

## 3 Engineering Assessment

### 3.1

#### ***Background***

The Uttoxeter Canal was completed in 1811 by John Rennie as an extension to the Caldon Canal for the Trent & Mersey Canal Company. It was originally used to transport coal down the Churnet Valley and ultimately to Uttoxeter.

Due to the rural nature of large parts of the route, with no major industrial areas along its length, the canal suffered from financial losses and by the mid 1840s was losing around £1000 per annum. It was decided by the owners that the canal would be closed.

However, before the canal was closed, the Trent & Mersey Canal Company was taken over by the North Staffordshire Railway Company. The canal was officially closed by act of parliament on 15th January 1849, and sections of the route were used to construct the Churnet Valley Railway line.

The Churnet Valley Railway continued to operate until in 1963 it was ear-marked for closure in the 'Beeching Report'. Parts of the route down to Oakamoor continued to run a limited freight service until 1988 when the line was closed entirely. Volunteers have re-opened, in stages, the route between Leek - Brook and Froghall to steam hauled passenger traffic, and the section beyond Froghall continues to be used to gain access to rolling stock storage sidings at the former sand quarry sidings at Oakamoor.

It is not known whether any historical rights for the canal still exist, though given the length of time the canal has been closed, this is unlikely.

The Caldon and Uttoxeter Canal Trust were established in order to try to safeguard the possibility of future restoration of the canal. Their first major success was in securing funding from the Heritage Lottery Fund, in partnership with British Waterways, in order to restore the top lock of the Froghall flight. This was completed and opened in 2005.

### 3.2

#### ***Water management***

While water supply and management of the canal has not been assessed, this will be a significant issue for the canal. Water may be available from the Caldon Canal,

though it is not a guaranteed supply. A number of options are likely to exist for water supply and ultimately this could be addressed.

There are potential opportunities to use the canal to aid flood risk management. This should be investigated in partnership with the EA.

### 3.3

#### ***Route description – Froghall to Denstone***

The Uttoxeter Canal ran roughly north-south from its junction with the Caldon Canal down to Uttoxeter, through the Churnet Valley and then alongside the open floodplain of the River Dove. A schematic illustration of this route can be seen in Figure 1 below.

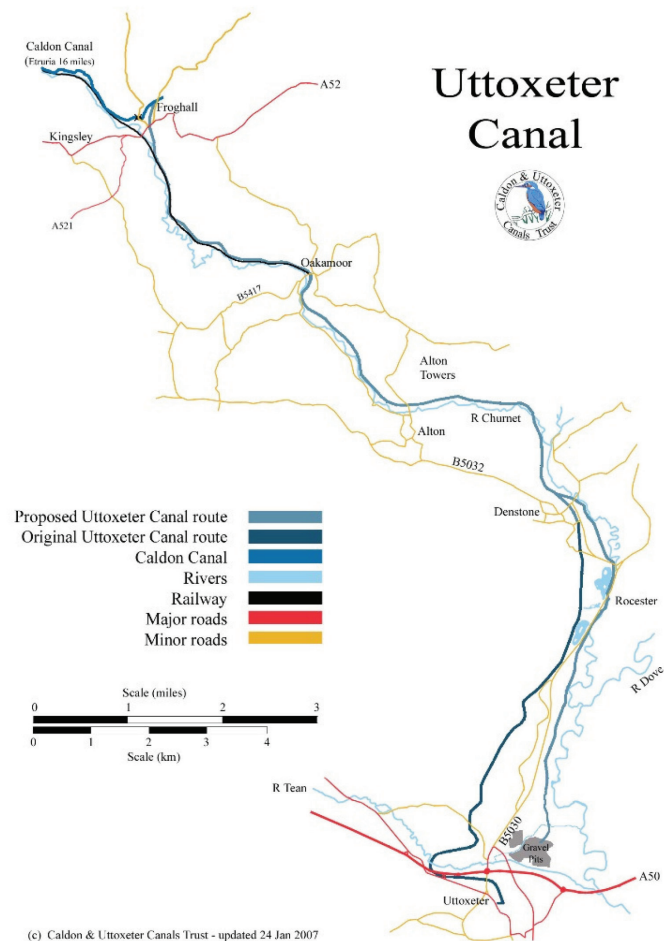


Figure 1 – schematic layout of Uttoxeter Canal route

Along a significant length of the northern section of this route, from Froghall to Denstone, the line of the canal is still relatively open and available, though with a number of constraints now present. Along the southern section of the route, from Denstone to Uttoxeter, there are a number of major obstructions blocking the route, meaning that a new cut is required.

