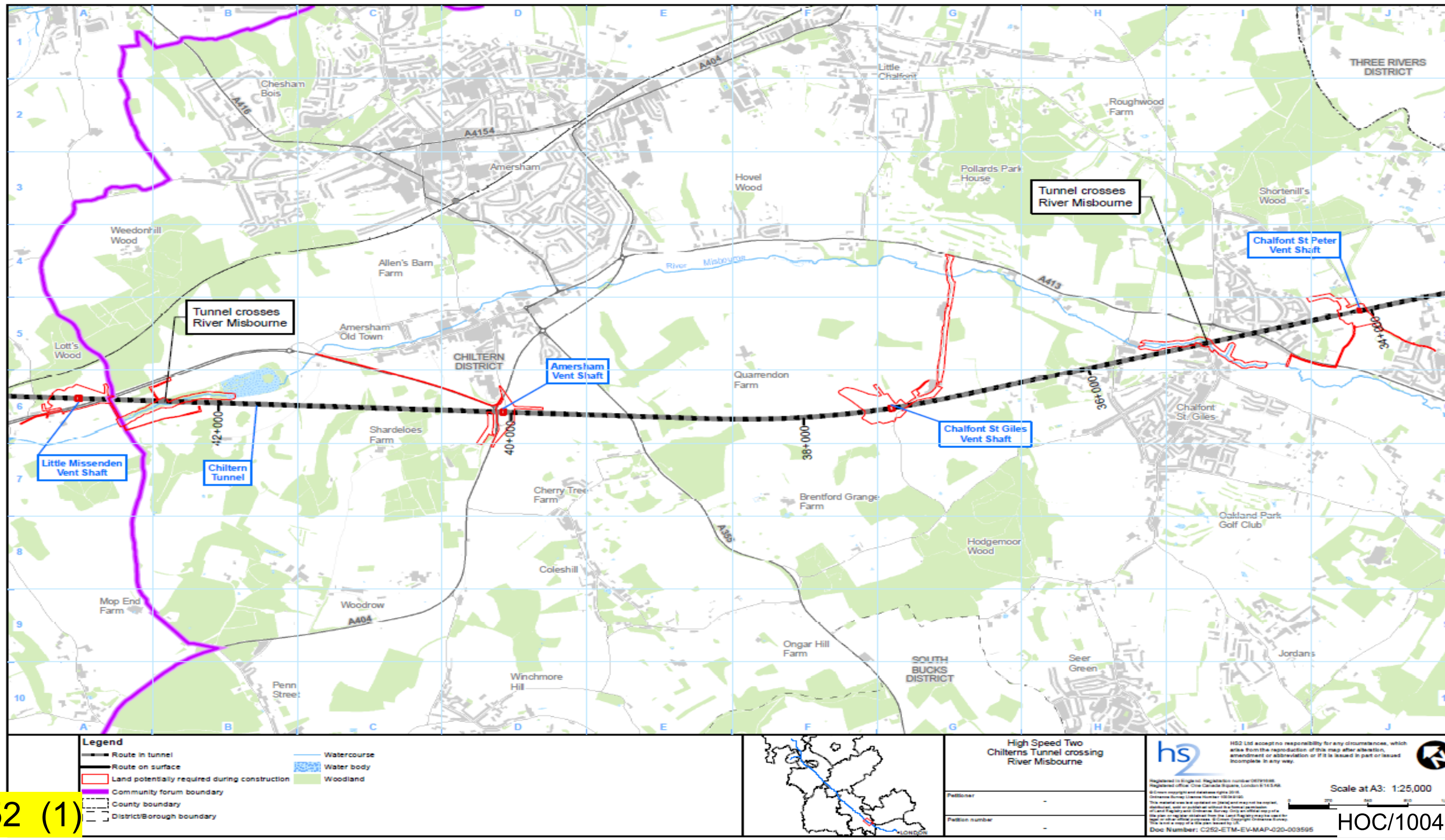
Chilterns Tunnel - mitigation options for the River Misbourne

The Proposed Scheme will be predominantly in tunnel throughout the Chalfonts and Amersham area, with three above-ground vent shaft locations. The tunnels will cross under the River Misbourne in two locations, at chainages Ch. 35+600 and Ch. 42+000 (Shardeloes lake).



