Bridge, Great Bedwyn, the canal is under the immediate control of the Devizes Section Inspector, whilst east of there it is in the Newbury Section, which is based at Padworth Yard. Dredging equipment is hired, as and when necessary.

16. The river navigations are both well patronised by pleasure craft and by other amenity users; the length of artificial cuts, less so. The gradual extension of the cruiseway does not appear to have led to any dramatic upturn of craft using the canal. Nevertheless, the number of people using the canal for recreational purposes is substantial and would probably increase were the canal to be fully restored.

17. An outstanding feature of the canal is the quality of its architecture. There are no less than twenty six 'listed' structures, including bridges, locks and houses. Nineteen of them occur in Bath, where the canal takes a particularly attractive route through the town.

13 Bridgwater and Taunton Canal

Category: Remainder 23km
Map: Plate 12 Profile: Figure 8

1. This canal stretches from Taunton to Bridgwater in the County of Somerset. It leaves Taunton in an easterly direction, but turns northwards at Creech St. Michael where, for a short period in its history, it was joined by a canal from Chard, 22km to the south. It passes close to several other villages but in general is located in open agricultural country. It is in the form of an artificial channel for the whole of its length and links the River Tone at Taunton with the River Parrett at Bridgwater; it has no other branches or connections. Over its 22.5km length, the canal falls approximately 7.25m by means of four single locks. A fifth lock connects the canal directly with the River Tone, but at its northern end its connection with the River Parrett is via a tidal basin and docks with associated locks. These are in the ownership of British Rail but are not in use, and the river locks have been closed off by concrete barriers.

2. This canal was conceived as part of a much larger scheme, which was never wholly implemented, to link the Bristol Channel with the English Channel. The River Parrett, which is tidal to several miles upstream of Bridgwater, was to provide the initial navigation of the River Tone, followed by an artificial canal to Taunton and a length of river navigation and finally by an artificial canal to Topsham on the River Exe estuary downstream from Exeter. Although an Act in 1796 authorised the construction of the section from Taunton to Topsham together with a branch from Burlescombe, on that canal, to Tiverton, only the section between Taunton and Tiverton was built. The length between Lowdells (near Burlescombe) was closed in 1864, whilst the remainder, known as the Grand Western Canal, passed through the successive ownership of the railways and BWB, to Devon County Council. Meanwhile, in 1811, an artificial canal linking Taunton and the River Parrett at Huntworth, just south of Bridgewater was constructed. In 1824, the canal company took over the powers of the River Tone Conservators and under an Act of 1837, constructed an extension to Bridgwater, a dock and an entrance lock from the River Parrett, thus closing the river access to Huntworth. The branch from Creech St. Michael to Chard (the Chard Canal) was opened in 1842 and closed in 1865; little now survives.

3. The dimensions of the locks are such as to have limited their use to vessels no wider than 3.96m, nor longer than 16.5m, nor with draught greater than 1.22m (lock sills are about 1.20m deep).

4. There are thirty four road bridges across the canal, one railway bridge and one motorway viaduct, and another motorway bridge is under construction. BWB are responsible for the maintenance of fourteen highway bridges and fourteen accommodation bridges, the rest being the responsibility of others. Most of the highway bridges are either of brick arch or steel girder construction; one has been strengthened by a reinforced concrete deck. There are twelve timber bridges, two of which carry public roads, and all of which restrict the headroom on the canal, sometimes to as little as 0.6m. They were constructed at the end of the second World War to replace the original swing bridges which had been demolished when the canal was prepared as a line of defence against invasion forces. There are no tunnels or aqueducts on the canal and only five locks with quite small lifts (no great than 1.8m). Chambers are constructed in brick and gates of timber.

5. The canal is generally located on low embankment or in shallow cutting, but in Bridgwater, for about 500m, it passes through a heavily built up area in deep cutting. The sides of this cutting are supported by masonry retaining walls and in recent years slips have occurred. Remedial work has included patching these walls and strutting them apart above the level of the towpath and in the canal itself below water level.

6. Whilst a small amount of water is brought into the canal by Durleigh Brook in Taunton, by far the main quantity is fed in from the River Tone at Firepool lock in Taunton. The intake is through ground paddles which can be set to a predetermined opening, the water being passed down the canal by using similar arrangements at the other locks. At one time, this intake was supplemented by pumps taking water from the River Tone downstream of Creech St. Michael; the pumphouse is now disused and derelict.