A drawing showing the layout of the proposed route can be seen in Appendix A.

A description of the route and various works anticipated is given in the following sections below.

- Froghall to the A52
- A52 to Oakamoor
- Oakamoor to Alton
- Alton to Denstone

### 3.3.1

#### *Froghall to the A52*

The existing basin at Froghall has a pound level of approximately 126m AOD. The ground south from here slopes relatively steeply down through a light industrial area to the A52.



Figure 2 – Bottom end of Froghall basin

The canal will need to cross the A52 at a level of around 121m AOD. It will therefore be necessary to construct two locks on this slope. It is likely that the existing locks are still present and it may be possible to excavate and restore them. A cost for this refurbishment has been included in the cost estimate.

Along the old line of the canal, three locks were present along this flight, though with the alignment changed, one would now need to be moved to the south of the A52.

A pipeline is shown as being present in this area, running parallel with the canal. There is a chance that this has been laid along the old line of the canal. If this is the case, there appears to be room alongside the pipeline to construct the canal. This would however mean that new locks would be required or the pipeline be diverted. A description of the options for crossing the A52 is given in 3.4.2 below.

### 3.3.2

#### *A52 to Oakamoor*

Once past the A52, the canal would cross through a brownfield site. This area may be contaminated, due to its proximity to a former colour works, and to its recent use by the nearby copper works. A cost for disposal of contaminated material has been included in the cost estimate, though this still poses a significant risk. The channel would head south through this area and pick up the old line of the canal. An existing lock may be present in this location and could be refurbished and reused dropping the pound level to approximately 117m AOD.



Figure 3 – Land owned by nearby copper works

From here the canal would follow its original course south along the Churnet Valley for a number of miles, alongside the existing Churnet Valley Railway line. Due to the constraint of the railway line running generally to the south and west of the canal, a series of embankments, cuttings and retaining walls are likely to be required along this section of the canal.

An existing footpath crosses the line of the canal at grid ref 402752, 346719, where a new footbridge would be required.

From grid ref 402908, 346475 to 403096, 345744 a series of embankments will be required varying in size. Through this area the original line of the canal crossed the railway twice. For the canal restoration alone, this would remain the simplest solution, however, with the railway line now in use, it would be necessary to diverge from the original line and run the canal along the east of the railway between these points. The ground level in this area varies from around 121m to 127m at its highest, some 10 metres above canal water level. The canal would be running through what is currently the railway cutting slope. In this instance it may be necessary to construct a short tunnel through the highest ground (approximately 50 metres long) with cuttings formed at either end.

Beyond grid ref 403096, 345744 the canal would rejoin its original alignment and continue south east past Jackson Wood. Between grid ref 403463, 345455 and 403619, 345401 (some 165 metres) an area of high ground exists. At its highest, this reaches around 125m AOD on the line of the canal, though is commonly closer to 120m AOD. The natural ground slopes up to the north from here at around 1 in 10. It would therefore be possible to construct the canal in a cutting with a side slope of 1 in 3 or 1 in 4 in this location.

At the end of this section, at grid ref 403643, 345387, is an existing pond. A new lock would be required at this location to drop the canal down to 114.5m AOD into or alongside this pond with another lock required some 100 metres south east dropping the canal to 112.0m AOD. This is in the vicinity of the remains of California Lock. This lock is currently visible and it may be possible to restore and reuse this lock rather than constructing a new lock.

The canal then heads towards Key Wood where a section of embankment, approximately 2 -3 metres high and 350 metres long would be required.

Between the end of the embankment at grid ref 404055, 345157 and Oakamoor, the canal runs between Key Wood and the railway track. There appears to be limited but sufficient space for the canal along this section.

