Phase 2A C862 Strategic Evaluation of Railhead and IMB-R Locations – post CP3 design

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Contents

1 Executive Summary

1.1.1 This report re-evaluates the strategic location of the proposed temporary railway systems construction facility (railhead) required for the construction of the HS2 Phase 2A scheme, in conjunction with the permanent maintenance facility (IMB-R) required for the maintenance of the HS2 infrastructure.

1.1.2 The railhead is a temporary facility, which will be used for the temporary storage and preparation of the required railway systems construction materials for transportation along the HS2 trace.

1.1.3 The IMB-R is the permanent infrastructure maintenance facility with rail connections to the HS2 and the national rail networks. It will be used for the maintenance of the HS2 infrastructure, working in conjunction with facilities provided on previous and future phases of HS2.

1.1.4 During the course of the preliminary design there have been a number of assessments in order to define:

- The preferred location for an Infrastructure Maintenance Depot (IMD)
- The preferred strategic location for the railhead
- The preferred specific location for the railhead

1.1.5 These assessments were undertaken with the available design information at that point in time. As the design has been continuously progressing throughout this time it is considered pertinent to re-test the option selection based on the latest base line design which is the one submitted for the hybrid Bill (CP3 design).

1.1.6 This assessment follows the HS2 Sift process detailed in the "Route Development Procedure" (HS2-HS2-SA-PRO-000-000007).

1.1.7 For completeness this Sift re-evaluates the preferred option from the previous Sifts, alongside the previous baseline proposal, against the CP3 design which is the design deposited for the hybrid Bill submission.

1.1.8 Also, since the last Sift a new option was proposed by the Stone Railhead Crisis Group. This option was appraised at a high level in the Environmental Statement (ES) (Environmental Statement Volume 2: Community area 3, Stone to Swynnerton). This option is assessed in more detail as part of this Sift.

1.1.9 In addition, following further development on the HS2 maintenance strategy, it is proposed that this could be undertaken using an IMB-R facility rather than an IMD. An IMD is a much larger facility which provides more

functionality than an IMB-R. It was concluded that an IMB-R maintenance facility was taken forward for the CP3 design.

1.1.10 Finally, the CP3 design removed the requirement for maintenance loops at Pipe Ridware by moving the permanent maintenance facility from Crewe to the Stone railhead. Since the present Sift assesses potential combined Railhead and IMB-R locations there needs to be an associated assessment for the re-instatement of the maintenance loops at Pipe Ridware for all options other than Stone.

1.1.11 HS2 instructed C862 (Rail Systems consultant) to undertake a Sift of the following options with the support of C861 (Civil and environmental consultant). The options considered were:

- Railhead and IMB-R located at Stone (base case)
- Railhead and IMB-R located at Crewe, including maintenance loops at Pipe Ridware
- Railhead located at Stone and IMB-R located at Crewe, including maintenance loops at Pipe Ridware
- Railhead and IMB-R located at Aldersey's Rough. The requirement for maintenance loops at Pipe Ridware was to be assessed.

1.1.12 The Sift was completed on the 18th of October 2017. The outcome was that the location for the Railhead and IMB-R at Stone is the best option. This location is the same as the one included in the hybrid Bill.

2 Abbreviations and descriptions

C861	Civil and Environmental Engineering consultant
C862	Railway Systems consultant
CA	Community Area
CP	Control Point
C&L	Construction and Logistics
EIAR	Environmental Impact Assessment Report
ES	Environmental Statement
FOC	Freight Operating Company
HS2	High Speed Two
ICPP	Integrated Construction Phase Programme
IMB-R	Infrastructure Maintenance Base with Rail connection
IMD	Infrastructure Maintenance Depot
NBS Line	Norton Bridge Stone Line
OTM	On Track Machine
PSC	Professional Services Consultant
S&C	Switches and Crossings
SIFT	HS2 Option Selection Process
SRCG	Stone Railhead Crisis Group
TOC	Train Operating Company
WCML	West Coast Mainline
WDEIA	Working Draft Environmental Impact Assessment

3 Introduction

3.1 Route Announcement (November 2015)

3.1.1 In November 2015 the HS2 Phase 2A Route was announced. The Route Decision included an infrastructure maintenance depot (IMD) for HS2 to the west of the existing Basford Hall freight yard at Crewe.

3.1.2 The Route announcement also included the introduction of maintenance loops at Pipe Ridware as part of the wider HS2 maintenance strategy envisaged at that point in time.

3.1.3 The announcement did not include any information about a temporary construction facility (railhead) since this decision required more design information.

3.2 Working Draft EIAR (September 2016) and Design Refinements Consultation

3.2.1 The WDEIAR[1] published in September 2016 included a temporary railhead facility at Stone required to support the railway systems activities along the whole HS2 Phase 2A Route.

3.2.2 The WDEIAR also included the IMD facility adjacent to the existing Basford Hall freight yard and two maintenance loop facilities at Pipe Ridware.

3.2.3 It also mentioned that "An alternative option to locate a permanent maintenance facility for operation in the Stone and Swynnerton area (community area 3), at the site identified for the Stone railhead main compound, is being considered".

3.2.4 This was also included in the 'Design Refinements' consultation titled: "High Speed Two Phase 2a: West Midlands to Crewe Design Refinement Consultation"[2].

3.2.5 The identification of the preferred location for the railhead followed a two staged Sift process.

3.2.6 Stage 1 was the strategic evaluation of various railhead locations, which concluded that Stone was the preferred area to construct the temporary railhead. More information can be found in the document: Phase 2A C862

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/628757/E29_EIA_CSR_CT-008-000_WEB.pdf

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/552550/west-midlands-crewe-design-refinement-consultation-web-version.pdf

Strategic Evaluation of Railhead Locations (C862-PBR-CL-REP-000-000012).

3.2.7 Stage 2 was the Sift of different local geographic railhead options near Stone, compared to a railhead near Crewe, in order to define the preferred location and layout. More information can be found in the document: Phase 2A C862 Stone Railhead SIFT (C862-PBR-CL-REP-000-000015).

3.2.8 The IMD Sift process "assessed a number of suitable sites for accommodating a full size IMD on the Phase 2 Network". This process identified sixteen possible locations for an IMD. Four of them were selected to be progressed further and at the end of the Sift process the location at Basford Hall was assessed to be the optimum one. This Sift process was led by C861 and more information can be found in the document: C861 HS2 IMD Location Options Study (Sift 2) (C861-ARP-EN-REP-WS08-000001).

3.2.9 That Sift was based on the assumed maintenance strategy at that time. Due to its location at the northern end of the Phase 2a route and distance from Phase One maintenance facilities, 'maintenance loops' (track sidings located adjacent to the main line) were proposed at Pipe Ridware. These maintenance loops would provide a daytime stabling facility for engineering trains working in locations remote from the maintenance depots ('out-stabling').

3.2.10 After the WDEIR publication a consultation period started. The decision on the 'Design Refinements' consultation is documented in the following report: "High Speed Two Phase 2a: West Midlands to Crewe Government Response to the Design Refinement Consultation"[3].

3.3 Hybrid Bill (July 2017)

3.3.1 Since the publication of the WDEIAR and the design refinement consultation, further work has been undertaken to consider the location of the permanent maintenance facility.

3.3.2 Further development on the HS2 maintenance strategy showed that maintenance could be undertaken using an IMB-R facility rather than an IMD. An IMD is a much larger facility which provides more functionality than an IMB-R. It was concluded that an IMB-R maintenance facility located inside the temporary Stone Railhead footprint was taken forward for the CP3 design.

3.3.3 Therefore, the following two options were assessed on the basis of engineering and construction feasibility, cost and environmental impacts:

[3] https://www.gov.uk/government/publications/hs2-phase-2a-design-refinement-decision

- Stone: a permanent maintenance facility located near Stone, sharing the same footprint and core infrastructure as the proposed Stone railhead. The maintenance facility, in the form of an IMB-R, would be situated on land between the HS2 main line and the M6, between the Norton Bridge to Stone Railway and the M6 Meaford viaduct, with sidings connecting into the Norton Bridge to Stone Railway; and
- Basford, Crewe: a permanent maintenance facility located at Crewe. The maintenance facility would be situated in the west Basford area, with access spurs from the WCML via the proposed Basford Hall sidings and connection to the HS2 main line east of Hough.

3.3.4 After careful consideration, the option near Stone was taken forward into the Proposed Scheme. Basford, in comparison to Stone, would be significantly more expensive to construct requiring the development of a second rail connected facility, the requirement for maintenance loops at Pipe Ridware and realignment works to the existing road network.

3.3.5 Another aspect which affects the construction and maintenance strategy is the adopted track form for the HS2 Phase 2A route. The hybrid bill has been prepared on the assumption of slab track as the adopted track form; however a final decision on the track form will be made during later detailed design of HS2 Phase 2A.

3.4 Post Hybrid Bill

3.4.1 As detailed above, during the course of the design –between the Route Announcement and the hybrid Bill submission– there have been a number of Sifts in order to define:

- The preferred location for the Infrastructure Maintenance Depot (IMD);
- The preferred strategic location for the Railhead;
- The preferred specific location for the Railhead at Stone.

3.4.2 These Sifts were undertaken with the available design information at that point in time.

3.4.3 The IMD sift was undertaken by the C861 PSC and was based on ballasted track form. Also, the Strategic Evaluation of Railhead Locations was based on ballasted trackform. This was aligned with the configuration of the route at that point (which was ballast from the beginning of the Route until the south portal of the Whitmore Heath tunnel and slab track from that point northwards).

3.4.4 In July 2017 the Secretary of State confirmed the remaining section of the Government's preference for the full HS2 Phase 2b Route. The currently assumed route configuration for the Phase 2B Western Leg was not

available during the Sifts mentioned above and hence the need to include that in the updated HS2 maintenance strategy and re-evaluate the most appropriate IMB-R location.

3.4.5 In addition, the current Phase One design assumes that the trackform will be slab track; however a final decision on the track form will be made during the detailed design stage.

3.4.6 Therefore, it is considered pertinent to re-test the option selection based on the latest baseline design (CP3 design) and understanding of Phase One and Phase 2b position.

3.4.7 This Sift also evaluates 'Aldersey's Rough' in detail, a suggestion received from the public. This was appraised at a high level previously.

3.4.8 HS2 instructed C862 PSC to undertake a Sift of the following options with C861 PSC support. The options considered were:

- Railhead and IMB-R located at Stone (base case);
- Railhead and IMB-R located at Crewe including maintenance loops at Pipe Ridware;
- Railhead located at Stone and IMB-R located at Crewe including maintenance loops at Pipe Ridware;
- Railhead and IMB-R located at Aldersey's Rough. The requirement for maintenance loops at Pipe Ridware was to be assessed.

3.4.9 The deposited Environmental Statement (ES) states that the Railhead and the IMB-R will be located at Stone. Therefore, this option was considered as the Base Case against which all the other options/scenarios were compared and scored.

3.4.10 For consistency the numbering of the options above will follow the numbering mentioned in the deposited Environmental Statement. The letter A was added as a prefix in order to differentiate between previous Sift analysis and the present Sift.

3.4.11 In any case where the specific layout for the present Sift has been progressed further than the one examined in the Environmental Statement, a suffix was added to the numbering in order to differentiate between the two layouts.

3.4.12 The numbering is as follows:

- Option A8 (Base Case) - Railhead and IMB-R located at Stone;
- Option A5 - Railhead and IMB-R located at Crewe including maintenance loops at Pipe Ridware;

- Option A1 - Railhead located at Stone and IMB-R located at Crewe including maintenance loops at Pipe Ridware;
- Option A9.5 - Railhead and IMB-R located at Aldersey's Rough. The requirement for maintenance loops at Pipe Ridware was to be assessed (please see section 4 for more details).

3.4.13 Option A9.5 is a design refinement of Option 9 which was appraised at a high level in the Environmental Statement.

3.4.14 Option A1 is the combination of Option 8 (in the ES) and Option 1A (in the ES). The difference is that Option A1 (which was part of the WDEIA) was referring to an IMD facility located at Crewe (west Basford) whereas Option A1 refers to an IMB-R facility in the same area.

3.4.15 It needs to be noted that the northernmost Phase One Railhead was not taken into account since it was eliminated prior to the Strategic Evaluation of Railhead Locations (section 3.2.6). This was due to its location further south than the Phase 2A route and therefore the transit times and associated programme would be longer.

3.5 Railhead principles

3.5.1 The HS2 Phase 2A Railway Systems installation methodology aims to minimise the environmental impact of the construction of the railway while meeting the programme requirements of the project. As a result, a temporary Railhead will need to be constructed, where the majority of the Railway Systems materials will be stored and then transported by rail on the HS2 trace[4].

3.5.2 A connection to the conventional railway is essential because certain rail systems materials, such as rail, which is between 108 m and 216 m in length, cannot reasonably be delivered by road.

3.5.3 During the construction of the Railhead HGVs per day will be required to transport the earthworks, the railway systems materials, facilities, utilities equipment and other required materials on site. Also, during the operation of the Railhead there will be a number of daily deliveries which will be carried out by using HGVs. More information is included in Appendix M1 of the CA3 report: C862-PBR-CL-REP-000-000026 Phase 2A C862 Stone to Swynnerton Construction and Logistics Community Area Report – Slab Track Form.