7. In former years, the main user of water from the canal was the Railways Board at Bridgwater Docks, the water was used partly as the transporting medium for sluicing and dredged accumulations of silt in the dock through the discharging culvert. Currently, the main user is Wessex Water Authority which extracts up to 16 Ml/ day from the canal at Taunton.

8. Except in the built up area of Bridgwater where the towpath is supported by masonry walls, no special bank protection has been provided; in the absence of craft the sedges and reeds growing alongside the banks fulfil this function.

9. Minimum maintenance only is carried out using a small work force and depot at Durston. The foreman in charge can call on the maintenance workshops at Devizes for assistance when necessary.

10. Activity on the canal itself is limited to a few rowing boats and canoes, the unworkable locks and low bridges preventing more extensive use. The towpath which is scheduled as a public right of way provides a pleasant walk over much of its length. It is understood that Somerset County Council have announced a proposal to raise the bridges to 1.07m headroom, thus making the canal suitable for through navigation by craft of limited dimensions.

14a Monmouthshire and Brecon Canal

Category: Remainder 56km
Map: Plate 13 Profile: Figure 8

1. From Brecon, the canal follows the valley of the River Usk in a generally southerly direction. After passing near to Crickhowell and Abergavenny, the canal eventually reaches Pontypool and the current limit of the Board's jurisdiction. This limit occurs immediately south of Solomans Bridge, Sebastopol (Bridge 47). The bridge to the north of this, Crown Bridge, is culverted thus presenting a barrier to navigation. In fact, the official limit of navigation is Jockey Bridge (Bridge 55), and the channel between these two points is somewhat silted. South of Solomans Bridge, the main line to Newport and the Crumlin Branch have all been disposed of to Local Authorities and others. There is an obligation on these bodies to allow water to pass for sale to industrial users on the lower length of the main line. There are no connections to other waterways.

2. This canal is an amalgamation of two separate concerns, the Monmouthshire Canal and the Brecknock and Abergavenny Canal. The former concern was authorised by an Act of 1792 to provide water transport from industries of the valleys to Newport Docks. The main line rose from Newport to Pontnewydd with a branch to Crumlin. Although only authorised a year later, the Brecknock and Abergavenny Canal was not completed until 1812. The waterways connected at the Pontymoile Basin at Pontypool and both were in turn connected to various quarries and mines by an extensive network of tramways. In 1865, the two companies amalgamated and fifteen years later, the combined company was taken over by the Great Western Railway. Progressive closure of the canal ensued until the present situation was reached in 1962, commercial traffic having ceased as long ago as 1933. Since 1962, restoration of the canal to navigable standards has been carried out with financial assistance from county councils. The canal was officially reopened to navigation from Pontypool to Brecon in 1970.

3. Only six locks remain within the Board's jurisdiction, and five of these are concentrated near Llangynidr. They are of an unusual size, presenting limiting dimensions of 19.5m by 2.74m with 1.32m over the sill. In fact, the length of craft using the canal is restricted to about 16.5m (for craft of 2.13m beam) by a sharp bend introduced into the channel at Gilwern when a connection to the 'Heads of the Valleys' road was constructed some years ago. The clearance under some bridges of 1.70m presents a further restriction to through navigation.

4. There are over one hundred and twenty bridges crossing the Board's length, of which thirty seven carrying public roads and sixty seven accommodation bridges are the responsibility of the Board. The most common type of construction is stone arch, but there are five drawbridges towards the north end of the canal. Four of these are accommodation bridges of timber construction, but one at Talybont is a modern electrically-operated bridge carrying a minor road. Additionally, the Board still has responsibility for several bridges across the disposed of length of the Main Line and the Crumlin Branch. The five public road bridges involved could usefully be transferred to the relevant local authorities.

5. Eighteen aqueducts occur on the canal, only one of which can be deemed to be a major structure. This is the four arch masonry structure which carried the canal across the River Usk near Brecon. It is a 'listed' structure. Nine of the others carry the canal over streams running from the high ground west of the canal into the River Usk.

6. Ashford Tunnel near Talybont is the only one on the canal; it is 343m long and lined in stone. There is no towpath and the waterway is only 3.15m wide, thus allowing boats to pass in only one direction at a time.