Throughout this section, as noted above, the canal runs alongside the now restored Churnet Valley Railway line. When originally constructed, this was a two line railway, however for most of the route only one of these lines is now in use. This presents the possibility that the single track could be moved to the western side of the railway corridor, making additional space available for the new canal channel. This could significantly reduce the cost of construction of the canal and should be looked at jointly with the railway company.

At Oakamoor the original line has been lost beneath a new road with a new way through required. This is discussed under 3.4.3 below.

### *3.3.3*

#### *Oakamoor to Alton*

Once past Oakamoor and the B5417, the canal would run through the open area of grassland which runs alongside the river. Through this section, the pound level would be 106m AOD.





Figure 4 – Flat parkland south of Oakamoor

An 11kV underground electricity cable follows the line of the canal from Oakamoor to Alton. It is likely to be prohibitively expensive to divert or re-lay this cable. It would therefore be necessary to construct the canal adjacent to the cable with it being moved only where required.

The canal follows an existing footpath through the park area with some small areas of minor cutting or embankment required as necessary until it reaches the old Oakamoor Station.

At this location, the canal could run either through the old station between the platforms, or run to the north east of the station. Again this will have an impact on the potential restoration of the railway in the future. The area to the north east is at a ground level of around 109m AOD and would therefore necessitate a 3 metre deep cutting over a length of around 150 metres.



Figure 5 – Oakamoor Station looking south

From here the canal would make its way south east on the north east side of the railway. As the canal would be running through sidelong ground, cuttings would be required along the north east side. Along this section at around grid ref 405569, 344205, a lock would be required dropping the canal down to 103.5m AOD in order to keep to the bottom boundary of Mather Wood. Between Mather Wood and the railway, a series of water filled ditches and ponds exist which seem likely to have been the original canal. The new line of the canal would follow along and join these existing water bodies. Again along this section, some cutting is likely to be required on the north east side.

At grid ref 406333, 343335 the ground to the east of the canal rises sharply to form a 130 metre length of 25 metre high crags. The canal would need to run at the foot of these crags between them and the railway. Some work would be required to assess their long term stability to ensure integrity of the canal and the safety of boat users.

From here the canal continues south via another lock, dropping down to 97.5m AOD, toward Alton Station and Farley Road. This area is addressed in section 3.2.5 below. It should be noted that the section through Alton station would be simple for the canal to pass through if no allowance is made for future restoration of the railway. In making provision for the railway little additional cost would be



involved if the canal were to remain to the north of the railway, though this would sever the railway from the station buildings and access. By allowing the railway to remain to the north, the canal will be required to cross to the south then back again, leading to significant increased costs.

Once leaving Alton, a lock is required to drop the canal to 95m AOD. From here the canal appears to be in existence and in water most of the way to Crumpwood Weir, a distance of around 2 km. Along this section, there is likely to be significant clearance, dredging and possibly some relining work required, though this work could be undertaken by well organised and resourced volunteers. Some work will also be required to refurbish or construct access and foot bridges.

To the north of Crumpwood Weir is an existing lock. This appears to be in restorable condition and would drop the canal down to 92.5m AOD at which point the pound level would be in continuity with the River Churnet in order to allow boats to cross as per original alignment.

An access track currently crosses the canal just upstream of this lock. This access track would be severed by the canal and a moving bridge would be required to provide continued access. An existing water main is understood to run along this track. This would require diversion below the canal.

From Crumpwood Weir south, the canal could simply continue along its original line until it reaches Denstone. From here, the route is addressed in section 3.5 below.

### **3.4**

#### ***Route constraints – Froghall to Denstone***

This section of the route covers approximately 11.5 km. While the route is largely clear, there are a number of major / significant constraints which have been identified so far, each of which is addressed below. These are:

- Froghall Tunnel
- A52 at Froghall
- River Churnet at Oakamoor
- The existing weir and road crossing in Oakamoor
- Oakamoor station
- Existing tunnel at Alton
- Crumpwood weir

#### 3.4.1

##### *Froghall Tunnel*

The existing tunnel at Froghall has suffered from some deformation in the past. This has resulted in a reduced air draft which now poses a constraint to navigation for many craft.



