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# Periodic Drying of the Grantham Canal from Gamston Lock to Lady Bay – The Likely Causes and Possible Solutions

September 2024

## **Background**

Since 2018, water levels in the last pound of the Grantham Canal (Gamston Lock to Lady Bay Bridge) have declined significantly, if not completely, during periods of low rainfall (typically summer and late autumn). This has attracted widespread concern and interest amongst local residents who have taken to social media to instigate community action in various forms in an attempt to understand and rectify the situation.

The intention here is to summarise the known key events that have led to the declining water levels in the hope that it helps to provide technical direction to those local residents and canal enthusiasts who are able and willing to lend their time to the ongoing repair, maintenance and future of the canal and all that thrives within.

Whilst providing a reasonably comprehensive account of the key events to the author's best knowledge, there remains the possibility that some events are missed. This document therefore represents the most complete summary available at this time and should be read with this in mind.

## **Pre-2018**

The western end of the canal (from near Hollygate Lane in Cotgrave to West Bridgford) has long been disconnected from the rest of the canal (Kinoulton to Grantham) in terms of water supply. This is due to a now "dry section" of the canal, which was originally constructed over shallow gypsum deposits – a soluble rock prone to dissolution. Solution features in the gypsum, coupled with chemical reaction between the gypsum and clay-lining of the canal, contributed to this section being unable to retain water.

The severed western end remained water-filled as it was fed by a number of productive sources:

- Hollygate Brook at Cotgrave taking surface water runoff from nearby fields
- Cotgrave coal mine dewatering
- Cotgrave Brook at Skinners Lock

Cotgrave coal mining ceased in 1991. The contribution of the Hollygate Brook is believed to have been significantly reduced after widening of the A46 between 2009 – 2012 resulting from modifications to the surface water runoff regime. Therefore, Cotgrave Brook was the remaining primary feed.

Fortunately, while Cotgrave Brook is a relatively small watercourse, its flow volume was bolstered by the discharge of treated water from a Severn Trent Water (STW) treatment facility located on Woodgate Lane in Cotgrave. The discharge point from this facility was located at National Grid Reference SK 6386 3568, which ultimately fed into the Cotgrave Brook (see excerpt from STW discharge consent in Figure 1).

STW were consented to discharge up to 2 million litres of treated effluent per day during dry weather periods and up to 5.3 million litres per day during normal weather conditions at this location. This is a volume of water equivalent of up to two Olympic sized swimming pools per day.