7. The primary water supply is derived from the River Usk at Brecon. A 200m long weir enables water to be diverted through a 1.22m diameter culvert, about 1km long, to the head of the canal. At present, about 23 Ml/day is abstracted from the river, but apparently up to four times this quantity has been abstracted in the past. Secondary supplies may be obtained by diverting water from streams which flow under the canal, and the large number flowing down the hillside which discharge directly into the canal. The quality of the water is good and there is no pollution problem. It is all passed down to the lower length of the canal (not now the Board's maintenance responsibility), where there are substantial sales to industrial users.

8. The canal is in the South Wales Section of the Gloucester Area. The Section Inspector has offices in the disused railway station at Govilon and a maintenance yard at Llangynidr. Dredging equipment consists of a land-based grab dredger which is sufficient for present needs, but there are lengths of the canal where access is very difficult. Siltation occurs particularly where hillside streams enter the canal. South of Jockey Bridge, the canal is heavily silted and shallow, and considerable tonnages would have to be removed to bring it up to a full navigable standard.

9. Bank erosion is not a serious problem, but bed and bank leakage is. There has been a long history of trouble on the length of contour canal, where seepage occurs regularly on the downhill side. This seepage has led to subsidence of the bed on a number of occasions. There was a major breach near Llanfoist earlier this year which caused much damage to surrounding property and the closure of a section of the canal for several months.

10. Trees line long lengths of the canal and present a continuing maintenance problem. Those on the cut side of the canal are prone to overhanging the canal, and branches are constantly falling in. On the embankment side, the roots of full grown trees present an obvious danger should the trees collapse, whilst heavy vegetation inhibits inspection of the banks for slips or leaks. Some of the lower lengths of the canal have also had weed growth problems.

11. Although mining subsidence did affect the Crumlin Branch, there are no problems, on the length currently within the Board's jurisidiction.

12. The amenity attractions of this canal are many. South of Llanfoist the cruising length of the canal forms the boundary of the Brecon Beacons National Park and north of there it is wholly within the Park. The number of cruising craft on the canal has increased considerably since 1970. Most of the usual facilities for pleasure craft are provided, although there is a scarcity of such facilities within the vicinity of Brecon. The canal was recently restocked with fish so that the number of anglers using the canal can be expected to increase.

13. Although officially a 'remainder' category waterway, this canal is now 'de facto' a cruising canal. If the culvert at Crown Bridge were removed, it would be possible to extend cruising down to Cwmbran and thus extend the somewhat limited length available at present.

14b Swansea Canal

Category: Remainder 6km
Map: Plate 13 (inset) Profile: not applicable

1. Originally some 26km long, the canal was authorised under an Act of 1794 to convey coal from the upper Tame Valley to the Docks at Swansea. It was transferred to the Great Western Railway in 1872 and progressively closed down from the late 19th century onwards. Apart from the two short lengths currently in BWB's ownership, which provide water to industry, the remaining lengths were finally closed in 1962.

2. Supplies to the two lengths consist of up to 90 Ml/day from the River Tame near Ystalyfera and up to 7 Ml/day from the Lower Clydach River at Clydach, respectively. Revenue from these sales is substantial and the canal is not used for any other purpose, except for some land drainage.

3. Maintenance is carried out by the South Wales Section of the Gloucester Area, the Section Inspector being based at Govilon on the Monmouthshire and Brecon Canal (14a). There are few structures left: the remaining locks are unusable and most of the bridges have been culverted or disposed of. Two public road bridges do, however, still remain the responsibility of the Board. Spot dredging is carried out as and when required, using the Section's drag line dredger.

15 Gloucester and Sharpness Canal

Category: Commercial 27km & Remainder 1km
Map: Plate 14 Profile: Figure 9

1. The Gloucester and Sharpness Canal extends from the docks at Gloucester to the docks at Sharpness, passing close to the hamlets of Hardwick, Saul, Frampton-on-Severn and Purton. It is 27km long and at the same level throughout; it was constructed to replace a gradually deteriorating river navigation through the shallow and treacherous Severn Estuary. Connections are made with the River Severn Navigation (16) at Gloucester and the Severn Estuary at Sharpness (via their respective docks). If forms a level junction with the Stroudwater Canal at Saul, but this is now disused, save for a short length close to the main canal which serves as a marina.

2. Although the responsibility of the Board, the Gloucester Docks, covering an area of 5.7 ha, and the Sharpness Docks, which occupy 8 ha are excluded from this report. These docks accommodate vessels up to 750 tonnes and 9,000 tonnes respectively.

