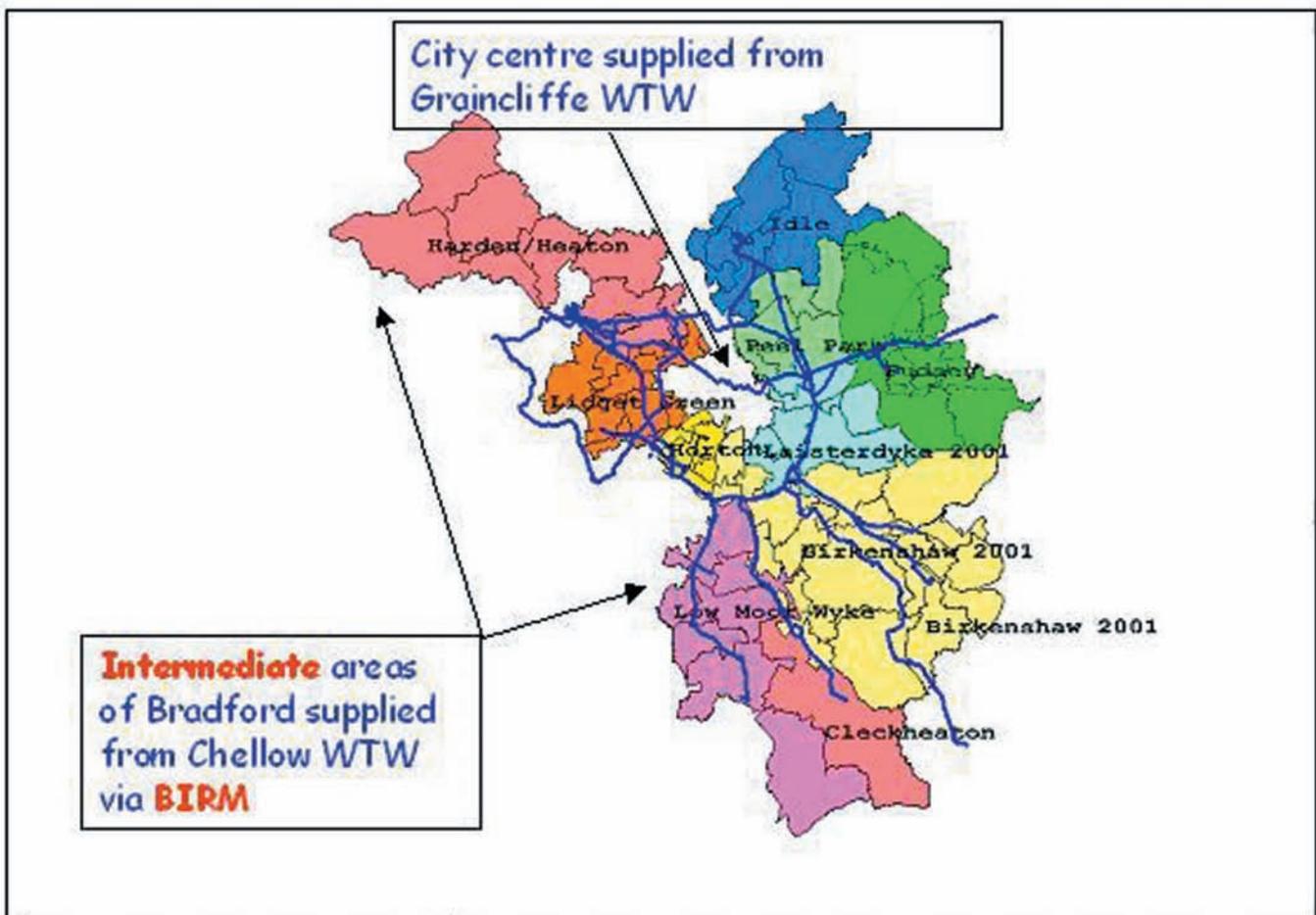


# Bradford Intermediate Ring Main rehabilitation of large dia.mains within city ring road network

by Ian Johnson

**B**radford Intermediate Ring Main (BIRM) is supplied from Chellow Water Treatment Works (AOD256m) from whence it gravitates through large diameter mains ranging in size from 48 inch to 18 inch diameter. The BIRM feeds water to approximately 160,000 properties in Bradford and West Leeds, comprising 125km of pipe. The Ring Main is predominantly located within the Bradford Ring Road network, presenting enormous difficulty in maintaining traffic flow when works are planned on the main. Although not immediately obvious, Bradford is a little like Rome, built on hills. This means there is a great variation in mains pressure throughout the system, occasionally exceeding 100m/hd.



