

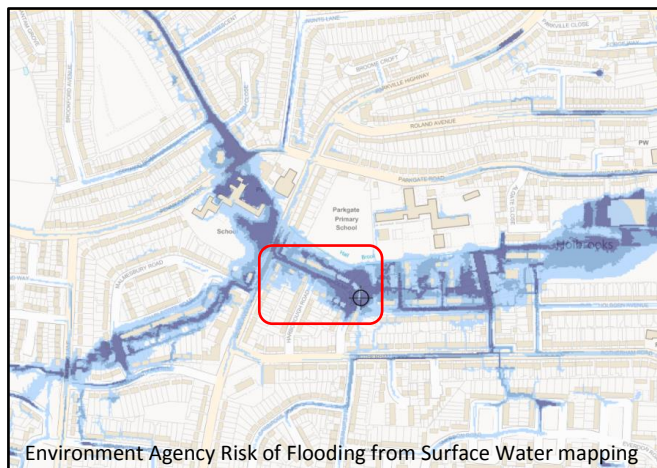
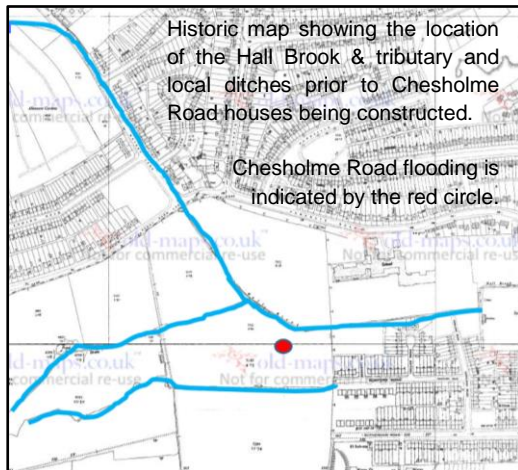
# Cheshome Road Coventry Flood Alleviation Scheme

Simon Parkinson, Severn Trent Water

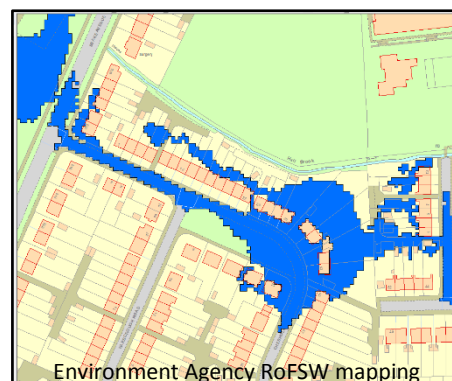
With thanks to Coventry City Council, Richard Allitt Associates, Stantec UK, NMCN