[4]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/656360/f3_infrastructure_maintenance_and_rail_systems_construction_facilities.pdf

3.5.4 The location of the Railhead affects the construction programme of the HS2 Railway Systems, as the number of the construction faces, the construction sequence and the construction planning are all affected by its location.

3.5.5 Therefore, the exact location of the Railhead will have a major impact on the traffic created during both the construction and the operation of the Railhead, depending on how the Railhead connects to the local road network and the rail network.

3.5.6 Finally, the landscape around the Railhead will be affected – although mitigation measures will be applied – during its construction, operation and decommission.

3.5.7 The methodology used during the Sift meetings was to compare and assess against the Base Case option. The criteria used were those identified by the HS2 Sift process. These are:

- Strategic fit;
- Engineering Construction feasibility;
- HS2 Operation Feasibility – Trains (HS2 and Network Rail);
- Environmental Impacts;
- Safety, Assurances/Commitments;
- Risks related to Structures, Highways, Water and Drainage;
- Geotechnics;
- Cost.

4 Pipe Ridware Maintenance Loops

4.1 Description

4.1.1 The Hs2 Phase 2A Route Announcement (November 2015) included the introduction of maintenance loops at Pipe Ridware as part of the wider HS2 maintenance strategy envisaged at that point in time.

4.1.2 These loops were intended to provide a location for stabling of engineering trains and OTMs plus provision of a facility to recess faulty service trains clear of the running lines to minimise the impact on passenger services. The proposed loop included as part of the current Stone IMB-R design provides a similar service.

4.1.3 The available area and access at Pipe Ridware means that it cannot provide the complete IMB-R specification but could be used in conjunction with one of the other sites.

4.1.4 The CP3 design removed the requirement for maintenance loops at Pipe Ridware by relocating the permanent maintenance facility previously proposed at Crewe to Stone on the site of the construction Railhead.

4.1.5 Locating the permanent maintenance facility at Stone would reduce travel time to undertake maintenance activities along the length of the Phase 2a route. Combined with the closer proximity to Phase One facilities, it removes the need for the maintenance loops at Pipe Ridware and maintenance facilities along the remainder of the Phase 2a route, or additional maintenance loops for 'out-stabling' maintenance trains or plant.

4.1.6 However, since the present Sift assesses potential combined Railhead and IMB-R locations there needs to be an associated assessment for the re-instatement of the maintenance loops at Pipe Ridware for all options other than Stone.

4.2 Stone IMB-R

4.2.1 The distance between the Stone IMB-R to the northernmost maintenance facility of Phase 1 (Washwood Heath RSD) is 65.3km. The associated transit time in the worst case scenario (middle point between the two facilities) allows for a minimum maintenance working window greater than 3hrs which is the minimum working time on site assumed to be acceptable, based on the currently envisaged time required to complete the typical maintenance activities.

4.2.2 Therefore, locating the IMB-R at Stone would remove the requirement for maintenance loops at Pipe Ridware (please see Appendix H for more details).

4.3 Crewe IMB-R

4.3.1 The distance between the Crewe IMB-R to the northernmost maintenance facility of Phase One (Washwood Heath RSD) is 88.3km. The associated transit time in the worst case scenario (middle point between the two facilities) allows for a minimum maintenance working window less than 3hrs which is the minimum working time on site based on the currently envisaged time required to complete the typical maintenance activities.

4.3.2 Therefore, locating the IMB-R at Crewe would require the installation of maintenance loops at Pipe Ridware (please see Appendix H for more details).

4.4 Aldersey's Rough IMB-R

4.4.1 The distance between the Stone IMB-R to the northernmost maintenance facility of Phase One (Washwood Heath RSD) is 78.3km. The associated transit time in the worst case scenario (middle point between the two facilities) allows for a minimum maintenance working window less than 3hrs which is the minimum working time on site based on the currently envisaged time required to complete the typical maintenance activities.

4.4.2 Therefore, locating the IMB-R at Aldersey's Rough would require the installation of maintenance loops at Pipe Ridware.

4.4.3 Therefore, Option A9.5 as detailed in section 3.4.12 is refined as:

- Option A9.5 - Railhead and IMB-R located at Aldersey's Rough including maintenance loops at Pipe Ridware

4.4.4 However, for the purpose of the present Sift, it was considered valuable to explore the sensitivity of the Aldersey's Rough's assessment to the inclusion of the Pipe Ridware maintenance loops.

4.4.5 A number of identified opportunities regarding the maintenance strategy were assumed to be realised, and therefore the minimum maintenance working window was increased to 3hrs and 10min (please see Appendix H for more details).

4.4.6 Following this, a fifth Sift Option was included in the Sift.

- Option A9.5* - Railhead and IMB-R located at Aldersey's Rough without the inclusion of the Pipe Ridware maintenance loops.

4.5 Summary

4.5.1 Following the findings above the following five Options are assessed as part of the present Sift:

- Option A8 (Base Case) - Railhead and IMB-R located at Stone;
- Option A5 - Railhead and IMB-R located at Crewe including maintenance loops at Pipe Ridware;
- Option A1 - Railhead located at Stone and IMB-R located at Crewe including maintenance loops at Pipe Ridware;
- Option A9.5* - Railhead and IMB-R located at Aldersey's Rough;
- Option A9.5 - Railhead and IMB-R located at Aldersey's Rough including maintenance loops at Pipe Ridware.

5 Option A8 (Base Case) – Railhead and IMB-R located at Stone

5.1 Option Description

5.1.1 Option A8 is the option as presented within the Hybrid bill submission.

5.1.2 The proposed site is located to the West of the M6 between the Stone and Yarnfield. The Railhead and IMB-R would be located between the HS2 mainline alignment and the M6 (Appendix C).

5.1.3 The land which is largely open countryside, rises gently to the north of Yarnfield Lane Underbridge to Ch 222+000 and to then fall gently towards the M6 embankment. The land use is a combination of agricultural/pasture and isolated residential properties.

5.1.4 The railhead would provide connection to the Norton Bridge to Stone Railway in both directions on the southern side via 1km long railway sidings in a north-easterly direction towards Stone. This option would also enable direct connections into the HS2 main line in both directions, with vehicular access to the railhead and associated compound made via connections to the M6 as well as the local road network, namely Yarnfield Lane.

5.1.5 Under this Option after the construction of the HS2 Phase 2A the temporary railhead facility will be modified to a permanent IMB-R facility sharing the same footprint, core infrastructure and connections to the NR and HS2 networks as the Stone railhead.

5.1.6 To the west of the IMB-R / Railhead is the M6 motorway. New permanent slip roads are proposed for the southbound carriageway with temporary slip roads on the northbound carriageway proposed during the construction of the railhead.

5.1.7 Direct access will be provided to the Railhead via a new roundabout off the new M6 slip roads.

5.1.8 Temporary slip roads off the M6 at this location would be recommended to construct HS2 mainline, even if the Railhead / IMB-R was not located here. However, Option A8 requires the provision of both permanent and temporary slip roads which will be for works traffic access only.

5.1.9 This option does not require the installation of maintenance loops at Pipe Ridware.

5.2 Engineering Feasibility

Highways

5.2.1 To the west of the IMB-R / Railhead is the M6 motorway. The M6 is planned to undergo a smart motorway improvement scheme to All Lane Running prior to the construction of the railhead / IMB-R. C861 consultant have liaised with Highways England and their technical partners. No adverse comments were received from Highways England by C861 Consultant on the proposal to site the HS2 maintenance facility and associated proposed slip roads alongside the motorway. Highways England are receptive to the incorporation of the Railhead / IMB-R proposals to upgrade the M6 as far as is reasonably possible.

5.2.2 The existing Yarnfield Lane is to be realigned 50m to the North of the Existing alignment. A new M6 motorway overbridge is to be constructed. The new alignment will go over the M6 Motorway before going down under the Railhead / IMB-R through tracks and under HS2 mainline. The proposed road alignment matches or betters the existing geometry of Yarnfield Lane. There are departures from standard associated with the horizontal and vertical geometry of this road (Refer to C861-SA-REG-000-000002). The offline realignment allows Yarnfield lane to remain open during construction. The new realignment for the Railhead / IMB-R allows construction traffic to be limited on Yarnfield Lane. If no Railhead / IMB-R facility is provided access would still be required onto the M6 at this location, but the existing Yarnfield Lane would likely be impacted by HS2 mainline construction more than under Option A8 with the Railhead / IMB-R.

5.2.3 Eccleshall Road will be re-provided as part of the Railhead enabling works. Option A8 requires a lengthening of Eccleshall Road overbridge than that required for just the HS2 alignment due to the headshunt and S&C required.

5.2.4 The existing Eccleshall Road is to be realigned east of the Eccleshall Road / M6 Motorway Overbridge. The existing M6 motorway overbridge will remain unaffected by the HS2 proposals.

Water and flood Risk

5.2.5 The Railhead / IMB-R is located in the Filly Brook catchment, in a rural setting that is generally grading down to the south-east. Filly Brook Flows south along the western side of the M6 motorway passing under Yarnfield Lane. Downstream of Yarnfield Lane, Filly Brook is culverted under the M6 motorway to pass south-east through the Railhead / IMB-R. Flood flows are likely to bypass this culvert and pool in the vicinity of the Norton Bridge to Stone Railway, flowing north-east along the rail corridor to re-join Filly

Brook downstream of the proposed scheme. Downstream of the M6, Filly Brook flows through an existing culvert for approximately 300m, to be removed and the watercourse realigned for the scheme.

5.2.6 Approximately 850m downstream of the Filly Brook Viaduct, Filly Brook passes through a culvert crossing under the Norton Bridge to Stone Railway.

5.2.7 It is noted the Norton Bridge to Stone Railway corridor is currently adversely affected by flood events. HS2 proposals do not make this flooding situation any worse.

Geotechnics

5.2.8 There are a number of infilled pits and ponds, including an infilled lake that could be a potential source of contamination. Soft Alluvium is shown on the south-east side of footprint in Filly Brook valley, the Alluvium is underlain by River Terrace 1 Deposits. Alluvium is also shown along the south-west boundary (along M6 corridor). Solid geology is Mercia Mudstone Group.

5.2.9 The majority of the excavated materials would be Class 2 railway embankment fill (if it can be stabilised) or, more likely, highway embankment fill. It is expected that this excavated material can largely be used in the platform for the IMB-R.

Utilities

5.2.10 Option A8 design affects the following utilities and therefore requires either diversionary, removal or protection measures:

5.2.11 These utilities include: Western Power Distribution 11kV overhead electricity lines, Three Mobile Telecommunication Mast, telecommunication cables and underground fibre optic cables. Note. The construction of the IMB-R and Railhead does not cause any new utility diversions in this area that are not already affected by the HS2 alignment.

5.2.12 Extents of Yarnfield Lane overbridge results in utility diversions within the highway corridor.

Structures

5.2.13 To facilitate keeping Yarnfield Lane open during the construction of the Railhead / IMB-R at Stone a new structure is require to take Yarnfield Lane over the M6.

5.2.14 The extents of Filly Brook Viaduct are significantly larger than required to accommodate the crossings underneath due to the S&C being located on the viaduct.

5.3 Railway Systems

5.3.1 This Option provides access to the HS2 network from both directions. The access can be direct by using a parallel loop hence removing the need for any headshunt movements.

5.3.2 Regarding the access from the national rail route, trains arriving from the north and the south would use the proposed crossovers on the existing NBS lines and then access the reception sidings adjacent to the existing railway lines. This configuration is minimising any potential delay on the existing train services due to the entering/exiting of construction trains in the Railhead.

5.4 Environmental Impacts

5.4.1 Option A8 (as described in the Proposed Scheme) would consist of the railhead / IMB-R located to the west of Stone, on land isolated between the M6 and the HS2 main line, north and south of the Norton Bridge to Stone Railway. There would be no requirement to introduce maintenance loops in Pipe Ridware and the vertical alignment of the route would be as described in the Proposed Scheme. The areas of Aldersey's Rough and Crewe would also remain as described in the Proposed Scheme.

5.4.2 Option A8 would impact on the landscape character of the area, during construction and operation, due to the rural setting of the location within Yarnfield Settled Farmlands landscape character area (LCA) and proximity to Swynnerton Park. Visual impacts are likely to occur on the dispersed residential and recreational receptors at Walton and east of Yarnfield, with the railhead / IMB-R (including the associated lighting) changing the views experienced by these receptors.

5.4.3 This option would result in a permanent loss of approximately 80ha of best and most versatile (BMV) agricultural land (predominantly Subgrade 3a) and would impact on ten agricultural land holdings. This option would contribute to the loss of Pool House Wood local wildlife site (LWS), which would be completely lost as a result of the Proposed Scheme. The construction of the Norton Bridge to Stone sidings, required to connect the railhead / IMB-R into the Norton Bridge to Stone Railway, would also result in the loss of the majority of Filly Brook LWS. There is potential for impacts on protected species, including reptiles, great crested newt, bats and otter. The loss of Pool House Wood LWS would remove habitat for a population of white-letter hairstreak, a notable invertebrate species.

5.4.4 The area required for this option has former pits and quarries, infilled ponds and a historic landfill site presenting the likely risk of contamination during construction. This option would impact on archaeological remains and former trackways, during construction of the railhead/IMB-R, as well as the

removal of the remains of field systems to the west of Walton and Darlaston.

5.4.5 This option would require the deculverting of a section of Filly Brook, due to the location of the railhead / IMB-R, which would provide a more natural channel compared to existing conditions. Flood compensation areas would be required with this option, which would additionally provide an opportunity to reduce the existing flood risk issue in the area.