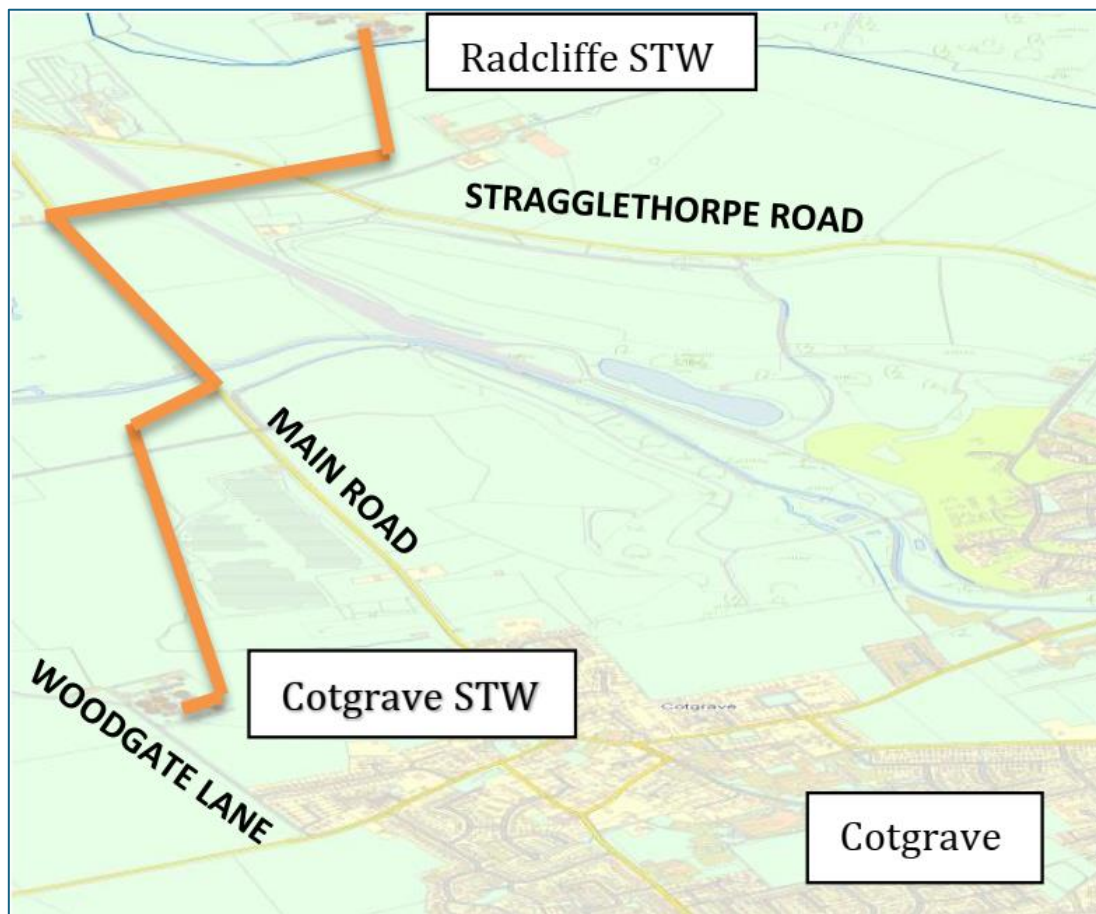


*Figure 1. Excerpt from STW discharge consent illustrating the location of the discharge point into drainage channel which flowed north into Cotgrave Brook, which in turn fed the Grantham Canal at Skinners Lock Cottage*

### **During 2018**

During 2018, work commenced to construct a pipeline allowing the STW treatment facility in Cotgrave to send its water to another treatment facility in Radcliffe on Trent. From here, the treated water is discharged directly to the River Trent. The works on the entire pipeline commenced around April of 2018 and were undertaken by a contractor called NMCN. The route

of the pipeline was set out in a bulletin issued by STW in early 2018, a copy of which is reproduced in Figure 2.



*Figure 2. Excerpt from Severn Trent Water Bulletin Board Reference 6129124. Project Title: Radcliffe / Cotgrave STW Quality released in early 2018*

The works were required to improve the quality of the treated water being discharged to the Cotgrave Brook to ensure the water quality met tightened standards imposed through the EU Water Framework Directive (WFD) for phosphorus, ammonia and Biological Oxygen Demand. The STW treatment facility at Cotgrave could not treat to these tightened standards without significant redevelopment. Therefore, the Environment Agency identified the option of discharging the treated water directly into the River Trent as it has less stringent discharge permit requirements.

A screening assessment of the pipeline proposal undertaken by Fisher German LLP (dated April 2017) concluded that the proposal did not have significant adverse environmental impacts. Therefore, it was decided that the pipeline did not require an Environmental Impact Assessment (EIA). The pipeline was installed under permitted development rights afforded to STW for developments undertaken below ground level required in connection with the improvement of an outfall pipe.

Unfortunately, the impact of the proposal to cease the discharge of treated water into the Cotgrave Brook on sustaining the water levels in the Grantham canal along its route to West

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Bridgford was not given any consideration in the screening assessment. Given the subsequent environmental impact on the canal and its wildlife, this was clearly an oversight within the assessment.

### **Post-2018**

Post operation of the pipeline, the western section of the Grantham Canal has been vulnerable to water level decline during drier months when the Cotgrave Brook struggles to sustain the canals need for water.

The water loss is less obvious in the pounds between Gamston Lock and Cotgrave as these pounds are the immediate beneficiaries of the now reduced inputs from the Cotgrave Brook at Skinners Lock. Furthermore, the underlying superficial geology for these pounds is potentially locally less permeable, which may help to reduce losses of water via seepage. In addition, the section of Grantham canal through Gamston is understood to have benefited from improvements funded by developers as part of a planning obligation associated with the development of the Gamston housing estate in the 1980s, which may have contributed to its integrity and ability to retain water.

Unfortunately, the final pound of the Grantham canal (Gamston Lock to Lady Bay), which is largely constructed above the shallow permeable sand and gravels of the Holme Pierrepont River terrace deposit suffers much greater water loss resulting from enhanced seepage coupled with the ever-increasing evaporation and transpiration during the summer months influenced by climate change.

Pioneering work undertaken by a group of local enthusiasts in 2020 (undertaken under the name of 'Friends of Lady Bay Canal' which is essentially a precursor to later-forming local groups with similar objectives to support the Canal) established that the canal water levels declined by approximately 15mm/day during a dry period in September of that year (water levels declined by 220mm over 15 consecutive days). This equated to a loss of approximately 192,000 litres of water per day, suggesting that the historically large discharges of treated water from the STW facility in Cotgrave had likely masked leakage problems from the canal by keeping it topped-up, probably for many years.

### **Future Direction for Enhancing Water Supply**

Short of excavating and re-lining the 227-year-old section of canal from Gamston Lock to the Lady Bay junction, there is no effective way to stop this section of the canal from losing water due to seepage (remembering that clay is not 'impermeable', it just has a 'low permeability'). Also, it is unlikely that this section of the canal was originally lined with modern specification puddle clay, but rather local clay excavated from alluvium that is naturally sandy in texture and consequently more permeable. Therefore, at present the section of canal from Gamston Lock to Lady Bay is acting like a large linear soak-away (or arguably a form of sustainable urban drainage to use modern language in urban planning).

While repairs on large detectable leaks within the Gamston Lock to Lady Bay section will have great value for water retention, a more effective solution (assuming we don't want to accept the

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change and adapt to the canal being a transient water body / wetland / linear soak-away) is to replace the lost source of water supply during the drier months when it is needed most.