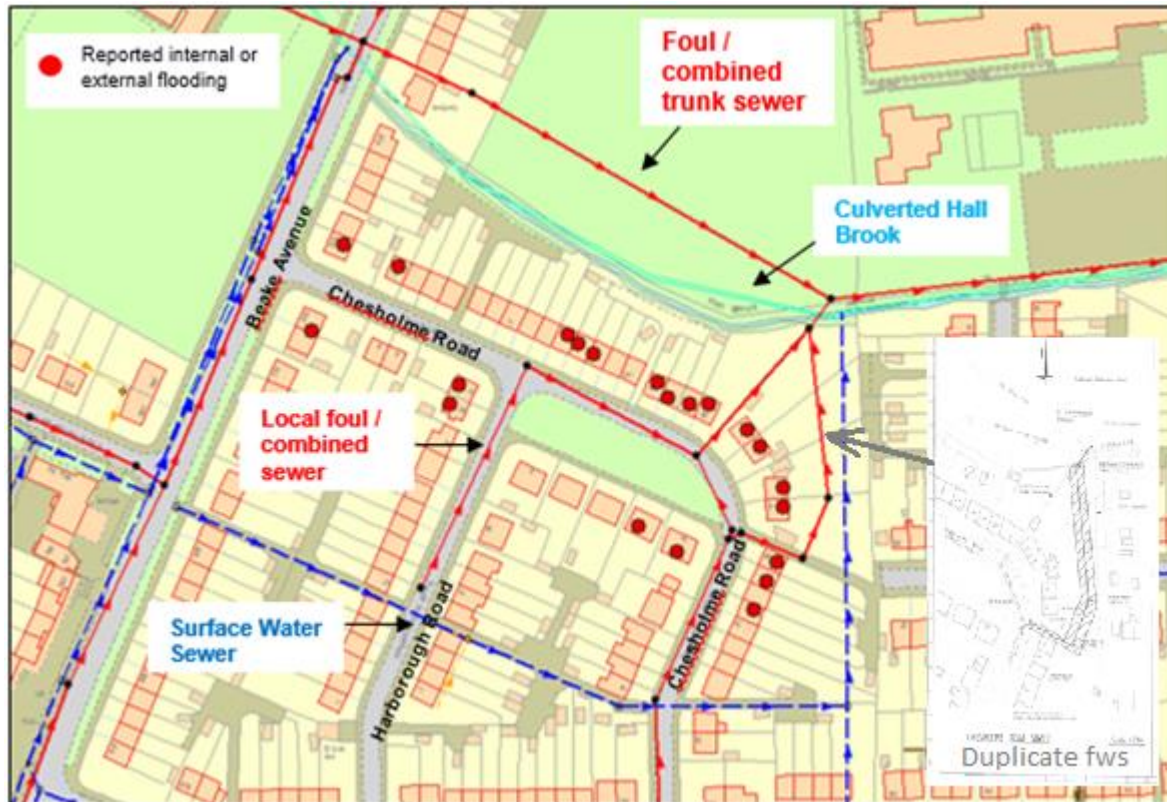
There had been a long history of flooding at Chesholme Road in the Holbrooks area of Coventry. The road sits at the confluence of the Hall Brook and a former tributary and numerous properties were vulnerable to flooding during intense rainfall. Pluvial flooding / surface water runoff was a factor as well as sewer flooding.



The Hall Brook runs behind properties on the north side of Chesholme Road and has long been culverted (contrary to as is indicated on Ordnance Survey mapping). Surface water sewers run to the south and east of the flooded areas broadly following the lines of former drainage channels. Chesholme Road itself was served by a small diameter (150mm to 300mm diameter) local foul / combined sewer system discharging into a 525mm diameter trunk sewer running parallel with the Hall Brook.



Many years ago, Coventry City Council, acting as sewerage agents to Severn Trent Water, installed a duplicate foul sewer between Chesholme Road and the trunk sewer.



Following significant flooding in 2014, residents understandably were upset that seemingly nothing was happening to reduce the risk. Residents were also frustrated that the flooding appeared to be being passed from Coventry City Council to Severn Trent Water and vice versa. Local Councillors also championed the cause of the residents after the event in 2014.

Part of the difficulty with flooding in this location was that it was not clear who had responsibilities for the type of flooding at Chesholme; was it surface water flooding? Highway Drainage? Sewer Flooding? Residents were getting mixed messages about who was responsible for dealing with the flooding. On one occasion, some local residents walked into Severn Trent Water's headquarters in Coventry very unhappy with the situation demanding answers.

Following the promotion of a Severn Trent Water capital scheme in 2014, Severn Trent and Coventry City Council agreed to work collaboratively to reduce flooding risk at Chesholme Road.

Pressure existing to do something immediately given a scheme would take a long time to progress. It was concluded that properties would benefit from 'smart' airbricks replacing existing airbricks thereby providing basic protection against low depth internal flooding. Severn Trent funded and installed these as a no-regrets and quick win measure during the latter part of 2014.





Impermeable area survey confirmed surface water runoff from the highway and from properties on Chesholme Road and adjacent Harborough Road discharged to the foul / combined sewer.

It was identified that some highway runoff contribution could be removed / disconnected from the foul / combined sewer and re-directed into the existing surface water sewer to the south of the flood risk area. The required capacity checks were carried out and the gullies could be accommodated. In 2015 Coventry City Council funded and undertook this work in advance of the proposed main scheme given that it delivered immediate benefit.



Further separation would however require a dedicated new surface water sewer / highway drain in Chesholme Road connecting to the culverted Hall Brook.

Severn Trent Water appointed its Sewerage Management Plan consultant Richard Allitt Associates to create an integrated model. The Severn Trent Water 1D Infoworks CS model was used as a basis for the integrated model. Severn Trent undertook extensive asset survey and flow survey in the area to enhance the model and verify the flows in the foul / combined and surface water sewers.