5.4.6 Construction of the railhead / IMB-R would require the offline realignment of Yarnfield Lane, over the M6, as well as the offline realignment of the B5026 Eccleshall Road and the diversion of Stone Rural Footpath 33 around the railhead / IMB-R. Some lane restrictions and speed reductions would be required at both Yarnfield Lane and the B5026 Eccleshall Road at locations where the realignment would connect with the existing alignment. Some disruptions along the M6 would occur due to an increase in construction traffic.

5.4.7 An area of a committed development[5] for strategic development and housing would be impacted as a result of the construction of the Norton Bridge to Stone sidings (up to 10% of the land) but would still be viable. The demolition of the farmhouse at Brook House Farm would be required with this option and there would be a minor impact on a dog training business located at Brook house Farm.

5.5 Construction Feasibility and Construction Programme

Civil Engineering

5.5.1 The main element of construction complexity is the need for a HS2 parallel access loop which will require additional embankment widening. However, this is not considered a significant engineering issue.

Railway Systems

5.5.2 Some works on the Norton Bridge to Stone railway are required however, they fall within the standard S&C works.

5.5.3 The Stone railhead is located at the middle of the HS2 Phase 2A route and it can support two workfronts. It is situated away from complex engineering works (Whitmore Heath and Madeley tunnels and HS2/NR tie-in works at Crewe) hence this railhead provides high robustness to the HS2 construction programme. A potential delay to the tunnels construction and/or to the HS2/NR tie-in works at Crewe will not prevent the railhead

[5] Information on committed developments, defined as approved planning applications and adopted allocations, has been collected for an area of up to 2km (5km for larger schemes such as nationally significant infrastructure projects) from the land required to construct the Proposed Scheme.

from feeding the railway systems construction activities at the majority of route. Therefore, by locating the railhead at Stone the construction programme risk is low.

5.6 Maintenance

5.6.1 At the end of HS2 Phase 2A construction stage the temporary railhead facility will be modified to a permanent IMB-R facility sharing the same footprint, core infrastructure and connections to the NR and HS2 networks as the Stone railhead.

5.6.2 As detailed in Section 4.1.2, locating the IMB-R at Stone would remove the requirement for maintenance loops at Pipe Ridware.

5.7 Costs

5.7.1 The cost for this is Option is the cost submitted for the hybrid Bill. This will serve as the baseline cost against which the other Options' costs will be compared.

6 Option A5 – Railhead and IMB-R located at Crewe

6.1 Option Description

6.1.1 The proposed site is located north of Chorlton adjacent to Basford Hall Sidings. The site is restricted by Gresty Brook to the North, Jack Mills Way to the West and A500 to South. The resulting configuration is single-ended, with a long connection to HS2 and Network Rail (Appendix D).

6.1.2 The site currently has planning permission for a commercial development. Jack Mills Way was opened in July 2015 connecting A500 roundabout with Crewe Road.

6.1.3 The railhead would provide connection to the Basford Independent lines –and subsequently to the WCML– in both directions using a headshunt. The movements required to get in and out of the depot are very complex since top and tailed trains or shunting locos are required to carry out these movements.

6.1.4 This option would also enable direct connections into the HS2 main line in both directions, with vehicular access to the railhead made via connections to the local road network, namely Jack Mills Way.

6.1.5 Under this Option after the construction of the HS2 Phase 2A the temporary railhead facility will be modified to a permanent IMB-R facility

sharing the same footprint, core infrastructure and connections to the NR and HS2 networks as the Crewe railhead.

6.1.6 Highway access to the HS2 Crewe Railhead / IMB-R is proposed via the recently constructed roundabouts on Jack Mills Way. The impact that the new access would have on the level of service of the existing Jack Mills Way has not been investigated at this stage. In addition to this, abnormal loads accessing the site would need to be explored.

6.1.7 The proposed Railhead / IMB-R footprint is located in close proximity to local bus routes and Crewe railway station.

6.1.8 This option requires the installation of maintenance loops at Pipe Ridware.

6.2 Engineering Feasibility

Highways

6.2.1 The proposed Railhead / IMB-R footprint would not require the modification of the existing highways other than new accesses off Jack Mills Way roundabouts. The connections between HS2 and Network Rail would affect a number of local roads:

6.2.2 Weston Lane will be realigned with a new overbridge over the WCML, HS2, and Railhead / IMB-R tracks. The new bridge will require approaches on embankments before tying in to the existing road alignment. The existing Weston Lane overbridge would be repurposed to access the HS2 Phase 2b tunnel portal.

6.2.3 Newcastle Road will be realigned with a new overbridge over the WCML, HS2, and Railhead / IMB-R tracks (This would be an extension of what is required for the HS2 mainline). The new bridge will require approaches on embankments before tying in to the existing road alignment. The old overbridge would be removed as required by HS2 mainline works.

6.2.4 Casey Lane will require stopping up with turning heads located either side of the WCML and the HS2 connection. A new road linking Weston Lane and Newcastle Road would be created to the North of WCML, with a new junction onto Casey Lane providing access to HS2 balancing ponds.

Water and flood Risk

6.2.5 The Railhead / IMB-R is located partially within floodzone 2. This may increase the risk downstream in the Basford Brook. The proposed footprint also sits partially within existing Sustainable Urban Drainage systems (SuDs) features, which will require modification. A culvert is required under the IMB-R / Railhead, to manage the existing watercourses which passes through the proposed scheme.

6.2.6 The Railhead / IMB-R requires a new balancing pond which is located on the IMB-R footprint. A pumping station is likely to be required to facilitate the Railhead / IMB-R site drainage.

6.2.7 A review of the design strategy of the existing SuDs ponds was conducted, based on the information publically available. The catchment areas for each existing pond were reviewed. An adjusted catchment was undertaken based on the proposed Railhead / IMB-R footprint. More information is required to fully design the new drainage strategy and ensure that the current site developer's drainage system is not adversely affected by the Railhead / IMB-R. Whilst still a small risk, it is considered that the reduction in catchment area for the existing ponds will more than outweigh the modifications and reduction in pond sizes, to facilitate an acceptable drainage solution.

Geotechnics

6.2.8 A review of the ground conditions suggest there are a few in-filled pits and ponds that could be a potential source of contamination. There are Glaciolacustrine Deposits comprising of laminated silts and clays over the entire Railhead / IMB-R. The majority of the excavated material would only be suitable for landscape fill.

6.2.9 The requirement of the Pipe Ridware maintenance loops requires reverting the HS2 CP2 alignment. This in turn requires larger higher embankments. There are not any notable superficial deposits present in the footprint, except at the extreme northern end of the maintenance loops (approximate Ch 194+000 to 195+400). There is a major fault at Ch 195+000 with Mercia Mudstone to the south-east of the fault. Helsby Formation overlies Chester Formation to north-west of the fault. Maintenance loops are likely to be largely on medium to high embankment, with increased earthwork width which would mean an increase in the requirement for railway embankment fill in a part of the route where the large amount of material to be won from borrow pits is already a sensitive issue.

Utilities

6.2.10 No utility connections to the IMB-R have been assumed or included at this early stage of design Utility companies will not guarantee to meet any utility supply demands at this early stage of design.

6.2.11 There are a number of utility diversions required by HS2 mainline alignment in the Crewe area that will increase in length to accommodate the proposed IMB-R connection. Therefore diversionary works will increase. These utilities include; 24" dia. concrete mains water pipe and low voltage overhead electricity line.

6.2.12 All utilities within the existing Weston Lane will require diversions to accommodate the re-alignment highway works. These utilities include; telecommunication cables and underground fibre optic cables, Scottish Power Energy Networks high voltage 33kV overhead and underground electricity cables.

6.2.13 All diversions within Newcastle Road will require lengthening to accommodate the increased length of the overbridge as a result of the IMB-R connection, thus increasing diversionary works. These utilities include water mains, telecommunications, fibre, sewers and 11kv power.

Structures

6.2.14 The Railhead / IMB-R at Crewe requires the lengthening of Newcastle Road Overbridge and a number of footbridges compared with the baseline. An additional overbridge for Weston Lane and associated realignment is required.

6.2.15 To facilitate the headshunt adjacent to the HS2 mainline a retaining wall is required. This requires the separation between the HS2 mainline and the headshunt to increase to 15m. This facilitates he required separation between structures and HS2 tracks.

Key benefits and challenges

6.2.16 A significant benefit of Option A8 is the fact that the Railhead / IMB-R earthworks are significantly reduced compared with the baseline. There is also a readily accessible existing connection to A500 available.

6.2.17 A significant challenge is that the works are adjacent to existing NR sidings / infrastructure. The approach tracks cut across the HS2 tunnel portal and they restrict the works and increase the complexity in an area of intense activity. This affects the Phase 2a programme. The approach tracks will also restrict access for the Phase 2b tunnelling works in a later period.

Assessment

6.2.18 Option A5 has been assessed as a minor worsening compared with the baseline.

6.2.19 Option A5 reduces the amount of work required at Stone, including the realignment and replacement of Yarnfield lane the additional lengthening of Ecclestone Road obverbridge.

6.2.20 There are worsenings in relation to water, with a pumping station required at Crewe. Additional structures are required with a lengthening of Newcastle Road overbridge and a new overbridge for Weston Lane.

6.2.21 The inclusion of the maintenance loops at Pipe Ridware adds significant impacts particularly with the earthworks and additional imported material

associated with reverting the mainline to CP2 alignment in the 10km affected.

6.3 Railway Systems

6.3.1 This Option provides access to the HS2 network from both directions. However, the use of a headshunt is required to access on to HS2 for trains heading northbound. Trains arriving from Hs2 from the north would use this headshunt to reverse into the Railhead/IMB-R.

6.3.2 Regarding the access from the national rail route, trains arriving from the north would need to stop on the on the Independent lines clear of the turnout into the Railhead/IMBR before heading north again. This assumes that trains arriving are top and tailed with a loco at each end. If trains were not top and tailed a shunting loco would be required to leave the Railhead/IMBR and pull the train in. This movement would not be ideal as shunting locos would need to operate on both HS2 and NR infrastructure and be controlled by both signalling systems.

6.3.3 The complexities of access from the national rail route are considered as moderate worsening compared to the baseline Option.

6.4 Environmental Impacts

6.4.1 Option A5 would consist of the railhead / IMB-R located in the South Cheshire area (CA5), south of Crewe in the west Basford area. This option would require the introduction of maintenance loops near Pipe Ridware and to increase the vertical alignment of the route in Fradley to Colton area (CA1). The area of land near Stone required for the railhead / IMB-R in the Proposed Scheme would be largely utilised for construction activity and would retain the M6 access during construction. Yarnfield Lane would be retained as per its existing alignment. The area of Aldersey's Rough would remain as described in the Proposed Scheme.

6.4.2 In comparison to Option A8, Option A5 would introduce new visual impacts in the Crewe area due to the relocation of the railhead / IMB-R and would have an increased impact overall due to the increased number of visual receptors within the Crewe area. This would reduce the scenic quality of the undulating, open rural fringe farmland south of the A500 Shavington Bypass during both construction and operation, as well as having an impact on a large number of visual receptors in and around Basford, Hough, Chorlton, Wychwood Park, Gonsley Green and proposed housing north of the Shavington Bypass. There would also be an increase in impacts on landscape character and visual impacts on residential properties at Pipe Ridware due to the need to provide maintenance loops and the increase to the vertical alignment of a section of the route in the Fradley to Colton area.

6.4.3 There would be an additional loss of approximately 20ha of BMV agricultural land (Grade 2 and Subgrade 3a) in the Fradley to Colton area as a result of the increased earthworks associated with the increase in the vertical alignment of the route. Overall this option would see a reduced impact on agricultural land and holdings affected due to the relocation of the railhead / IMB-R to Crewe, requiring a reduced amount of agricultural land (predominantly Subgrade 3b).

6.4.4 With this option there would be a reduction in the loss to Pool House Wood LWS and Filly Brook LWS due to the relocation of the railhead / IMB-R to Crewe. No designated sites would be directly affected in the Crewe area. This option would see a reduction on the likely impact on protected species and habitats overall.

6.4.5 There would be an increased risk of contamination with this option due to the presence of a number of infilled ponds and quarries, a fuel point and tank, and a historic landfill site in the Crewe area. Potential for contamination would also be present within the existing railway sidings at Crewe resulting from a prolonged history of rail use.

6.4.6 The railhead / IMB-R at Crewe would be located within Flood Zone 2 and on top of an existing unnamed watercourse. This is likely to increase flood risk downstream on the Basford Brook. An unnamed tributary of Gresty Brook would be affected due to loss of river channel.

6.4.7 This option would result in an increase in traffic impacts during construction due to access being required via the local road network, namely the A500 Shavington Bypass and Jack Mills Way. There would be an increase in overall traffic movements for the construction of the railhead / IMB-R, as well as the increase in earthworks associated with the increase in the vertical alignment of a section of the route in the Fradley to Colton area. The access from the M6 would still be required at Stone for construction traffic routes, however there would be a substantial reduction in construction vehicles in the vicinity due to the relocation of the railhead / IMB-R at Crewe. This option would also present opportunities to reduce the length of diversion of Stone Rural Footpath 33 in the Stone area.

