Appendix J:
Design and Optioneering Report – Greenway Sewer Diversion Southern Site

May 2021

1 Design and Optioneering

1.1 The Phase 1 HS2 works require the portal structure adjacent to (north of) the existing Chiltern Main Line railway. The existing Ruislip Branch sewer is constructed of concrete pipes with 1.14m diameter, at a depth of 8-10m. The sewer is circa 90 years old. The construction of the HS2 portal structure will impact the existing sewer, and the portal cannot be constructed until the sewer is diverted.

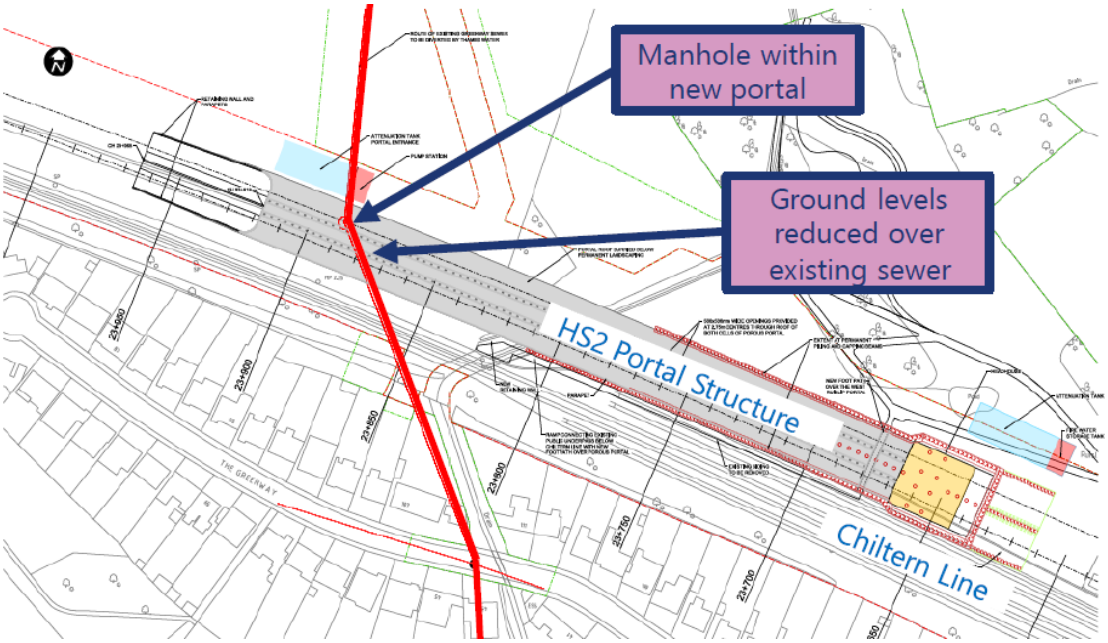

Figure 1: Plan of existing sewer under the Chiltern Line and HS2 portal structure

1.2 There is a risk that the sewer would fail by ground heave when the ground level is reduced above it through excavation for the new HS2 portal structure. The manhole also needs to be repositioned away from the new HS2 tracks. Diversion options have been instigated by Thames Water and developed collaboratively with HS2. An outline of these options is provided below.

Options Considered

1.3 Considerable optioneering work has been undertaken over recent years to assess a range of solutions to protect the sewer. Initially, solutions were proposed by HS2 as part of the Hybrid Bill in 2016. Thames Water reviewed the Hybrid Bill Solutions for a list of impacted assets highlighted as being critical and produced a constructability review report on each. The objective of these reports was to analyse and comment on the suitability, constructability and estimated cost of the solutions proposed. Alternative solutions were presented where feasible, and later investigated in more detail at outline design stage. Options suggested by the local community have also been assessed.

Hybrid Bill Solution

1.4 In 2013, a Hybrid Bill submission was made by HS2 to Parliament with a view to receiving Royal Assent in 2016. Royal Assent was granted in early 2017. This included outline concept solutions for the diversion and protection of utilities. Thames Water employed a consultant to produce these solutions, based on reasonable engineering judgement and experiences with similar major infrastructure projects. It had not been possible to carry out detailed reviews, hydraulic modelling or fully consult Thames Water Operations. This initial concept solution is referred to as the Hybrid Bill Solution. This option involved a pipe jack to construct a new sewer of approximately 260

metres in length, as open trench excavation of 31 metres from reception pit to an existing manhole.

1.5 This option would require at least one property to be demolished, and potentially up to 3-4 properties to create working space close to The Greenway. It would also involve rebuilding the bridge over the stream on The Greenway, with a road closure, due to the existing 7.5T weight limit. There were also technical complexities due to the proximity of the railway bridge and very limited working space between the existing sewer and watercourse.