Figure 6 – Froghall Tunnel western entrance

While this does not currently form a major problem as only a short stretch of the Caldon Canal lies beyond the tunnel, on restoration of the Uttoxeter Canal, the limits of navigation at Froghall tunnel would act to constrain the amount of boat traffic on the Uttoxeter Canal.

As part of the restoration of the Uttoxeter Canal, it is suggested that improvements to Froghall Tunnel are carried out.

#### 3.4.2

##### *A52 at Froghall*

At this location, the A52 is on a relatively steep slope of around 1 in 12, running down hill to its intersection with the B5053 at which point it once again begins to climb.

There is therefore limited scope to adjust the road levels. In order for the canal to cross with sufficient air draft, it would be necessary for the canal to pass the road approximately 70 metres further north east, higher up the slope of the road, than

the original alignment. To avoid the need to lock up to natural ground level once passed the road, thereby creating a short top pound, it would be necessary to construct either a retaining wall or a tunnel for a length of around 75 metres before coming out to normal ground levels and rejoining the old line of the canal.

### 3.4.3

#### *Oakamoor*

As the canal enters Oakamoor, the old line ran along what is now Churnet Road and beneath the B5417, through an arched bridge remains which can now be seen in the adjacent pub garden.



Figure 7 – Original route along now Churnet Road



Figure 8 – Old arch bridge visible in pub garden

This route is no longer available so a new route through is required. There appears to be three potential options available. These are to:

- a) lock down into and canalise the River Churnet;
- b) run through the old railway tunnel;
- c) cross the River Churnet and run along the south west bank.

(a) Canalisation of the River Churnet

While technically feasible, this solution poses a number of difficulties. The technical solution would require a lock to be constructed to drop the canal into the river probably at the bend in the river adjacent to Woodside Cottages. Some dredging work may then be required in the river to provide a navigable depth.

It would then be necessary to lock down at the weir adjacent to the B5417 to allow the canal to run through an existing arch of the bridge.





Figure 9 – Possible lock location alongside weir



Figure 10 – Possible access below B5417

From here, the river becomes much narrower and faster flowing so it would be necessary to lock up immediately and into the flat parkland area.

This would create a new top pound for the canal which would require a source of water. It may be possible to supply this by installing a balancing pipe between the two canal pounds upstream of the weir and downstream of the river.

#### *Constraints*

This option is likely to require significant work in terms of flood risk modelling and ecological investigations in order to obtain approval from the Environment Agency. There are likely to be major issues with respect to loss of habitat and with water quality from mixing of lower quality canal water with river water.

#### (b) Use of the railway tunnel

While on face value this appears an attractive option, it is not judged at this stage to be feasible.

The length of the tunnel is approximately 450 metres. Across this length, the survey data available shows a fall from north west to south east of around 2.5 metres. It would therefore be necessary to either build levels up inside the tunnel effectively running on an embankment within the tunnel, or construct a lock within the tunnel. Given the age of the tunnel, both of these options would appear to pose significant risk.

This option would also have a significant impact on the feasibility of restoration of the railway.

*Without further detailed structural investigations it is not felt that the use of the tunnel is viable.*

#### (c) Crossing the River Churnet

An area of land is present to the south west of the river.





Figure 11 – View of possible route on far side of River Churnet

It appears that it would be possible to construct an aqueduct over the river upstream of Oakamoor, adjacent to the railway viaduct. The canal would then run alongside the river and between the existing war memorial and the Old Police House. The canal would then lock down north of the B5417 with a moving bridge constructed on the B5417. It would then be necessary to construct an aqueduct over the river downstream of the B5417 before locking down into the parkland area.

#### *Constraints*

The three main constraints of this option are the air-draft below the aqueducts, above the 1 in 100 year water level in the river, land ownership issues in the area north of the B5417 and the acceptability of a moving bridge being constructed on the B5417. It is likely that traffic lights and warning signs would be required some distance from the bridge to alert approaching drivers. If this is a heavily used route, this may also cause delays during busy periods.

This is unlikely to be a viable option due to the level of traffic use on the B5417.

## Conclusion

At present, it seems that Option A, or a variant of this is the only viable solution. It is recommended that a more detailed options assessment is carried out to determine the preferred solution.