6.4.8 The increase in traffic movements within this option would result in new in-combination impacts on residential properties along Crewe Road and the proposed residential properties along Jack Mills Way due to visual, noise and HGV impacts. An increase in the severity of in-combination impacts will also be seen in Pipe Ridware, Quintons Orchard and along Pipe Lane due to increase in the vertical alignment of the route in the Fradley to Colton area. This option would therefore see an overall increase in impacts on nearby communities despite the avoidance of demolitions including the farm house at Brook House Farm and Little Micklow in the Stone area.

6.4.9 An area of a committed development at Basford West for general industry, storage and distribution, as well as separate applications for residential development, offices and local amenity facilities, would be affected by this option.

6.5 Construction Feasibility and Construction Programme

Civil Engineering

6.5.1 Option A5 has been assessed as a major worsening compared to Option A8 (baseline) for the construction programme and construction complexity.

6.5.2 Option A5 necessitates provision for access to the IMB-R / Railhead at Crewe for stockpiling materials in advance of the handover to Rail Systems. This would segregate the civils work areas in and around CA5 by creating a live rail environment. This provides a challenging programme at Crewe, as well as additional complexity associated with segregating the site.

6.5.3 The introduction of Pipe Ridware maintenance loop changes the vertical alignment up to Moreton Brook Viaduct. This increases the pier heights on the River Trent Viaduct (the critical path) with increases the complexity of the structure, it also increase the earthworks volumes significantly.

6.5.4 River Trent and Kings Bromley viaducts will need to be raised as a consequence of reintroducing the maintenance loop at Pipe Ridware, this will cause a critical delay to the programme for contract area A1.

6.5.5 This option requires the early handover of the Crewe railhead to Rail Systems which condenses the programme and would also cause large sections of CA5 to be under construction adjacent to a live rail environment which would lower productivity due to working area restrictions increasing the complexity.

6.5.6 A significant amount of additional import material is required, mainly to form the maintenance loops.

6.5.7 This option would create approximately an additional 275,000 HGV movements on the public highway compared with the baseline, mainly around the A51 and A515.

Railway Systems

6.5.8 From a Railway Systems C&L perspective Option A5 has been assessed as a moderate worsening compared with the baseline option A8.

6.5.9 This Option requires some works on the Basford Independent lines which will create significant disruption to the freight path heading in and out of the Basford sidings.

6.5.10 The Crewe railhead is located at the north end of the HS2 Phase 2A route and it can support one workfront. It is situated north of the most complex engineering works (Whitmore Heath and Madeley tunnels and HS2/NR tie-in works at Crewe) hence this railhead does not provide robustness to the HS2 construction programme. A potential delay to the tunnels' construction and/or to the HS2/NR tie-in works at Crewe will block the railhead from feeding all the railway systems construction activities south of these points. Therefore, by locating the railhead at Crewe the construction programme risk is very high.

Safety

6.5.11 Minor safety risks have been identified due to the Crewe tunnel approach area being locked between the WCML and the Railhead reception line.

6.6 Maintenance

6.6.1 At the end of HS2 Phase 2A construction stage the temporary railhead facility will be modified to a permanent IMB-R facility sharing the same footprint, core infrastructure and connections to the NR and HS2 networks as the Stone railhead.

6.6.2 As detailed in Section 4.34.1.2, locating the IMB-R at Crewe would require the installation of maintenance loops at Pipe Ridware.

6.7 Costs

6.7.1 The cost for the Civil Engineering elements of this Option is estimated to be approximately +£32million compared to the base line.

6.7.2 The cost for the Railway Systems elements of this Option is estimated to be approximately +£3million compared to the base line.

6.7.3 In total, the cost for this Option is approximately £35million higher than the base line cost submitted for the hybrid Bill.

6.7.4 All costs do not include the following:

- Land compensation / purchase;
- Client own costs / fees;
- Contingency & OB; and
- Any further layering or efficiencies the client may allow for.

6.7.5 All options have been considered discreetly and compared with the hybrid bill.

6.8 Key Risks

6.8.1 There is a very high construction programme risk due to the location of the Railhead at the north end of the route and northern than the most complex Civil Engineering elements.

6.8.2 The Civils programme becomes very constrained due to the requirement of handing over the Railhead to the Railway Systems early. This constraint is adding more risk to this Option.

7 Option A1 – Railhead located at Stone and IMB-R located at Crewe

7.1 Option Description

Stone Railhead

7.1.1 The proposed site is located to the West of the M6 between the Stone and Yarnfield. The Railhead would be located between the HS2 mainline alignment and the M6 (Appendix E).

7.1.2 The land which is largely open countryside, rises gently to the north of Yarnfield Lane Underbridge to Ch 222+000 and then falls gently towards the M6 embankment. The land use is a combination of agricultural/pasture and isolated residential properties.

7.1.3 The railhead would provide connection to the Norton Bridge to Stone Railway in both directions on the southern side via 1km long railway sidings in a north-easterly direction towards Stone. This option would also enable direct connections into the HS2 main line in both directions, with vehicular access to the railhead and associated compound made via connections to the M6 as well as the local road network, namely Yarnfield Lane.

7.1.4 To the west of the Railhead is the M6 motorway. New temporary slip roads are proposed for the southbound and northbound carriageway.

7.1.5 Direct access will be provided to the Railhead via a new roundabout off the new M6 slip roads.

7.1.6 Temporary slip roads would be required off the M6 at this location to construct HS2 mainline, even if the Railhead / IMB-R was not located here. However, Option A1 requires the provision of additional temporary slip roads which will be for works traffic access only, and will be removed and reinstated following the removal of the Railhead after construction.

7.1.7 Under this option the temporary railhead facility will be a separate depot from the permanent IMB-R facility.

Crewe IMB-R

7.1.8 The proposed site is located north of Chorlton adjacent to Basford Hall Sidings. The site is restricted by Gresty Brook to the North, Jack Mills Way to the West and A500 to South. The resulting configuration is single-ended, with a long connection to HS2 and Network Rail. (Appendix F).

7.1.9 The site currently has planning permission for a commercial development. Jack Mills Way was opened in July 2015 connecting A500 roundabout with Crewe Road.

7.1.10 The IMB-R would provide connection to the Basford Independent lines - and subsequently to the WCML- in both directions using a headshunt. The movements required to get in and out of the depot are very complex since top and tailed trains or shunting locos are required to carry out these movements.

7.1.11 This option would also enable direct connections into the HS2 main line in both directions, with vehicular access to the IMB-R made via connections to the local road network, namely Jack Mills Way.

7.1.12 Highway access to the HS2 Crewe IMB-R is proposed via the recently constructed roundabouts on Jack Mills Way. The impact that the new access would have on the level of service of the existing Jack Mills Way has not been investigated at this stage. In addition to this abnormal loads accessing the site would need to be explored.

7.1.13 The proposed IMB-R footprint is located in close proximity to local bus routes and Crewe Railway station.

7.1.14 This option requires the installation of maintenance loops at Pipe Ridware.

7.2 Engineering Feasibility

Stone Railhead Description

Highways

7.2.1 To the west of the Railhead is the M6 motorway. The M6 is planned, by Highways England, to undergo a smart motorway improvement scheme to All Lane Running prior to the construction of the railhead / IMB-R. C861 consultant have liaised with Highways England and their technical partners. No adverse comments were received from Highways England by C861 Consultant on the proposal to site the HS2 maintenance facility and associated proposed slip roads alongside the motorway. Highways England are receptive to the incorporation of the Railhead / IMB-R proposals to upgrade the M6 as far as is reasonably possible.

7.2.2 The existing Yarnfield Lane is to be realigned 50m to the North of the existing alignment. A new M6 motorway overbridge is to be constructed. The new alignment will go over the M6 Motorway before going down under the Railhead / IMB-R through tracks and under HS2 mainline. The proposed road alignment matches or betters the existing geometry of Yarnfield Lane. There are departures from standard associated with the horizontal and vertical geometry of this road (Refer to C861-SA-REG-000-000002). The offline realignment allows Yarnfield lane to remain open during construction.

7.2.3 Eccleshall Road will be re-provided as part of the Railhead enabling works. Option A8 requires a lengthening of Eccleshall Road overbridge than that required for just the HS2 alignment due to the headshunt and S&C required.

7.2.4 The existing Eccleshall Road is to be realigned east of the Eccleshall Road / M6 Motorway Overbridge.

Water and flood Risk

7.2.5 The Railhead is located in the Filly Brook catchment, in a rural setting that is generally grading down to the south-east. Filly Brook flows south along the western side of the M6 motorway passing under Yarnfield Lane. Downstream of Yarnfield Lane, Filly Brook is culverted under the M6 motorway to pass south-east through the Railhead. Flood flows are likely to bypass this culvert and pool in the vicinity of the Norton Bridge to Stone Railway, flowing north-east along the rail corridor to rejoin Filly Brook downstream of the proposed scheme. Downstream of the M6, Filly Brook flows through an existing culvert for approximately 300m, to be removed and the watercourse realigned for the scheme.

7.2.6 Approximately 850m downstream of the Filly Brook Viaduct, Filly Brook passes through a culvert crossing under the Norton Bridge to Stone Railway.

7.2.7 It is noted the Norton Bridge to Stone Railway corridor is currently adversely affected by flood events. HS2 proposals do not make this flooding situation any worse.

Geotechnics

7.2.8 There are a number of infilled pits and ponds, including an infilled lake that could be a potential source of contamination. Soft Alluvium is shown on the south-east side of footprint in Filly Brook valley, the Alluvium is underlain by River Terrace 1 Deposits. Alluvium is also shown along the south-west boundary (along M6 corridor). Solid geology is Mercia Mudstone Group.

7.2.9 The majority of the excavated materials would be Class 2 railway embankment fill (if it can be stabilised) or, more likely, highway embankment fill. It is expected that this excavated material can largely be used in the platform for the IMB-R.

Utilities

7.2.10 Option A8 design affects the following utilities and therefore requires either diversionary, removal or protection measures;

7.2.11 These utilities include: Western Power Distribution 11kV overhead electricity lines, Three Mobile Telecommunication Mast, telecommunication cables and underground fibre optic cables.

7.2.12 Extents of Yarnfield Lane overbridges and viaducts results in utility diversions within the highway.

Structures

7.2.13 To facilitate keeping Yarnfield Lane open during the construction of the Railhead at Stone a new structure is require to take Yarnfield Lane over the M6.

7.2.14 The extents of Filly Brook Viaduct are significantly larger than required to accommodate the crossings underneath due to the S&C being located on the viaduct.

Crewe IMB-R Description

Highways

7.2.15 The proposed IMB-R footprint does not require the modification of the existing highways other than new accesses off Jack Mills Way roundabouts. The connections between HS2 and Network Rail would effect a number of roads:

7.2.16 Weston Lane will be realigned with a new overbridge over the WCML, HS2, and IMB-R tracks. The new bridge will require approaches on embankments before tieing in to the existing road alignment. The existing Weston Lane overbridge would be repurposed to access the HS2 Phase 2b tunnel portal.

7.2.17 Newcastle Road will be realigned with a new overbridge over the WCML, HS2, and IMB-R tracks (This would be an extension of what is required for the HS2 mainline). The new bridge will require approaches on embankments before tieing in to the existing road alignment. The old overbridge would be removed as required by HS2 mainline works.

7.2.18 Casey Lane will require stopping up with turning heads located either side of the WCML and the HS2 connection. A new road linking Weston Lane and Newcastle Road would be created to the North of WCML, with a new junction onto Casey Lane providing access to HS2 balancing ponds.

Water and flood Risk

7.2.19 The IMB-R is located partially within floodzone 2. This may increase the risk downstream in the Basford Brook. The proposed footprint also sits partially within existing Sustainable Urban Drainage systems (SuDs) features, which will require modification. A culvert is required under the IMB-R, to manage the existing watercourses which passes through the proposed scheme.

7.2.20 The IMB-R requires a new balancing pond which is located on the IMB-R footprint. A pumping station is likely to be required to facilitate the IMB-R site drainage.

7.2.21 A review of the design strategy of the existing SuDs ponds was conducted, based on the information publically available. The catchment areas for each existing pond were reviewed. An adjusted catchment was undertaken based on the proposed IMB-R footprint. More information is required to fully design the new drainage strategy and ensure that the current site developer's drainage system is not adversely affected by the IMB-R. Whilst still a small risk, it is considered that the reduction in catchment area for the existing ponds will more than outweigh the modifications and reduction in pond sizes, to facilitate an acceptable drainage solution.

Geotechnics

7.2.22 A review of the ground conditions suggest there are a few in-filled pits and ponds that could be a potential source of contamination. There are Glaciolacustrine Deposits comprising of laminated silts and clays over the entire footprint. The majority of the excavated material would only be suitable for landscape fill.

7.2.23 The requirement of the Pipe Ridware maintenance loops requires reverting the HS2 CP2 alignment. This in turn requires larger taller embankments. There are not any notable superficial deposits present in the footprint, except at the extreme northern end of the maintenance loops (approximate Ch 194+000 to 195+400). There is a major fault at Ch 195+000 with Mercia Mudstone to the south-east of the fault. Helsby Formation overlies Chester Formation to north-west of the fault. Maintenance loops are likely to be largely on medium to high embankment, with increased earthwork width which would mean an increase in the requirement for railway embankment fill in a part of the route where the large amount of material to be won from borrow pits is already a sensitive issue.

Utilities

7.2.24 No utility connections to the IMB-R have been assumed or included at this early stage of design Utility companies will not guarantee to meet any utility supply demands at this early stage of design.