3. Since medieval times the River Severn has provided navigable access to the heart of England. In the second half of the 18th century the demands for such navigation increased with the spread of new canals in the West Midlands. Sandbanks and shifting shoals in the Gloucester area had always been impediments to easy navigation in the lower reaches of the river, and these problems increased as ships became larger. It was therefore decided to by-pass this section of river by the construction of a canal. Work commenced on the canal and Gloucester Docks in 1794 under an Act passed the previous year, authorising its construction from Gloucester to Berkeley Pill. Lack of funds caused work to stop when only 8.5km had been built and the canal was not completed until 1827, after the injection of Government funds following a report and recommendation by Telford that it should be shorter and terminate at Sharpness. The Sharpness Docks were enlarged and modernised in 1847.

4. Constructed initially with a centre depth of 5.49m and a top width of 30.5m, this was at the time the broadest and deepest canal in the world. The relatively narrow central bed width was subsequently increased to baout 7.62m but with an average depth of about 4.27m. The ruling width for vessels is now 9.14m however, due to the narrowing that occurs at the various swing bridges that have been constructed. At Sharpness, the sea lock is 97.5m long by 18.3m wide with 7.32m over the sill, thus allowing large vessels to enter the docks. Gloucester Lock, one of the many listed structures in the Gloucester Docks complex, allows vessels to lock down to the River Severn and is 43.4m by 9.22m with 2.87m normally available over the sill.

5. There are thirteen swing bridges, all single span and hand operated, nine of which carry public highways. There is also one fixed bridge maintained by the Board, at Llanthony, Gloucester, and four crossings maintained by other authorites. There are no locks, other than those connecting the docks to the rivers, no tunnels and no aqueducts (other than those carrying five streams in inverted syphons). For most of its length the canal passes through flat terrain and is constructed on low embankment or in shallow cutting. Just south of Gloucester it is in a deeper cutting for about 1.5km with the towpath on a berm in the wall of the cutting.

6. The canal is perched well above the normal level of the River Severn (3.66m high at Gloucester). To replace water used for locking at either end it relies on gravity flow from the River Cam and River Frome (via the remaining section of the Stroudwater Canal), supplemented by water pumped up from the River Severn at Llanthony near Gloucester. This latter has become the major source of supply since the advent of Bristol Corporation as the principal customer for water, using its abstraction plant at Purton. It is currently purchasing up to 110Ml/day, but has powers to increase this to 250 Ml/day.

7. The Section Inspector responsible for the canal is based at Sharpness. The Gloucester Area offices and the repair yard are based in the docks at Gloucester. Dredging is the major ongoing task, equipment consisting of a 300 tonnes per hour capacity bucket dredger, a grab dredger, one tug, a discharger and eight 200 tonne hoppers. Siltation occurs at the feeder entries and particularly at Gloucester where the water is pumped up from the River Severn. Dredging arisings are pumped back in to the Severn Estuary, just north of Sharpness, where the canal is immediately adjacent to and above the river. In recent years only one of the dredgers has been available full time and as a result, there is now a considerable backlog of dredging.

8. Over the years the canal banks have been protected by the installation of a wide variety of types of piling. Latterly steel sheet piling has been used exclusively, and now larger piles are having to be used to combat scouring taking place in front of the toe, caused by excessive drag from the wide flat-bottomed tankers using the canal. Some of the older piling will have to be replaced because of this damage. In the past protective work has been concentrated on the more vulnerable embankment section, and this must continue, particular attention being taken to ensure the piles have an adequate freeboard to prevent overtopping by waves caused by the wash from ships. In the future, the cut section close to Gloucester should also be attended to as extensive erosion is taking place.

9. Traffic on the canal is substantial, consisting both of commercial traffic heading for the docks at Gloucester, and through traffic to the River Severn. Commercial traffic consists of oil, timber and general cargoes, but that passing through to the River Severn has fallen in recent years.

10. Despite the somewhat bleak and isolated nature of much of the canal surroundings, some recreational use if made of the canal. For instance, the deep and unpolluted water makes for good angling. Many of the boats based on the canal are sea-going yachts and cruisers which use the canal for moorings. There are moorings and other facilities at Sharpness and Saul Junction. A feature of interest near the canal is the Slimbridge Wildfowl Trust, which attracts many visitors.