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Summary:

- All the Chilterns tunnel proposals cross under the River Misbourne in two locations.
- There will be at least two tunnel diameters depth between the river bed and the top of the tunnel.
- There is a low risk that tunnelling will induce settlement producing enhanced permeability and loss of water from the river and lake.
- Mitigation measures include monitoring of ground settlement, lake levels and river flows where the route passes beneath the River Misbourne and Shardeloes Lake and for a suitable distance up and downstream, in order to underpin prompt decision making should further mitigation be necessary.
- The potential for the tunnel to obstruct groundwater flow and exacerbate flooding has been identified, however the tunnel is very small in comparison to the overall thickness and extent of the aquifer so the impact on river flows is considered to be negligible.

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Our Ref: HNL-150430 HS2

Your Ref:

Date: 19 May 2015

Dear Simon

Re: River Misbourne crossing

Thank you for your e-mail of 4 April 2015.

As described in the Environmental Statement (ES) submitted in support of the Hybrid Bill for Phase One, the route is proposed to cross beneath the River Misbourne in a tunnel at two locations – east of Chalfont St Giles, and north of Shardeloes Lake.

As set out in the ES, a number of avoidance and mitigation measures are proposed to be incorporated into the design of the route in this area, including:

- a minimum cover of two tunnel diameters depth being provided between the river bed of the River Misbourne and the top of the tunnel
- operating the tunnel boring machine in a closed face mode within water bearing parts of the aquifer, and designing the tunnel lining to keep leakage rates to a minimum
- closely monitoring river flows during construction, immediately upstream and downstream of crossing points – and working with us to agree appropriate trigger levels to prompt where further mitigation could be required

The ES identified a potential significant effect in relation to the proximity of the works to local public water supply sources. Alongside Affinity Water we will continue to provide advice (in line with our statutory role) to ensure a management strategy and mitigation measures are agreed. This will have to demonstrate that Affinity Water is able to maintain the resilience of public water supplies at all times both during construction, and in the longer term, in accordance with their Water Resources Management Plan.

Ultimately, before we could approve applications in line with the Protective Provisions within the Hybrid Bill and other UK legislation, we will need to be satisfied that all potential risks to the river and the surrounding environment have been mitigated. This will need to be supported by evidence from your ground investigation programme.

We will continue to provide advice to ensure the proposed mitigation will be acceptable, and that approvals can be issued.

It would be possible, however, for the tunnel to fall outside of this requirement if a substantial open section (more than 500m) or emergency-access station was included somewhere close to the mid-point of the tunnel, effectively splitting it into two shorter tunnels.

8.1.6.

As there are no prescribed standards for access and evacuation for tunnels over 20km we have considered a number of options for tunnel design, covering a range of options for emergency evacuation:

- A tunnel with ventilation shafts at 2km intervals (as required in TSIs for tunnels from 1km to 20km long).
This would mean that, in the event of a fire within the tunnel, passengers would be evacuated into the adjacent tunnel awaiting a rescue train.
There are a number of practical issues with the rapid evacuation of a high capacity train in fire conditions into the other running tunnel. It could not be made safe for access immediately as other high speed trains would still be passing through it. It is unlikely to be acceptable for evacuation of the tunnel to be solely through the adjacent bore and there is a strong likelihood that we would be required to provide additional measures, such as an emergency access station or a third bore, at substantial extra cost and potential disruption. On that basis our view is that an option for a twin-bore tunnel with ventilation shafts only is not a realistic proposition.

- A continuous tunnel with a third bore between main bores to facilitate evacuation and access.
In this case passengers would be evacuated into the central bore.
However it would mean that emergency service access would only be from either portal, potentially requiring them to travel more than six miles underground to reach an incident, and would require a complex and extensive ventilation system to control smoke in event of a fire.
We do not consider it appropriate for the emergency services to be required to travel this far underground to reach the site of an incident if ventilation shafts are a feasible option.
A third bore would also come at a substantial additional construction cost, and would be likely to require its own dedicated emergency rescue service to provide acceptable response times.

- A tunnel with a third bore between main bores to facilitate evacuation and ventilation shafts at 2km intervals.
In the event of an incident this would allow evacuation and rescue via a central bore, with the shafts providing ventilation and emergency service access. This would be likely to meet safety requirements for long tunnels but would come at a substantial additional cost.

- A tunnel with ventilation shafts at 2km intervals and either an open section or evacuation box.
An open section or emergency station somewhere near the midpoint of the tunnel, effectively splitting into two tunnels for the purposes of the TSI, would enable a train to reach an area where passengers could be evacuated to surface level. This would need to be a substantial construction within the AONB. The alternative of a bored cavern large enough to hold a full train of passengers for up to two days (as is being