7.2.25 There are a number of utility diversions required by HS2 mainline alignment in the Crewe area that will increase in length to accommodate the proposed IMB-R connection. Therefore diversionary works will increase. These utilities include; 24" dia. concrete mains water pipe and low voltage overhead electricity line.

7.2.26 All utilities within the existing Weston Lane will require diversions to accommodate the re-alignment highway works. These utilities include; telecommunication cables and underground fibre optic cables, Scottish Power Energy Networks high voltage 33kV overhead and underground electricity cables.

7.2.27 All diversions within Newcastle Road will require lengthening to accommodate the increased length of the overbridge as a result of the IMB-R connection, thus increasing diversionary works. These utilities include water mains, telecommunications, fibre, sewers and 11kv power.

Structures

7.2.28 The IMB-R at Crewe requires the lengthening of Newcastle Road Overbridge, a number of footbridges and an additional overbridge for Weston Lane. Realignment is required.

7.2.29 To facilitate the headshunt adjacent to the HS2 mainline a retaining wall is required. This requires the separation between the HS2 mainline and the headshunt to increase to 15m.

Assessment

7.2.30 Option A1 has been assessed as a moderate worsening compared with Option A8 (baseline).

7.2.31 Option A1 has the same impacts at Stone during construction and operation of the Railhead as the baseline, with additional impacts associated with the additional footprint for the IMB-R at Crewe.

7.2.32 Impacts are generally increased due to not realising the efficiencies provided by combining the Railhead and IMB-R.

7.2.33 The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected.

7.3 Railway Systems

7.3.1 Both the Crewe IMB-R and the Stone Railhead provide access to the HS2 network from both directions However, for the Crewe IMB-R the use of a headshunt is required to access on to HS2 for trains heading northbound.

Trains arriving from Hs2 from the north would use this headshunt to reverse into the Railhead/IMB-R.

7.3.2 Regarding the access from the national rail route in to the Crewe IMB-R, trains arriving from the north would need to stop on the on the Independent lines clear of the turnout into the Railhead/IMBR before heading north again. This assumes that trains arriving are top and tailed with a loco at each end. If trains were not top and tailed a shunting loco would be required to leave the Railhead/IMBR and pull the train in. This movement would not be ideal as shunting locos would need to operate on both HS2 and NR infrastructure and be controlled by both signalling systems.

7.3.3 For the Stone Railhead access from the national rail route can be direct from both directions making use of the reception sidings adjacent to the existing Stone railway.

7.3.4 The complexities of access from the national rail route in to the Crewe IMB-R are considered as moderate worsening compared to the baseline Option.

7.4 Environmental Impacts

7.4.1 Option A1 would consist of the railhead located to the west of Stone, as described in the Proposed Scheme, and the relocation of the IMB-R to the South Cheshire area (CA5), south of Crewe in the west Basford area. This option would require the introduction of maintenance loops near Pipe Ridware and to increase the vertical alignment of the route in Fradley to Colton area (CA1). The area of land required for the railhead at Stone would be reinstated following the construction of the Proposed Scheme. The area of Aldersey's Rough would remain as described in the Proposed Scheme.

7.4.2 In comparison to Option A8, Option A1 would result in an overall increase in landscape and visual impacts during both construction and operation. The retention of the railhead at Stone would have similar impacts, as stated in Option A8, during construction on the Yarnfield Settled Farmlands LCA as well as the dispersed residential and recreational receptors at Walton and east of Yarnfield. As stated in Option A1, the relocation of the IMB-R to Crewe would reduce the scenic quality of the undulating, open rural fringe farmland south of the A500 Shavington Bypass during both construction and operation, as well as having an impact on a large number of visual receptors in and around Basford, Hough, Chorlton, Wychwood Park, Gonsley Green and proposed housing north of the Shavington Bypass. Maintenance loops and the increase to the vertical alignment of a section of the route in the Fradley to Colton area would result in additional landscape and visual impacts during both construction and operation.

7.4.3 This option would result in an increase in agricultural land and holdings impacted overall due to the retention of the railhead at Stone, additional land required in the Crewe area due to the relocation of the IMB-R, and additional land required for earthworks in Pipe Ridware associated with maintenance loops and the increase to the vertical alignment of the route in the Fradley to Colton area.

7.4.4 This option would result in the same impacts on LWSs as stated in Option A8. Basford Brook and Mere Gutter LWS in the South Cheshire area (CA5) and Pipe Wood Lane LWS to the north of the proposed maintenance loops in the Fradley to Colton area (CA1) are located in proximity to the proposal of Option A1 but are not directly affected. Option A1 would result in an increased overall impact on habitats and protected species due to the extent over which the design in this option would extend (Crewe, Stone and Pipe Rideware).

7.4.5 Option A1 would result an increased risk of contamination due to the increased presence of likely contamination in the Crewe area in addition to areas affected at Stone due to the location of the railhead.

7.4.6 The construction of Option A1 would result in an increase in overall flood risk and impacts on surface water. The IMB-R with this option at Crewe would be located within Flood Zone 2 and on top of an unnamed watercourse. This is likely to increase flood risk downstream on the Basford Brook. An unnamed tributary of Gresty Brook would be affected due to loss of river channel. A number of additional culverts, as well as the lengthening of existing culverts, would be required in the Fradley to Colton area due to the change in vertical alignment of the route of the Proposed Scheme.

7.4.7 An overall increase in traffic impacts would be present within Option A1 due to construction traffic within Stone and the surrounding areas, for the construction of the railhead, as well as additional traffic around Crewe and Pipe Ridware, due to the relocation of the IMB-R and the introduction of the maintenance loops respectively. Construction traffic movements at Crewe would access the IMB-R site via the A500 Shavington Bypass and Jack Mills Way and would increase the impact on the local road network. The introduction of maintenance loops and the associated increase in vertical alignment would also increase traffic movements in Pipe Ridware and the surrounding areas, due to the additional movements of material to form the earthworks.

7.4.8 The additional traffic movements with this option would result in new in-combination impacts on residential properties along Crewe Road and the proposed residential properties along Jack Mills Way, and there would be increase in the severity of in-combination impacts in Pipe Ridware, Quintons Orchard and along Pipe Lane, as stated in Option A5.

7.4.9 An area of a committed development[6] for strategic development and housing at Stone, as stated in Option A8, and an area of a committed development for general industry, storage and distribution, residential development, offices and local amenity facilities, as stated in Option A5, would be affected by this option.

7.5 Construction Feasibility and Construction Programme

Civil Engineering

7.5.1 Option A1 has been assessed as a moderate worsening for construction complexity and construction programme compared with the baseline option A8.

7.5.2 The installation of slab track is assumed to occur from Stone, in which case the complexity at Stone Railhead remains unchanged however the addition of the Crewe IMB-R increases the overall scope of the scheme without increasing the programme duration and thus increases the complexity.

7.5.3 It is assumed that after use as the railhead, Stone will be reinstated, effectively requiring the same amount of earthworks. This also extends the programme.

7.5.4 The introduction of Pipe Ridware maintenance loops changes the vertical alignment up to Moreton Brook Viaduct. This increases the pier heights on the River Trent Viaduct (the critical path) with increases the complexity of the structure, it also increase the earthworks volumes significantly.

7.5.5 River Trent and Kings Bromley viaducts will need to be raised as a consequence of reintroducing the maintenance loop at Pipe Ridware, this will cause a critical delay to the programme for contract area A1.

7.5.6 The Crewe IMB-R would be handed over to Rail Systems at the same time as the trace in CA5 so there is no worsening in the programme for contract Area A2.

7.5.7 This option results in major additional internal and site hauls and a significantly increased amount of imported material.

7.5.8 This option would create approximately an additional 345,000 HGV movements on the public highway.

[6] Information on committed developments, defined as approved planning applications and adopted allocations, has been collected for an area of up to 2km (5km for larger schemes such as nationally significant infrastructure projects) from the land required to construct the Proposed Scheme.

Railway Systems

7.5.9 From a Railway Systems C&L perspective Option A1 has been assessed as a moderate worsening compared with the baseline option A8.

7.5.10 This option requires the construction of two separate depots and the recovery of one of them at the end of the HS2 Phase 2A construction phase. This adds a construction programme delay for both the Civils and Rail Systems works.

7.5.11 The extensive works on the existing railway infrastructure due to the construction of two depots adds to the complexity and the cost of this Option.

Safety

7.5.12 Minor safety risks have been identified due to the Crewe tunnel approach area being locked between the WCML and the Railhead reception line.

7.6 Maintenance

7.6.1 At the end of HS2 Phase 2A construction stage the temporary railhead facility at Stone will be recovered and the land will be returned to its previous state.

7.6.2 The Crewe IMB-R will be a separate depot to the Stone temporary railhead. The IMB-R will be operational by the HS2 opening date.

7.6.3 As detailed in Section 4.34.1.2, locating the IMB-R at Crewe would require the installation of maintenance loops at Pipe Ridware.

7.7 Costs

7.7.1 The cost for the Civil Engineering elements of this Option is estimated to be approximately +£99million compared to the base line.

7.7.2 The cost for the Railway Systems elements of this Option is estimated to be approximately +£31million compared to the base line.

7.7.3 In total, the cost for this Option is approximately £130million higher than the base line cost submitted for the hybrid Bill.

7.7.4 All costs do not include the following:

- Land compensation / purchase;
- Client own costs / fees;
- Contingency & OB; and
- Any further layering or efficiencies the client may allow for.

7.7.5 All options have been considered discreetly and compared with the hybrid bill.

7.8 Key Risks

7.8.1 The key risk in this Option is the availability of resources during the construction of two depots along with the main route works. The resourcing risk is having a direct impact in the construction programme which may be affected if the resources are lower than required.

8 Option A9.5* – Railhead and IMB-R located at Aldersey's Rough

8.1 Option Description

8.1.1 The proposed site is located close to Madeley adjacent to the disused Silverdale line railway. The M6 and Keele Services are located to the North, and Three Mile lane located to the east. The configuration is single-ended, with connections to HS2 and Network Rail provided along the disused Stoke to Market Drayton Railway (also referred to as the Silverdale line) corridor (Appendix G).

8.1.2 The configuration is single ended to minimise the impact on earthworks quantities.

8.1.3 The railhead would provide connection to the WCML in both directions using the out-of-use Silverdale line west of the WCML as a headshunt. This option would also enable direct connections into the HS2 main line in both directions, with vehicular access to the railhead made via connections to the local road network and then to the M6.

8.1.4 Highway access to the HS2 Aldersey Rough Railhead / IMB-R is proposed via the Three Mile lane. During construction of the railhead and IMB-R temporary slip roads are proposed around Keele Services. This would be subject to agreement with the motorway services operator and HS2.

8.1.5 The proposed Railhead / IMB-R footprint is located within a reasonable proximity to local bus routes on the A53 and in Keele.

8.1.6 Under this Option after the construction of the HS2 Phase 2A the temporary railhead facility will be modified to a permanent IMB-R facility sharing the same footprint, core infrastructure and connections to the NR and HS2 networks as the Aldersey's Rough Railhead.

8.1.7 Finally, this option will not take into consideration the installation of maintenance loops at Pipe Ridware. As detailed in section 4.4.4, this will allow us to explore the sensitivity of the Aldersey's Rough's assessment to the inclusion of the Pipe Ridware maintenance loops.

8.2 Engineering Feasibility

Description

Highways

8.2.1 The proposed IMB-R footprint would not require the modification of the existing highways other than new accesses off Three Mile lane. However, the construction of the railhead and the IMB-R requires temporary access off the M6 around Keele.

8.2.2 Temporary access off the M6 is proposed by extending the existing Keele slip roads Northbound and the diverge Southbound. It is not feasible to construct a Southbound Merge without effecting existing woodland to the north of Keele services. In this instance controlled access is suggested using the existing back of services road.

8.2.3 Due to the early stage of design Highways England and the Motorway Service Operator have not been consulted. The proposed access off the M6 would therefore be subject to the consultation process and there is a risk associated with this. If temporary access is not possible then it is likely that there will be an increased adverse effect on Keele and Whitmore.

Water and flood Risk

8.2.4 The Railhead / IMB-R is located atop an existing partially culverted watercourse, which is a minor tributary of the River Lea. Due to the widening of the Stoke to Market Drayton Railway, three existing culverts will require lengthening and replacing / upgrading.

8.2.5 Dabgreen Drop Inlet, Whitmore Wood and Madeley Park Culvert which are required for the HS2 mainline works will all require lengthening. A new channel diversion and culvert on the River Lea tributary will also be required.

8.2.6 Reinstatement of Madeley Chord causes possible introduction of flood defences due to 1 in 1000 year requirement. A new spur form WCML to Stoke to Market Drayton Line will not be protected to 1m above 1000 year flood level due to the existing level of the WCML.

8.2.7 The new WCML spur causes significant impact on the floodplain of the River Lea as it effectively blocks the area off with the only possible crossing being the three cell culvert proposed for the 14m wide drainage system for the field.

8.2.8 Additional culverts are required beneath the spur from HS2 to the Stoke to Market Drayton Line near the end of mainline viaduct to convey surface water flows.

8.2.9 This option will see an increase in flood risk, and will require departure from HS2 Standards.

Geotechnics

8.2.10 No notable superficial soils are present within the footprint. Existing BGS BH logs suggest that there is Warwickshire Group composed of mudstone over the full depth of the excavation of the entire site.