Possible options to increase the water supply into the canal are as follows:

- Improved surface water runoff interception – much of the canal is constructed in embankment rather than cutting, meaning that the surrounding land and surface water runoff is unable to be diverted into the canal via gravitational flow. Instead, this runoff is diverted into watercourses that are culverted beneath the canal and ultimately discharge into the River Trent. At the strategic scale, this could be re-evaluated to identify areas of the canal that are in cutting and to ensure the canal's interception of surface water runoff is maximised in these areas. Good examples of where this could work well is the Hollygate Park estate in Cotgrave, the proposed residential development just east of the A52 at Tollerton, and the land north of the A46 feeding the Hollygate Brook.
- Surface water abstraction – whilst fraught with Regulatory challenge, surface water abstraction from the River Trent at Lock 1, or from the various brooks that flow beneath the canal remains a technically viable option. Constraints associated with this relate to the surface water quality, which in some cases may lead to effective 'pollution' of the canal.
- Groundwater abstraction – the Coal Measures strata in the Cotgrave area provides a plentiful supply of groundwater for potential abstraction to supplement the canal when water levels fall to a pre-determined level, subject to the acquisition of an abstraction license to extract the required volumes. Numerous boreholes currently exist in the area, albeit it is understood that they are used to abstract much smaller quantities of groundwater (e.g. those located on land of the Nottinghamshire Golf and Country Club).
- More detailed consideration of the use of treated public waste water – It is important to recognise that STW are not the villain here. The decision to cease their discharge of treated water to the Cotgrave Brook that fed the canal was underpinned by economics and the need to comply with the Water Framework Directive. The failing was arguably the underestimation of the true environmental impact of the works (which was the responsibility of others). Whilst an optimistic option, it would not seem unreasonable for this to be revisited.
- Re-connection of the canal through the “dry section” – it would be remiss not to acknowledge the long-term goal of the Grantham Canal Society (GCS) to restore the dry section (Cotgrave to Kinoulton), which would of course restore the water supply to the western end from the feeder reservoirs in Knipton and Denton in the east. The water loss post-2018 has provided GCS with a renewed opportunity to lever the support of West Bridgford residents for this cause, which we should wholly embrace as a sustainable long-term solution.

All of these options are technically feasible from an engineering perspective. The limiting factors to their implementation are economics, politics and of course our desire to implement them. However, akin to river management plans, the consideration and implementation of these

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options should ultimately be undertaken at the catchment scale to ensure their effectiveness and sustainability.

### **Future Direction for Identifying Leaks**

The contribution of large detectable (and therefore repairable) leaks to this overall problem is by no means being dismissed. The potential for large detectable leaks is greatest where the canal is formed within an embankment or a culverted void / watercourse passes beneath the canal.

Embankments pose a risk for water loss where they are damaged by human or animal activity. Culverted watercourses provide a viable opportunity for water loss from the overlying canal where the culvert is of older brick construction and the mortar joints may have been washed out over the years allowing the ceiling bricks to drop and preferential flow pathways to form in the canal base.

While leakage through the embankment sides is likely to be easier to see, identifying leaks in culverted watercourses may be much harder to investigate without gaining access to undertake a camera survey. Several culverted watercourses are known to exist beneath the canal between Cotgrave and Lady Bay, including one in the Bassingfield area that drains fields to the Polser Brook and has maintained audibly high flow rates during a reasonably dry summer (an area for further investigation).

### **Words of Warning - Flooding**

Whilst maximising the supply of water to the canal during drier months is identified and advocated herein as a high priority technical solution to maintaining water levels all year round, it is important to remember that the section of canal from Gamston Lock to Lady Bay is also the lowest pound relative to the River Trent.

The only way for excess water to escape, in addition to unwanted leakage via seepage, is the spill weir at the end of Rutland Road which has recently been repaired by the GCS. The spill weir leads to an unnamed brook that passes under Regatta Way and ultimately feeds the 2000m long rowing lake at Holme Pierrepont and ultimately the River Trent.

Unfortunately, the water level difference between the canal and brook is relatively small and the brook is currently poorly maintained and heavily silted. Furthermore, during flood events within the River Trent, the culverts through which the brook passes have backflow gates causing them to close (which provide the important job of protecting Lad Bay and West Bridgford from flooding).

Therefore, any solution involving the provision of additional water supply to the canal should be mindful of this to avoid inadvertently flooding areas of Lady Bay near the canal. In other words, a water supply solution only has value during periods of need and should be implemented and managed accordingly.

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**Key Documents**

*Environment Agency Discharge Consent No. T/64/45774/R issued to Severn Trent Water Ltd for the Discharge of Secondary Treated Sewage Effluent from Cotgrave Sewage Treatment Works to the Cotgrave Brook*

*Fisher German LLP (2017). Installation of Sewer Rising Main between Cotgrave Sewage Treatment Works to Radcliffe Sewage Treatment Works, and Final Effluent/Storm Water from Radcliffe Sewage Treatment Works to the River Trent Discharge Point. Environment Impact Assessment Screening Opinion Request. April 2017. Prepared for Severn Trent Water Ltd*

*Severn Trent Water Bulletin Board Reference 6129124. Project Title: Radcliffe / Cotgrave STW Quality*