1.6 The Hybrid Bill Solution was discounted as it was considered unbuildable due to access and land constraint issues.

Lining Solution and Sewer Diversion

1.7 The proposed lining solution looked to insert a structural liner through the existing sewer from the deconstructed manhole (MH9011), beneath the proposed HS2 portal and the existing network rail lines, through the rear gardens of residential properties and into an existing manhole (MH0907) located in highway along The Greenway. A new manhole access point would also be required and a short length of tunnelled diversion sewer to provide reconnection. Temporary over-pumping of wastewater would be required in order to construct this solution, so that the existing flows can be diverted to allow the decommissioning of the existing manhole and the construction of the new manholes. It is also required so that the liner could be inserted into the existing sewer. The over-pumping pipes would run along the ground in the golf course, over the HS2 portal in pipe-bridge, across ground again in the golf course, through the underpass beneath the existing railway lines and along the drain leading to The Greenway. The over-pumping pipes would then be fed underneath the road culvert in The Greenway and along a dense wooded area, along EA watercourse to discharge into a new manhole located within the allotment area.

1.8 This option was discounted due to the complexities of the temporary works. It would have involved closure of The Greenway road for a large excavation for working space to install the liner within the existing sewer. It would also involve rebuilding the bridge over the stream on The Greenway, with a road closure, due to the existing 7.5T weight limit.

1.9 The temporary over pumping would require 8No. 400mm diameter pipes running from generators 24 hours a day with no clear route for these pipes, and there would be a need to construct a chamber on the allotments for over pumping purposes.

Diversion to the East

1.10 The proposed diversion to the east looked to provide a new tunnelled sewer with 2No. reception shafts and 1No. drive shaft. The reception shafts would be located on the existing sewer to allow for easier connection once the off-line tunnelling work was complete. Once the diversion of flows had been achieved from the existing sewer to the new sewer, the existing sewer would be decommissioned and filled with concrete and manholes will be broken down/deconstructed to avoid impacting with the portal base slab.

1.11 The proposed line of the new tunnelled sewer would start in Ruislip Golf Course, run through the golf course, beneath a small watercourse, HS2's proposed line, Network Rail's existing line, residential properties and would discharge into a new shaft located in the allotment gardens.

1.12 This option was discounted, due to the need to remove and reinstate trees adjacent to properties to create working space; the large working area required taking over many allotment plots; pumps near properties; and the proximity of the stream course making deep excavations challenging. The crossing within the piled structure and the overlying piled secant retaining walls provides minimal flexibility. In addition, the permanent and temporary works will require a major redesign of HS2 working areas and landscaping design.

Divert West via Cricket Club

1.13 The proposed diversion to the west was developed in order to avoid the secant piles that are being proposed for the HS2 portal. The proposed solution itself would again start within the

Ruislip Golf Course and would run west across the golf course and cross the proposed HS2 line and existing Network Rail lines in a tunnel. The pipeline then turns east and runs along a gravel track towards and through the allotment gardens where it will re-connect into the existing sewerage system.

1.14 As HS2 have confirmed the portal structure will now not be piled in this area, this option has been discounted and superseded by the preferred solution which allows shorter diversion pipe lengths tunnelled through the zone where piling is now no longer proposed.

Community Suggestions

1.15 Through engagement with the community, various solutions were proposed by local residents. These were not taken forward due to a range of technical challenges and environmental implications:

- Potentially up to 50% of trees would have to be removed including mature trees, leaving a scar and full reinstatement would take many years;
- No vehicular access for maintenance to the new shaft;
- Longer programme and impact to community working around nesting seasons;
- Larger storage area at The Green;
- Clashes with HS2 portal structure;
- New shafts with associated utility diversions in Ickenham Road would likely close this major road or have long duration lane closures, plus restricted access to residential properties; and
- Longer sewer route (extra 50%) may require a pumping station due to shallow pipe gradients.

Proposed Solution

1.16 The proposed solution is a revised version of the 'Divert West via Cricket Club' option, whereby the diverted sewer is further east, thus reducing new sewer lengths. Most of the proposed works can be undertaken off-line i.e. minimal need for over-pumping and flow management; there are no secant piles in this corridor which creates less complex interfaces; and there is greater flexibility for tunnel alignment.

1.17 The solution involves a 582m pipejack diversion to the west of the existing sewer, under the existing railway and HS2 portal at varying depth of 8-12 metres. The new section of sewer will be 1200mm in diameter and will be constructed from concrete. The existing sewer is to be decommissioned, filled with concrete and left in situ. The route of the existing sewer and the proposed diversion are shown on the Site Plan (J923_01-AJ-TS001304-101-DR-C-0030). Two new shafts will be required on the allotment area with construction access off Ickenham High Road, however there will be no permanent above ground structures. The new concrete sewer will be connected at both ends to the new online shafts. Indicative section drawings of the shafts have been provided with this submission, for information (H582_05-HI-TS001304-101-DR-C-0142_P04; H582_05-HI-TS001304-101-DR-C-0122_P05).

1.18 Several trees near the haul road entrance will need to be removed, however the chosen location of the haul road has minimum impact on the trees compared to the other options considered, and the site will be reinstated after construction, including the allotments, the area behind the public house, and the temporary haul road.

1.19 This solution has, on balance, the least overall impact on the wider community and environment. The construction works are proposed in the least occupied area of the allotment site. This solution will ensure the new sewer is not impacted by HS2 and maintains the same operation levels as the existing sewer.