8.2.11 Within the new embankment footprint, local peat deposits are present near the River Lea Viaduct. A fault may be present at Ch 234+600 that crosses the embankment. Excavated materials would be Class 2 Railway Embankment fill (if it can be stabilised) or, more likely, Class 2 Highway embankment fill. Where the IMB-R platform is on fill, it is expected that this material can be used as fill. However, most of the IMB-R is cut here, it is expected that this site would be likely to yield a large net surplus of cohesive fill which would need to be disposed of.

Utilities

8.2.12 No utility connections to the Railhead / IMB-R have been assumed or included at this early stage of design. Utility companies will not guarantee to meet any utility supply demands at this early stage.

8.2.13 There is limited utilities information for this area, however some major utilities have been identified. This may require a large increase in the diversionary works as a result. These utilities include; high voltage 132kV lattice tower overhead electricity line, 11kV overhead electricity line, and a 300mm dia. surface water sewer pipe and associated outfall.

8.2.14 There is an element of uncertainty regarding the need to divert the overhead lattice tower, as a full survey has not been completed to confirm if the required clearance to the new embankment is achieved. The need would be dependent on if the required clearance can be achieved under the new embankment required for the HS2 to IMB-R connection, which would be located under the likely sag point of the cables, hence it is considered likely a diversion is required.

Structures

8.2.15 The Railhead / IMB-R at Aldersey Rough requires the replacement and renewal of several structures. Replacement of the Silverdale line structure over Network Rail WCML tracks with a 'like-for-like' structure will result in a structure that is non-compliant with HS2 standards as the structure at current is an open structure. The structure also has inadequate spatial

clearance (both horizontally and vertically) to the Network Rail tracks. If Network Rail requires to meet the latest spatial requirements a 'special structure' will be required as to provide adequate clearance between the Network Rail lines at the Silverdale Line above. The height of Whitmoor Wood Retaining wall will be increased to a maximum of approximately 25m, which will limit the number of structural solutions available.

8.2.16 Multiple structures are required to be replaced along the disused Stoke to Market Drayton Line.

Assessment

8.2.17 Option A9.5* has been assessed as a moderate worsening compared to the baseline.

8.2.18 Option A9.5* reduces the amount of work required at Stone, including the realignment and replacement of Yarnfield lane and Ecclestone Road. However, additional impacts associated with the construction of an additional three slip roads around Keele Services are present.

8.2.19 There is a major worsening in relation to water and flood risk. Additional flooding is anticipated in the river Lea flood plain. The proposed IMB-R sits atop a watercourse which is altered by the site. Significant impact on culverts and Dab Green drop inlet expected due to the increase in retaining wall height for Whitmore Wood. Connection to WCML will not meet 1:1000 yr flood criteria, with the existing Madeley chord likely to require flood defences.

8.2.20 Additional impact on already significant structures particularly Whitmore Wood retaining wall which will increase in height by an additional 5 m. Replacement of multiple structures along the disused Silverdale line with a particular risk associated with the re-provision of a like for like structure over the WCML, which does not meet current NwR spatial standards.

8.2.21 A significant 132kv lattice tower HV overhead line diversion is required.

8.2.22 The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected.

8.3 Railway Systems

8.3.1 The Aldersey's Rough layout provides access to the HS2 network from both directions. However, the use of a headshunt is required to access on to HS2 for trains heading northbound on HS2. These trains would need to travel on the HS2 Up line until the north end of Madeley tunnel (approximately 4km) where they would use a facing perturbation crossover to cross on to the

HS2 Down line. There needs to be active provision for this crossover (currently, at CP3 there is passive provision only). Trains arriving from HS2 from the north would use the headshunt into the Railhead/IMB-R.

8.3.2 This is considered a minor worsening compared to the baseline.

8.3.3 Regarding the access from/to the national rail route to the Aldersey's Rough Railhead/IMB-R this can be done from both south and north without any major complexities.

8.4 Environmental Impacts

8.4.1 Option A9.5* would consist of the railhead /IMB-R located to the Aldersey's Rough area, to the west of the M6 in the Whitmore Heath to Madeley area (CA4). There would be no requirement to introduce maintenance loops in Pipe Ridware and the vertical alignment of the route would be as described in the Proposed Scheme. The area of land near Stone required for the railhead / IMB-R in the Proposed Scheme would be largely utilised for construction activity and would still retain the M6 access during construction. Yarnfield Lane would likely be retained as per its existing alignment. The area of Crewe would remain as described in the Proposed Scheme.

8.4.2 In comparison to Option A8, locating the railhead and IMB-R to Aldersey's Rough would result in a greater impact on the landscape character of the area, introducing construction effects into an area of wooded farmland currently unaffected by the Proposed Scheme. The presence of the IMB-R during the operational phase would create a lasting effect on the landform and landscape character of the area. An increase in the loss of mature hedgerows and trees is evident within this option, including the loss of trees within Hey Sprink and Whitmore Wood, both of which are ancient woodland inventory sites. Visual impacts would also be present along the edge of Madeley Park Wood, Manor Road, and the disused Stoke to Market Drayton Railway, Madeley Chord, residential properties at Aldersey's Rough and on receptors around Keele Services.

8.4.3 There would be a reduction in agricultural land holdings and agricultural land impacted with this option due to the relocation of the railhead/IMB-R to Aldersey's Rough, however there would be an increase in impact on forestry landdue to the impact on Whitmore Wood and Hey Sprink woodland.

8.4.4 Option A9.5* would increase the impact on protected species, habitats and designated sites. There would be an increase in impact on designated sites due to the relocation of the railhead/IMB-R to Aldersey's Rough. This option would result in the partial the loss of Hey Sprink and the increased loss of Whitmore Wood, which are designated as LWSs. There would also

be an increase in the loss of habitats and likely protected species, including the loss of grassland priority habitats (floodplain grazing marsh), ponds, hedgerows, bat assemblage, terrestrial habitats and likely otter habitats with the Aldersey's Rough area.

8.4.5 This option would have a reduced risk of contamination due to the relocation of the railhead/IMB-R to the Aldersey's Rough area. The sources of contamination within Option A9.5* include a small number of infilled ponds, as well as the likelihood of contamination from oils and fuels along the disused Stoke to Market Drayton Railway. Although there is a risk of contamination within this option, the overall likelihood and severity is much lower in comparison.

8.4.6 Option A9.5 would increase the level of flood risk impacts during construction. The location of the railhead and IMB-R with this option would sit atop a partially culverted tributary of the River Lea. A number of existing culverts on the Stoke to Market Drayton Railway would require lengthening/upgrading and a new channel diversion and a culvert on the tributary of the River Lea would also be required. The new WCML spur would create a loss of flood plain of the River Lea and would result in increased levels of flood risk in the area.

8.4.7 This option would require an increase in the overall traffic movements due to the construction of the railhead and IMB-R at this location and the movement of earthworks required. New accesses off the M6 at Keele Services would be required to facilitate construction traffic movement in both northbound and southbound directions. This would cause additional disruptions along the M6 with reduced speed and restrictions around Keele.

8.4.8 There would be an increase in community impacts with this option during the operational phase. There would be new in-combination impacts on residential properties at Stoney Lowe Farm and Bromley Green due to the proximity of the railhead / IMB-R to respective residential properties, as well as impacts at Hey House, along Madeley Park Wood and along Manor Road.

8.5 Construction Feasibility and Construction Programme

Civil Engineering

8.5.1 Option A9.5* has been assessed as a minor worsening compared with Option A8 (baseline).

8.5.2 Option A9.5* requires a relatively more complex engineering solution compared to the baseline particularly with additional possession requirements required on the WCML to build the crossovers. HGV access around Keele services is essential.

8.5.3 This option presents an overall saving on internal hauls due to the lesser earthworks required in this option when compared with option A8, but requires larger imports from the public roads.

8.5.4 This option would create approximately an additional 160,000 HGV movements on the public highway.

8.5.5 There is comparatively less earthworks to undertake in contract area A2 so there is a programme benefit in this sector.

8.5.6 There are some complex elements to the option A9.5* around the WCML, which may impose some constraints.

Railway Systems

8.5.7 From a Railway Systems C&L perspective Option A9.5* has been assessed as a moderate worsening compared with the baseline option A8.

8.5.8 A significant amount of railway systems works are required on the out-of-use Silverdale railway and the WCML.

8.5.9 The Silverdale railway will need to be recovered in order to be used as a haul road for the Civil Engineering works supporting the tunnels, viaduct and depot construction.

8.5.10 Following that the Railway Systems contractor will need to reinstate the railway to the current NR Standards. The railway will need to be doubled (with three headshunts at the west) with all the associated works (trackform, drainage, signalling, etc). The railway bridge over the WCML needs to be replaced and raised in order to meet the current NR Standards.

8.5.11 This will impact the WCML OLE configuration requiring OLE modification works. Also, some S&C works are required on the WCML Slow lines in order to connect these with the depot.

8.5.12 Also, Option A9.5* requires the permanent installation of one perturbation crossover north of the Madeley tunnel whereas currently there is only passive provision for this crossover. The inclusion of a crossover on a high speed line adds to the construction complexity and maintenance compared to the plain line design which is currently proposed in this area.

8.5.13 In terms of construction programme, the Aldersey's Rough railhead is located in CA4 being able to support two workfronts. However, being located between the Whitmore Heath and Madeley tunnels this railhead does not provide robustness to the HS2 construction programme. A potential delay to the tunnels construction will block the railhead from feeding all the railway systems construction activities. Therefore, by locating the railhead at Aldersey's Rough the construction programme risk is high.

Safety

8.5.14 No major safety risks have been identified for this Option.

8.6 Maintenance

8.6.1 At the end of HS2 Phase 2A construction stage the temporary railhead facility will be modified to a permanent IMB-R facility sharing the same footprint, core infrastructure and connections to the NR and HS2 networks as the Aldersey's Rough railhead.

8.6.2 As detailed in Section 4.44.34.1.2, locating the IMB-R at Aldersey's Rough would require the installation of maintenance loops at Pipe Ridware.

8.7 Costs

8.7.1 The cost for the Civil Engineering elements of this Option is estimated to be approximately +£38million compared to the base line.

8.7.2 The cost for the Railway Systems elements of this Option is estimated to be approximately +£3million compared to the base line.

8.7.3 In total, the cost for this Option is approximately £41million higher than the base line cost submitted for the hybrid Bill.

8.7.4 All costs do not include the following:

- Land compensation / purchase;
- Client own costs / fees;
- Contingency & OB; and
- Any further layering or efficiencies the client may allow for.

8.7.5 All options have been considered discreetly and compared with the hybrid bill.

8.8 Key Risks

8.8.1 Currently, it is assumed that the Keele motorway services can be used to access the railhead and later on the IMB-R. There is a risk around reaching an agreement with the Keele services and Highways England. If no such agreement can be reached then there would be potential impact on Keele.

8.8.2 A second risk is the HS2 legacy on the Silverdale railway. The current design requires the reception lines on the Silverdale line to be maximum 2 meters lower than the existing ground. This results in an alignment different than the existing unused railway line and corridor, which would require

significant excavation and associated cost if decided that the Silverdale line would reopen.

8.8.3 An additional risk on the HS2 legacy on the Silverdale railway results from the systems handover between HS2 and NR. Currently, the systems handover is assumed to take place at the spurs connecting the WCML with the reception lines. Therefore, the infrastructure from the reception lines up to the IMB-R entrance will be HS2 controlled. A potential reopening of the Silverdale railway would require trains running from Market Drayton to Keele to switch between the NR and the HS2 control systems twice which is considered very high risk.

9 Option A9.5 – Railhead and IMB-R located at Aldersey's Rough

9.1 Option Description

9.1.1 The option description for Option A9.5 is as per Option A9.5*.

9.1.2 However, the effect of the maintenance loops at Pipe Ridware will be incorporated in the Option assessment.

9.2 Engineering Feasibility

9.2.1 The engineering description and assessment is similar to that of Option A9.5*, with the main differentiators described in the construction complexity section below.

9.3 Railway Systems

9.3.1 The Railway Systems description and assessment is similar to that of Option A9.5*, with the main differentiators described in the maintenance section below.

9.4 Environmental Impacts

9.4.1 Option A9.5 would locate the railhead / IMB-R as per Option A9.5* with the introduction of maintenance loops near Pipe Ridware and would increase in the vertical alignment of the route in Fradley to Colton area (CA1) as a result.

9.4.2 In comparison to Option A8, Option A9.5 would result in the same impacts as stated in Option A9.5* due to the relocation of the railhead / IMB-R at Aldersey's Rough. Option A9.5 would additionally require maintenance loops and an increase to the vertical alignment of a section of the route in the Fradley to Colton area. The key differentiators regarding the additional

impacts resulting from the maintenance loops and the increase to the vertical alignment are detailed below.

9.4.3 This option would result in an increase in impacts on landscape character at Pipe Ridware due to the maintenance loops and the increased vertical alignment of the route in the Fradley to Colton area. Construction of maintenance loops at Pipe Ridware would increase visual impacts at residential properties in Pipe Ridware, Quintons Orchard and along Pipe Lane due to the increase in the vertical alignment of the route, increasing the severity of overall in-combination impacts in Pipe Ridware.

9.4.4 Additional land would be required at Pipe Ridware due to the introduction of the maintenance loops and increasing the vertical alignment of the route in the Fradley to Colton area. This would increase the amount of agricultural land required and there would be an increase in impacts on land holdings.