Coventry City Council had recently developed a model of the Hall Brook so this ISIS TUFLOW model was made available and was therefore used as the basis of the watercourse element of the integrated model. A site visit was undertaken to walk the length of the open channel in the upstream catchment and identify where it enters the culverted sections in the urban areas.

The sewer and watercourse models were combined in Infoworks ICM and a 2D mesh additionally created to represent overland flow routes. Property thresholds were also included in the integrated model based on an assessment of the height of the door step above ground level and also air bricks.

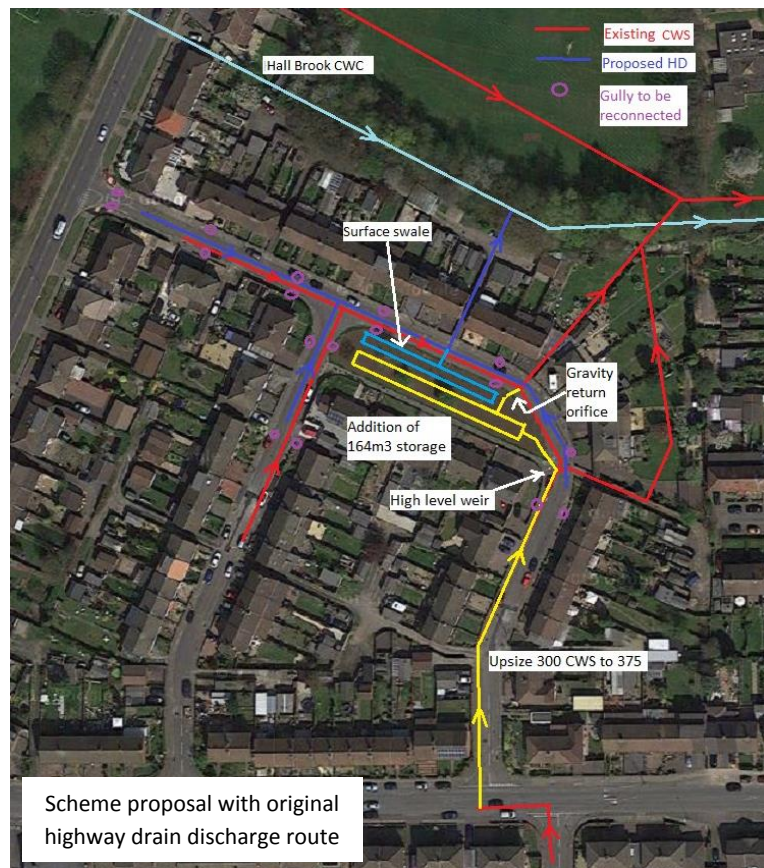
Flooding mechanisms were confirmed as:

- Foul / combined sewer locally overloaded – There was too much surface water runoff entering the local combined sewer which caused it to surcharge and flood during heavy rainfall. All the roofs and roads (had) drained to the combined sewer. The impermeable area draining to the combined sewer would have increased over the years due to urban creep.
- Combined Trunk Sewer – The local combined sewer connects to a larger trunk sewer running parallel to the Hall Brook. This trunk sewer surcharges in heavy rain, and surcharges back up the low lying connections from Chesholme Road.
- Highway Gullies – There was no separate highway drainage system or surface water sewer system on Chesholme Road, therefore the gullies discharge to the combined sewer. The combined sewer into which they discharge was prone to surcharge resulting in water ponding on the surface and not being able to discharge via the gullies.
- Surface water runoff – Surface water runoff from the upstream catchment routes overland and enters Chesholme Road from the west. This overland flow contributed to inundation of the foul / combined sewer, representing a source of the flood risk.

Baseline (2014) flood risk was assessed using the integrated model for return period events up to 1 in 200 year. This indicated 4 properties at 'very significant' (<1:20yr) risk of internal flooding, equating to the 4 properties on Severn Trent Water (STW)'s hydraulic flooding risk register known to have suffered internal flooding, as well as a further 8 at 'significant' or 'moderate' (>1:75yr) risk, the latter among 18 properties also on STW's register as having suffered external curtilage flooding.