Bradford Intermediate Ring Main (courtesy Yorkshire Water Services).

## Water quality history

Until recently, Chellow WTW for many years produced water high in manganese concentration. This contributed to deposition in trunk and distribution mains systems. Although water quality now leaving the works is fully compliant, with manganese levels virtually eliminated, there remains a deposition legacy from past processes that resurfaces when planned/unplanned flow reversals/velocity changes occur on the network. The BIRM suite of mains has contributed to no less than 15 separate DWI-notifiable incidents during the last five years, some following planned works, whilst others resulted from mains failures. On each occasion several thousand customers experienced dirty water.

## Investigation phase

We knew that pipeline interventions to facilitate removal of pipe

samples to determine internal pipe condition had potential to create widespread discolouration to customers. Therefore, we had to develop a process that would give clear indication of internal pipe condition with sufficient confidence to obtain approval for expenditure to undertake rehabilitation works. The use of top coupons to verify internal pipe lining condition had been previously used, but invariably giving mixed results when lining material became detached from coupons during the drilling process. Therefore, Service Partners, *Balfour Beatty Utilities Limited (BBUL)* approached a number of sub-contractors to develop a process for additionally extracting a bottom coupon at the same location on the pipeline to give greater certainty of lining material. Having established this process was available; we embarked on an extensive coupon-sampling programme to get a clear view of pipeline internal condition across the BIRM.



Clear indication of size and scale of rehabilitation work as section of 36" cast iron main is cut out. (courtesy Yorkshire Water Services).



Coupon extracted without need to isolate main - found to be in need of rehabilitation (courtesy Yorkshire Water Services)



BBUL operatives working on under-pressure tee installation (courtesy Yorkshire Water Services).

A total of 125 sites were identified where top and bottom coupons could be taken. All were extracted successfully without need for mains isolation and without causing water quality issues for our customers. The results of this investigation confirmed 47km of unlined and almost 75km of cement or bitumen lined trunk main.

#### Design criteria & options

A major design consideration for *BBUL* is the location of BIRM within the ring road of Bradford. In addition, rehabilitation works on mains of this size is not commonplace and it is essential that high levels of communication and teamwork exist if all project goals are to be delivered.

The preferred cost-effective solution for unlined mains was agreed as Scrape and Reline using the new Polymeric lining material (PU). A scheme in Sheffield in 2001 had successfully relined a 36" unlined cast iron main. However, limitations of the lining rig kept lining lengths short in comparison to those achieved on smaller diameter mains. *BBUL* have developed a rig capable of relining mains from 4" to 42" in diameter. It is hoped that lining lengths in excess of 150m can be achieved.

Rehabilitation works on large diameter lined mains presents a different issue. Due to the large volumes of water required to employ conventional swabbing methods, we decided that this would not be a viable option. *BBUL* investigated the possibility of using pressure jetting to provide the necessary level of cleaning required, without the need for large volumes of process water. To date (May 2003) over 4km has been successfully cleaned using this method.

#### Construction phase

Work commenced on three large diameter outlet mains from Chellow WTW in April 2002. A high level of proactive customer communication was required on this first section as mains ran through West Bradford Golf Course. Excavations were located to minimise impact on the course, and with agreement of the club committee, works progressed at a satisfactory rate allowing the course to remain open throughout the 6 month construction phase.

Cleaning works undertaken on the 36" cement-lined Eastbound and 900mm outlets were completed successfully and without incident. This was largely due to the use of "*Censar*" water quality monitoring loggers utilised during valve operations. Use of *Censar* has enabled monitoring of water quality (turbidity) during operations of valves on the network, giving visibility to effects of closure or opening.

#### Future construction works

Throughout 2003 and into 2005 we face many challenges relating to the construction phase. Not least, those presented by entry into major traffic arteries to the City of Bradford. Communication with all external parties and key opinion formers has been essential, and will remain so, in ensuring we inform the customers and commuters effectively, aiming to minimise disruption.

We are confident that the team has the capability to undertake remaining elements of the scheme in a professional, caring and customer-focused way, which is a fundamental to delivery of a scheme of this complexity. ■

**Note:** *The author of this article Ian Johnson, is Capital Solutions Manager with Yorkshire Water.*