9.4.5 There would be an Increase in-combination impacts due to increases in construction traffic movements due to the increased earthworks required and views of construction plant and activities at residential properties south and west of Kings Bromley, Trentside Meadows and residential properties at Hadley Gate.

9.4.6 Additional losses of habitats would be present due to the introduction of maintenance loops and increasing the vertical alignment of the route in the Fradley to Colton area. This would result in the additional loss and fragmentation of open arable farmland habitats including farm ponds and severance of a number of minor watercourses and drains. Increasing the vertical alignment of the route would result in a number of additional culverts required, as well as the lengthening of existing culverts.

9.5 Construction Feasibility and Construction Programme

Civil Engineering

9.5.1 Option A9.5 has been assessed as a moderate worsening compared with Option A8 (baseline).

9.5.2 Option A9.5 is a relatively more complex engineering solution than option A8, with additional possession requirements required on the WCML to build the crossovers. HGV access off the Keele services is essential.

9.5.3 The introduction of Pipe Ridware maintenance loop changes the vertical alignment up to Moreton Brook Viaduct. This increases the pier heights on the River Trent Viaduct (the critical path) with increases the complexity of the structure, it also increase the earthworks volumes significantly.

9.5.4 Due to the imports required at Aldersey's Rough and Pipe Ridware, there is approximately 1.5m m3 of additional imported material required.

9.5.5 This option would create approximately an additional 370,000 HGV movements on the public highway.

9.5.6 River Trent and Kings Bromley viaducts will need to be raised as a consequence of reintroducing the maintenance loop at Pipe Ridware, this will cause a critical delay to the programme for contract area A1.

9.5.7 There is comparatively less earthworks to undertake in contract area A2 so there is a programme benefit in this sector. There are some complex elements to option A9.5 around the WCML, which may impose some constraints.

9.5.8 The benefit in contract area A2, is outweighed by the effect of the Pipe Ridware Maintenance loops.

9.5.9 The primary difference between option A9.5 and Option A9.5* are the benefits associated with not requiring maintenance loops at Pipe Ridware. This reduces the amount of material and traffic movements.

Railway Systems

9.5.10 From a Railway Systems C&L perspective Option A9.5 has been assessed as a moderate worsening compared with the baseline option A8.

9.5.11 This assessment is similar to the respective assessment for Option A9.5* (sections 8.5.7 to 8.5.14).

9.6 Maintenance

9.6.1 At the end of HS2 Phase 2A construction stage the temporary railhead facility will be modified to a permanent IMB-R facility sharing the same footprint, core infrastructure and connections to the NR and HS2 networks as the Aldersey's Rough Railhead.

9.6.2 As detailed in Section 4.44.34.1.2, locating the IMB-R at Aldersey's Rough would require the installation of maintenance loops at Pipe Ridware.

9.7 Costs

9.7.1 The cost for the Civil Engineering elements of this Option is estimated to be approximately +£71million compared to the base line.

9.7.2 The cost for the Railway Systems elements of this Option is estimated to be approximately +£10million compared to the base line.

9.7.3 In total, the cost for this Option is approximately £81million higher than the base line cost submitted for the hybrid Bill.

9.7.4 All costs do not include the following:

- Land compensation / purchase;
- Client own costs / fees;
- Contingency & OB; and
- Any further layering or efficiencies the client may allow for.

9.7.5 All options have been considered discreetly and compared with the hybrid bill.

9.8 Key Risks

9.8.1 Currently, it is assumed that the Keele motorway services can be used to access the railhead and later on the IMB-R. There is a risk around reaching an agreement with the Keele services and Highways England. If no such agreement can be reached then there would be potential impact on Keele.

9.8.2 A second risk is the HS2 legacy on the Silverdale railway. The current design requires the reception lines on the Silverdale line to be maximum 2 meters lower than the existing ground. This results in an alignment much different than the existing corridor which would require significant excavation and associated cost if decided that the Silverdale line would reopen.

9.8.3 An additional risk on the HS2 legacy on the Silverdale railway results from the systems handover between HS2 and NR. Currently, the systems handover is assumed to take place at the spurs connecting the WCML with the reception lines. Therefore, the infrastructure from the reception lines up to the IMB-R entrance will be HS2 controlled. A potential reopening of the Silverdale railway would require trains running from Market Drayton to Keele to switch between the NR and the HS2 control systems twice which is considered very high risk.

10 Summary

10.1 Civil Engineering Assessment

10.1.1 Consideration of the Civil engineering assessment was completed by C861 consultant.

10.1.2 Based on the designs developed for the sifted options required and the criteria assessed for civil engineering option A8 (baseline) was considered the preferred solution.

Option A5

10.1.3 Option A5 has been assessed as a minor worsening compared with the baseline.

10.1.4 Option A5 reduces the amount of work required at Stone, including the realignment and replacement of Yarnfield lane and Ecclestone Road. There are worsenings in relation to water, with a pumping station required at Crewe. Additional structures are required with a lengthening of Newcastle Road overbridge and a new overbridge for Weston Lane.

10.1.5 The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected.

Option A1

10.1.6 Option A1 has been assessed as a moderate worsening compared with the baseline.

10.1.7 Option A1 has the same impacts at Stone during construction and operation of the Railhead as the baseline, with additional impacts associated with the additional footprint for the IMB-R at Crewe.

10.1.8 Impacts are generally increased due to not realising the efficiencies provided by combining the Railhead and IMB-R.

10.1.9 The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected.

Option A9.5/9.5*

10.1.10 Option A9.5 has been assessed as a moderate worsening compared to the baseline

10.1.11 Option A9.5 reduces the amount of work required at Stone, including the realignment and replacement of Yarnfield Lane and Ecclestone Road. However, additional impacts associated with the construction of an additional three slip roads around Keele Services are present.

10.1.12 There is a major worsening in relation to water and flood risk. Additional flooding is anticipated in the river Lea flood plain. The proposed IMB-R sits atop a watercourse which is altered by the site. Significant impact on culverts and Dab Green drop inlet expected due to the increase in retaining wall height for Whitmore Wood. Connection to WCML will not meet 1:1000 yr flood criteria, with the existing Madeley chord likely to require flood defences.

10.1.13 Additional impact on already significant structures particularly Whitmore Wood retaining wall which will increase in height by an additional 5 m. Replacement of multiple structures along the disused Silverdale line with a particular risk associated with the re-provision of a like for like structure over the WCML, which does not meet current NwR spatial standards.

10.1.14 A significant 132kv lattice tower HV overhead line diversion is required.

10.1.15 The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected. These additional impacts were not considered for option A9.5*.

10.2 Railway Systems Assessment

10.2.1 Based on the analysis and assessment carried out above, Option A8 has been identified as the preferred Option. This Option provides the best access from/to HS2 compared to the other Options. It also requires the least amount of works on the existing national rail network. Options A5 and A1 require complex train movements for entering the Railhead/IMB-R while options A9.5* and A9.5 require northbound trains on the HS2 network to reverse north of Madeley tunnel before entering the depot. Finally, Options A5, A1, A9.5* and A9.5 require more works on the existing national rail network compared to the baseline.

10.3 Environment and sustainability

10.3.1 Option A8 has been identified as the preferred option from an environment and sustainability perspective as on balance this provided the least impact in comparison to the alternatives assessed. Option A5, A1, A9.5* and A9.5 presented an increased impact from a landscape and visual, flood risk, noise, community integrity, waste arisings and a transport and severance perspective. Option A1, A9.5* and A9.5 would present an increase in

biodiversity. Option A5 and A1 would result in increased impact on committed developments in the Crewe area for general industry, storage and distribution, as well as separate applications for residential development, offices and local amenity facilities. Option A5 and A1 would also result in an increased impact from a land quality perspective due to the increased number of contamination sources in the Crewe area.

10.4 Construction complexity and Construction Programme

Civil Engineering

10.4.1 Consideration of construction feasibility of the civils works was carried out by the C861 consultant.

10.4.2 With regard to civils construction complexity Option A8 offered the least complex overall scenario, option A9.5* marginally worse and scoring neutrally. This was often due to the both options not requiring maintenance loops at Pipe Ridware. Option A5 is the most complex due to the programme constraints, with a moderate worsening on A1 and a minor worsening on A9.

10.4.3 Option A5 was assessed as the most complex with a major worsening compared to the baseline, this was primarily due to the required construction programme to hand over the railhead at Crewe earlier. Additional complexity is then added to the remaining construction in the Crewe area due to the segregation of the site by a live railway.

10.4.4 Option A1 presents all the complexity required for the baseline, but with added complexity associated with the inclusion of the maintenance loops at Pipe Ridware. It is noted the Crewe IMB-R would not be required to be handed over until the completion of HS2 Phase 2B which simplifies construction in that area compared with Option A5.

10.4.5 Option A9.5 has been assessed as a minor worsening compared with the baseline. This is primarily due to the inclusion of the maintenance loops at Pipe Ridware. Although relatively more complex, with more structures required including a 25m retaining wall, the close proximity to borrow pit means that the site earthworks could be relatively self-contained. The inclusion of the maintenance loops raises embankments and structures elsewhere creating additional vehicle movements and adding to the complexity.

Railway Systems

10.4.6 Option A8 has been identified as the preferred Option as it provides increased construction programme robustness compared to all the other Options. This is due to this Option located away from complex civil

engineering elements such as tunnels and the HS2/NR tie-in works at Crewe.

10.4.7 Also, Option A8 requires the least amount of disruption to the existing rail services compared to the other Options. This is due to the connections required on the existing rail network and the actual location of these connections.

10.5 Capital cost

10.5.1 C861 have carried out a comparison exercise of the capital construction cost, excluding, risk, operations and contingency. It is predicted the baseline option A8 provides the lowest capital cost. Options A1, A5, A9.5* and A9.5 costing approximately £99m, £32m, £38m and £71 more than option A8 respectively.

10.5.2 All costs are civil engineering costs only, and do not include the following:

- Rail systems;
- Land compensation / purchase;
- Client own costs / fees;
- Contingency & OB; and
- Any further layering or efficiencies the client may allow for.

10.5.3 All options have been considered discreetly and compared with the hybrid bill.

10.6 Sift presentation (panel review)

10.6.1 C862 consultant presented the sift process with the support and input from C861 consultant. The comparative assessment results were presented for Railway Systems, Civils, Environmental and Cost. The sift was presented to a multidisciplinary panel held at C861 Midlands Campus office on 11 October 2017. Attendees comprised representatives from HS2, C861 and C862.

10.6.2 The conclusion of the sift was that option A8 was the preferred option.

10.6.3 A record of this meeting is contained in Appendix B.

11 Conclusions

11.1.1 This report re-evaluated the strategic location of the proposed temporary railway systems construction facility (railhead) required for the construction of the HS2 Phase 2A in conjunction with the permanent maintenance facility (IMB-R) required for the maintenance of the HS2 infrastructure.

11.1.2 C862 PSC undertook a Sift of the following options with the C861 PSC support. The options considered were:

- Option A8 (Base Case) - Railhead and IMB-R located at Stone;
- Option A5 - Railhead and IMB-R located at Crewe including maintenance loops at Pipe Ridware;
- Option A1 - Railhead located at Stone and IMB-R located at Crewe including maintenance loops at Pipe Ridware;
- Option A9.5* - Railhead and IMB-R located at Aldersey's Rough;
- Option A9.5 - Railhead and IMB-R located at Aldersey's Rough including maintenance loops at Pipe Ridware.

11.1.3 The Sift was completed on the 18th of October 2017 and the outcome was that Option A8 is the preferred option for the construction of HS2 Phase 2A and the HS2 maintenance. This location is the same as the one included in the hybrid Bill.