### 3.4.4

#### *Oakamoor station*

With the loss of the original line of the canal through Oakamoor, the pound level of the restored canal is likely to be different to the original. In order to fit both canal and railway through this area, it is likely that the route of the canal would need to be moved north east slightly. As the ground levels in the area are slightly higher, a cutting or retaining walls would be required.

#### *Constraints*

While the construction of a cutting or retaining walls will increase the cost of the restoration, it is in no way an obstruction to the restoration.

### 3.4.5

#### *Alton Station and bridge*

It is not clear what original route the canal took past Alton Station and below Farley Lane. Three possible options appear to exist for the restored canal, though only one of these would seem to be a feasible option. The three options are:

- Running to the north of Alton Station through a new tunnel
- Running along the line of the railway and through the existing bridge
- Running to the south Alton Station with a new bridge constructed

#### (a) Running north of Alton Station

This would require the canal to branch to the north of Alton Station, before reaching the platform. The tunnel would then run through the gap between the station buildings and The Lodge on the east side of Farley Road. From map inspection, it appears this tunnel would need to be approximately 400-450 metres long.

#### *Constraints*

Due to the complex nature of tunnelling works, this would require significant further work to determine whether it was a feasible option. It would also have significant cost implications.

*This is not judged to be a feasible option at this time.*

(b) Running adjacent to Alton Station

Alton Station was part of the former currently abandoned Churnet Valley Railway. The Station has two through platforms with a width of around 6.5 to 7 metres. The southern side of the southern platform acted as a bay platform for excursion trains to Alton Towers. The station has two platforms with a clear width between these two platforms of around 6.5 to 7 metres.

If the railway were not to be restored, there would be ample room for the canal to run along the old line of the railway and through the existing bridge arch below Farley Road.

If the railway were to be restored in the future, it may be necessary to remove the southern platform to allow the canal to run through this area. This would require the canal to cross below the railway some way upstream and would likely require some raising of the railway. There would be sufficient space through the existing bridge arch below Farley Road for a 2.5 metre wide canal channel to run alongside a single track.

*Constraints*

To the east of Farley Road, the canal and railway track diverge with the canal moving further north. Through the arch below Farley Road, the canal would be likely to be on the south of the railway track. In order to allow the canal and railway to cross, the lock shown slightly to the east of this location would need to be moved west, and the railway raised slightly. Due to the oblique angle at which the canal would pass below the railway, this would lead to a relatively expensive bridge structure being required, possibly in the order of £600k - £750k.

(c) Running south of Alton Station

An area of rough land exists to the south of Alton Station, between it and the River Churnet. It would be possible for the canal to run through this area. It would then be necessary for a new bridge to be constructed below Farley Road. Once past Farley Road, it appears that it would then be necessary for a section of the old mill building to be demolished.

*Constraints*

Once past Farley Road and the Mill, it would be necessary for the canal to cross below the railway. Should the railway be restored, this would require a lock and

new bridge to allow the canal level to be adjusted and allow it to pass below the railway at an appropriate level.

#### 3.4.6

##### *Crumpwood weir*

Approximately 2 km east of Alton, the canal crossed the River Churnet. This crossing was made at Crumpwood Weir, where boats would cross along the top of the weir.



Figure 12 – Crumpwood Weir

The existing weir, which it is understood is now a listed structure, is still in fair condition with the remains of the lock structures on either side still apparent. From a visual inspection there appears to be no particular difficulty in restoring the weir crossing and locks to working condition.

##### *Constraints*

Additional work will be required in order to assess flood risk and boater safety in order to obtain consents from the EA.

River crossings carry with them inherent H&S risks that would need to be addressed as part of the restoration. The risk of boats becoming trapped against the weir would need to be assessed with mitigation measures put in place.

It is likely that these issues can be addressed by inclusion of electronic water level monitoring combined with a locking system on the lock gates to prevent boaters entering this section when it may be unsafe to do so.

Work would also be required in order to determine whether any navigation rights currently exist.

### **3.5**

#### ***Route options – Denstone to Uttoxeter***

Once the canal reaches Denstone, the original alignment has been almost entirely lost. A new route will therefore be required. A number of options have been identified and assessed in general terms as part of this study. These can be seen on the plan below.