Assessment was made of the practicality and impact of further separation. It was deemed that property level separation would be complex requiring significant construction work within customer property boundaries. Removal of all remaining highway drainage non-the-less showed significant benefit in reducing flooding risk. The integrated model also indicated any new (soffit to soffit) surface water connection into the 1.5m diameter culverted Hall Brook would have a free outfall during events up to and including a 1 in 20 year return period. To resolve residual (post highway drainage separation) flooding risk from the combined sewer up to and including a 1:40yr (or 1:30yr + climate change) event, 164m<sup>3</sup> of off-line gravity return storage was proposed utilising the area of green space adjacent to the central section of Chesholme Road along with a section of upsized combined sewer. Such a solution met the water industry standard of protection for sewer flooding.

However as both Coventry City Council and Severn Trent Water were keen to deliver a higher level of protection aligning with LLFA and EA flood risk significance bands (aiming for medium risk), focus was given to how to further reduce risk. Working with STW's Capital Delivery framework consultant Stantec and framework design & build contractor NMCN, as well as Coventry City Council, a proposal was developed whereby the buried combined water sewerage tank would be restricted to half the width of the open space with a 78m<sup>3</sup> swale incorporated alongside. The swale would provide relief



to the new highway drain / surface water sewer as well as accepting excess surface water runoff and would provide a 1:100yr (or 1:75yr + 15% allowance for climate change) level of protection. Additionally the attenuation contributes to managing downstream flood risk on the Hall Brook.

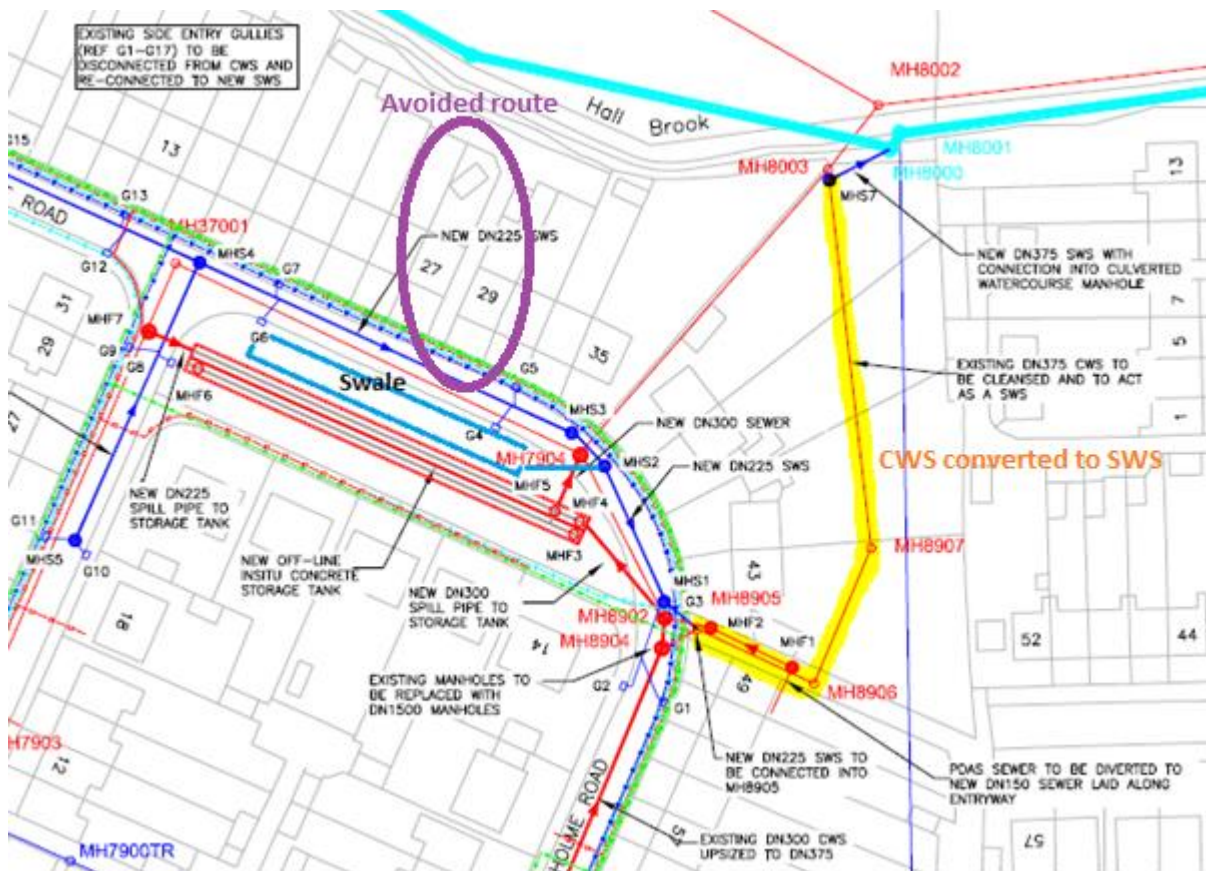
As this element of the proposal was outside Severn Trent Water's funding obligation, Environment Agency Flood Defence Grant in Aid and Local Levy funding totalling nearly £50k was successfully sought. Coventry City Council agreed to adopt the swale feature.



Severn Trent Water's AMP6 framework contract involved contracting on a target price notional solution with any subsequent cost savings arising from design innovation shared with the contractor. The notional solution involved a pipeline route for the new highway drain between 27 and 29 Chesholme Road. NMCN rejected this on grounds of engineering risk and cost associated with working at depth close to properties in favour of the innovative re-assignment of the existing duplicate foul sewer. This was technically and hydraulically viable, minimised disruption to residents and reduced cost by making use of an existing asset.



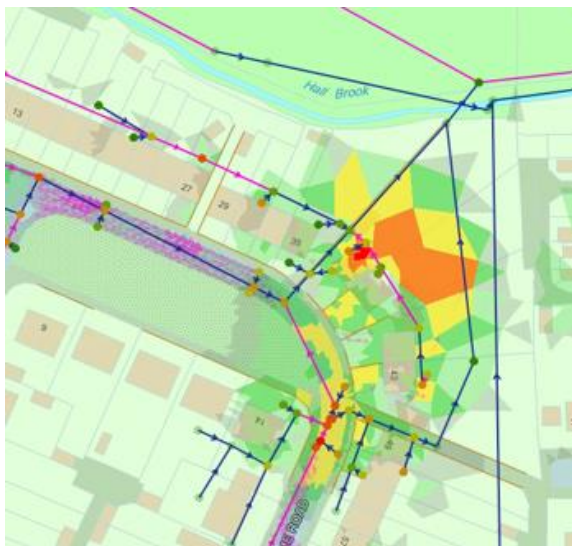
Nos 27 & 29 Chesholme Road



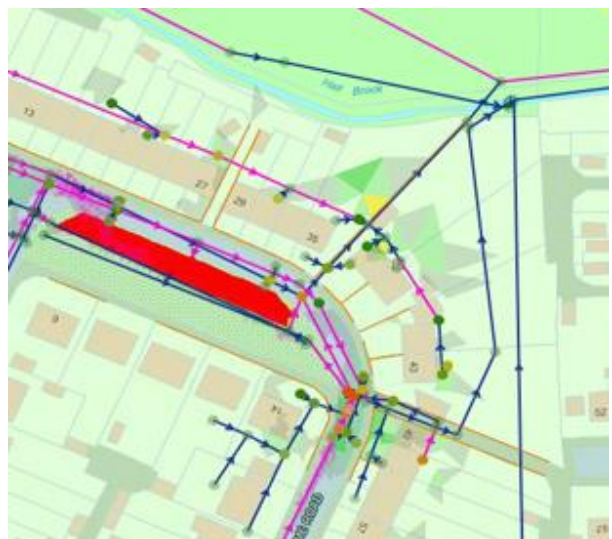
Residents were kept informed of the proposals through a pre-works drop in session and then by a dedicated page on the 'in my area' section of the STW website. NMCN opted to construct the tank walls in brick, maximising construction flexibility given limited working space. It was agreed to construct the swale to a depth of 0.6m with a grass finish and 1 in 3 sloped slides. A catch pit was included immediately downstream in order to prevent silt entering the surface water sewer. Construction was completed in October 2018. Total project spend was just under £700k.

The Chesholme Road Coventry Flood Alleviation scheme showcases multi-agency collaborative working to address multi-source flooding risk utilising both hard and soft (SUDS) engineering solutions and with integrated delivery.





2D model baseline flooding risk



2D model post scheme flooding risk