Appendix A – Strategic SIFT Matrix

C861

HS2 Phase 2a West Midlands to Crewe

Combined railhead/IMB-R Sift - Engineering Matrix

Document no.C861-ARP-EN-ASM-000-000057:

This Revision	Date	Author	Checked by	Approved by
P02	09/10/17	Alex Walton Topic Leads	Matthew Taylor	David Edwards

Engineering Option Comparison Matrix

Option Appraisal Assessment Criteria

- - -	Major worsening on the Comparator Scheme
- -	Moderate worsening on the Comparator Scheme
-	Minor worsening on Comparator Scheme
O	Neutral / no change to Comparator Scheme
+	Minor improvement on Comparator Scheme
+ +	Moderate improvement on Comparator Scheme
+ + +	Major improvement on Comparator Scheme
N/A	Not applicable

Community Area and location:	CA3	

Option name and description:				**Combine railhead/IMB-R Sift – EI222**							
OPTIONS CONSIDERED:		**Baseline – Option A8**		**Option A5**		**Option A1**		**Option A9.5***		**Option A9.5**	
OPTION DESCRIPTION		**Railhead and IMB-R at Stone (CP3 design) No Maintenance Loops at Pipe Ridware**		**Railhead and IMB-R at Crewe With Maintenance Loops at Pipe Ridware**		**Railhead at Stone IMB-R at Crewe With Maintenance Loops at Pipe Ridware**		**Railhead and IMB-R at Aldersey's Rough No Maintenance Loops at Pipe Ridware**		**Railhead and IMB-R at Aldersey's Rough With Maintenance Loops at Pipe Ridware**	
``Heading	**Appraisal Criteria**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	
Strategic fit	*Location and Space for Railhead*		N/A		O		O		O		O
	Approximate size (sq.m)	<u>Stone IMB-R and Railhead</u> IMB-R area: approx. 375,000m2 Connections: approx. 260,000m2	N/A	<u>Crewe IMB-R and Railhead</u> IMB-R Area: approx 325,000m2 Connections approx 125,000m2	O	<u>Crewe IMB-R</u> IMB-R Area: approx 325,000m2 Connections approx 125,000m2 <u>Stone Railhead</u> IMB-R area approx.:375,000m2 Connections: approx. 260,000m2	O	<u>Aldersey Rough IMB-R and Railhead</u> IMB-R area: approx 315,000m2 Connections and ancillaries: approx 415,000m2	O	<u>Aldersey Rough IMB-R and Railhead</u> IMB-R area: approx 315,000m2 Connections and ancillaries: approx 415,000m2	O
	Level/Straight Site	Differences in site level are Moderate	N/A	Differences in site level are low	+	<u>Stone Railhead</u> No change from baseline <u>Crewe IMB-R</u> Differences in site level are low	O	Differences in site level on the IMB-R are moderate, however differences in site levels around the connections are high	-	Differences in site level on the IMB-R are moderate, however differences in site levels around the connections are high	-

	Site Bisected by major canal or road	No major roads bisected, however B5026 and Yarnfield lane bisect the site and require realignment. Permanent access off the M6 which be provided Southbound, and temporary access Northbound during construction. It is noted that temporary M6 access is required at this location to construct HS2 Mainline.	N/A	No major road bisected by the IMB-R, however the connections to the railhead / IMB-R affect Newcastle Road by way of extending the proposed HS2 mainline overbridge. Weston Lane is affected and requires the construction of a new overbridge and road realignment. The IMB-R is located adjacent to A500 and Jack Mills Way.	0	<u>Stone Railhead</u> No major roads bisected, however B5026 and Yarnfield lane bisect the site and require realignment. Temporary access off the M6 which can be provided Southbound and Northbound during construction. <u>Crewe IMB-R</u> No major road bisected by the IMB-R, however connections to the IMB-R affect Newcastle Road by way of extending the proposed HS2 mainline overbridge. Weston Lane is affected and requires the construction of a new overbridge and realignment. The IMB-R is located adjacent to A500 and Jack Mills Way.	0	No major roads bisected. Temporary access provided via the M6 around Keele services Northbound (merge and diverge), Southbound (diverge), and through Keele services (Merge). This is subject to consultation and agreement with the Motorway Service Operator and Highways England. Permanent access would be provided through the existing road network.	0	No major roads bisected. Temporary access provided via the M6 around Keele services Northbound (merge and diverge), Southbound (diverge), and through Keele services (Merge). This is subject to consultation and agreement with the Motorway Service Operator and Highways England. Permanent access would be provided through the existing road network.	0

	Major Water Features on site	The IMB-R / Railhead and HS2 require the deculverting of Filley Brook and providing a more natural channel. Culverts will be required over short lengths of previously open channels	N/A	Some of the area required for the railhead and IMB-R is located within flood zone 2.This may increase flood risk downstream on the Basford Brook. The site also sits atop of a water course that drains the site area. A new balancing pond and pumping stations would be required to facilitate drainage for the Railhead / IMB-R.	--	<u>Crewe IMB-R</u> Some of the area required for the railhead and IMB-R is located within flood zone 2.This may increase flood risk downstream on the Basford Brook. The site also sits atop of a water course that drains the site area. A new balancing pond and pumping stations would be required to facilitate drainage for the Railhead / IMB-R. <u>Stone Railhead</u> The IMB-R / Railhead and HS2 require the deculverting of Filley Brook and providing a more natural channel. Culverts will be required over short lengths of previously open channels	--	The IMB-R is located atop an existing partially culverted watercourse, which is a minor tributary of the River Lea. Due to the widening of the Stoke to Market Drayton Railway, three existing culverts will require lengthening and replacing / upgrading. Dabgreen Drop Inlet, Whitmore Wood and Maidley Park Culvert will all require lengthening. A new channel diversion and culvert on the River Lea tributary will also be required. The new WCML spur causes significant impact on the floodplain of the River Lea as it blocks the area off with the only possible crossing being the three cell culvert for the 14m wide drainage system for the field. This option will see an increase in flood risk in comparison to the baseline option, which already possesses adverse impacts. Reinstatement of Madeley Chord causes possible introduction of flood defences due to 1 in 1000 year requirements.	---	The IMB-R is located atop an existing partially culverted watercourse, which is a minor tributary of the River Lea. Due to the widening of the Stoke to Market Drayton Railway, three existing culverts will require lengthening and replacing / upgrading. Dabgreen Drop Inlet, Whitmore Wood and Maidley Park Culvert will all require lengthening. A new channel diversion and culvert on the River Lea tributary will also be required. The new WCML spur causes significant impact on the floodplain of the River Lea as it blocks the area off with the only possible crossing being the three cell culvert for the 14m wide drainage system for the field. This option will see an increase in flood risk in comparison to the baseline option, which already possesses adverse impacts. Reinstatement of Madeley Chord causes possible introduction of flood defences due to 1 in 1000 year requirements.	---
	The site shall be served by public transport and be accessible for local staff	Reasonable proximity to Walton, some bus routes close by.	N/A	Located in close proximity to Crewe Railway station, and local bus routes close by	+	<u>Stone Railhead</u> Reasonable proximity to Walton, some local bus routes close by. <u>Crewe IMB-R</u> Located in close proximity to Crewe Railway station, and local bus routes close by	+	Reasonable proximity to Keele and A53, some local bus routes close by.	o	Reasonable proximity to Keele and A53, some local bus routes close by.	o

Civils Construction Feasibility	Assess the relative complexity of construction		N/A	This option necessitates provision for access to the IMB-R / Railhead at Crewe for stockpiling materials in advance of the handover to Rail Systems. This would segregate the civils work areas in and around CA5 by creating a live rail environment. This provides a challenging programme at Crewe, as well as additional complexity associated with segregating the site. The introduction of Pipe Ridware maintenance loop changes the vertical alignment up to Moreton Brook Viaduct. This increases the pier heights on the River Trent Viaduct (the critical path) with increases the complexity of the structure, it also increase the earthworks volumes significantly. Approximately +900k m3 of import material is required, mainly to form the maintenance loops. This option would create approximately an additional 275,000 HGV movements on the public highway, mainly around the A51 and A515.	---	The installation of slab track is assumed to occur from Stone, in which case the complexity at Stone Railhead remains unchanged however the addition of the Crewe IMB-R increases the overall scope of the scheme without increasing the programme duration and thus increases the complexity. It is assumed that after use as the railhead, Stone will be reinstated, effectively requiring the same amount of earthworks. This also extends the programme. The introduction of Pipe Ridware maintenance loop changes the vertical alignment up to Moreton Brook Viaduct. This increases the pier heights on the River Trent Viaduct (the critical path) with increases the complexity of the structure, it also increase the earthworks volumes significantly. This option results in an additional 2-3m m3 of internal and site hauls and 1m m3 of imported material. This option would create approximately an additional 345,000 HGV movements on the public highway.	--	The Aldersey location requires a relatively more complex engineering solution particularly with additional possession requirements required on the WCML to build the crossovers. HGV access off the Keele services is essential. This option presents an overall saving on internal hauls due to the lesser earthworks at Aldersey compared to Stone, but requires larger imports from the public roads. This option would create approximately an additional 160,000 HGV movements on the public highway.	0	This is a relatively more complex engineering solution with additional possession requirements required on the WCML to build the crossovers. HGV access off the Keele services is essential. The introduction of Pipe Ridware maintenance loop changes the vertical alignment up to Moreton Brook Viaduct. This increases the pier heights on the River Trent Viaduct (the critical path) with increases the complexity of the structure, it also increase the earthworks volumes significantly. Due to the imports required at Aldersey and Pipe Ridware, there is approximately 1.5m m3 of imported material required. This option would create approximately an additional 370,000 HGV movements on the public highway.	-

	Assess the relative construction programme	Some of the earthworks volumes are associated with the M6 junction slip roads which are required for the construction of HS2 regardless. This option also necessitates crossing the existing railway and Yarnfield lane. There is also a new road bridge over the M6.		River Trent and Kings Bromley viaducts will need to be raised as a consequence of reintroducing the maintenance loop at Pipe Ridware, this will cause a critical delay to the programme for contract area A1. This option also requires the early handover of the Crewe railhead to Rail Systems which condenses the programme and would also cause large sections of CA5 to be under construction adjacent to a live rail environment which would lower productivity due to working area restrictions increasing the complexity.	---	River Trent and Kings Bromley viaducts will need to be raised as a consequence of reintroducing the maintenance loop at Pipe Ridware, this will cause a critical delay to the programme for contract area A1. The Crewe IMB-R would be handed over to Rail Systems at the same time as the trace in CA5 so there is no worsening in the programme for contract Area A2.	--	There is comparatively less earthworks to undertake in contract area A2 so there is a programme benefit in this sector. There are some complex elements to the Aldersey option around the WCML, which may impose some constraints.	0	River Trent and Kings Bromley viaducts will need to be raised as a consequence of reintroducing the maintenance loop at Pipe Ridware, this will cause a critical delay to the programme for contract area A1. There is comparatively less earthworks to undertake in contract area A2 so there is a programme benefit in this sector. There are some complex elements to the Aldersey option around the WCML, which may impose some constraints. The benefit in A2, is outweighed by the effect of the Pipe Ridware Maintenance loops.	-
	Assess utility connections	No utility connections to the IMB-R have been assumed or included in the design at this stage. Utility companies will not guarantee to meet any utility supply demands at this early stage of the design.	N/A	No utility connections to the IMB-R have been assumed or included in the design at this stage. Utility companies will not guarantee to meet any utility supply demands at this early stage of the design.	0	No utility connections to the IMB-R have been assumed or included in the design at this stage. Utility companies will not guarantee to meet any utility supply demands at this early stage of the design.	0	No utility connections to the IMB-R have been assumed or included in the design at this stage. Utility companies will not guarantee to meet any utility supply demands at this early stage of the design.	0	No utility connections to the IMB-R have been assumed or included in the design at this stage. Utility companies will not guarantee to meet any utility supply demands at this early stage of the design.	0

	Assess the relative disruption to existing infrastructure	The baseline design affects the several utilities and therefore requires either diversionary, removal or protection measures; These utilities include: Western Power Distribution 11kV overhead electricity lines, Three Mobile Telecommunication Mast, telecommunication cables and underground fibre optic cables. Extents of Yarnfield Lane overbridges and viaducts results in utility diversions within the highway.	N/A	Diversions crossing the HS2 alignment in the Crewe area will increase in length to accommodate the proposed Railhead / IMB-R connection, and therefore diversionary works will increase. These utilities include; 24" dia. concrete mains water pipe and low voltage overhead electricity line. All utilities within the existing Weston Lane alignment will require diversions to accommodate the re-alignment highway works. These utilities include; telecommunication cables and underground fibre optic cables, high voltage 33kV overhead and underground electricity cables. All diversions within Newcastle Road will require lengthening to accommodate the increased length of the overbridge as a result of the Railhead / IMB-R connection, thus increasing diversionary works. These include: water mains, telecommunications, fibre, sewers and 11kv power.	-	<u>Stone Railhead</u> No additional impact at Stone from baseline <u>Crewe IMB-R</u> Diversions crossing the HS2 alignment in the Crewe area will increase in length to accommodate the proposed IMB-R connection, and therefore diversionary works will increase. These utilities include; 24" dia. concrete mains water pipe and low voltage overhead electricity line. All utilities within the existing Weston Lane alignment will require diversions to accommodate the re-alignment highway works. These utilities include; telecommunication cables and underground fibre optic cables, Scottish Power Energy Networks high voltage 33kV overhead and underground electricity cables. All diversions within Newcastle Road will require lengthening to accommodate the increased length of the overbridge as a result of the IMB-R connection, thus increasing diversionary works. These utilities include water mains, telecommunications, fibre, sewers and 11kv power.	--	There is limited utilities information for this area, however some major utilities have been identified. There will be a large increase in the diversionary works as a result. These utilities include; high voltage 132kV lattice tower overhead electricity line, 11kV overhead electricity line, and a 300mm dia. surface water sewer pipe and associated outfall.	--	There is limited utilities information for this area, however some major utilities have been identified. There will be a large increase in the diversionary works as a result. These utilities include; high voltage 132kV lattice tower overhead electricity line, 11kV overhead electricity line, and a 300mm dia. surface water sewer pipe and associated outfall.	--

	Assess the relative disruption to highways	Access would be provided off the M6 for HS2 mainline alignment works, however providing the Stone Railhead and IMB-R requires the realignment of Yarnfield lane and Eccleshall Road, including permanent access off the M6. The Yarnfield lane diversion will be constructed offline which will reduce the impact of construction at this location.	N/A	<u>Crewe</u> A500 and Jack Mills Way remain in place. The realignment of Newcastle Road and Weston Lane is required (Additional realignment of Weston Lane compared to baseline). Diversion between Chorlton Lane and Newcastle Road adjusted compared with baseline. Existing Weston Lane Overbridge to be repurposed to provide maintenance and emergency access to HS2 Phase 2b tunnel portal. <u>Stone</u> The realignment of Yarnfield lane is not required, however temporary slip roads will be required off the M6 to join Yarnfield lane for HS2 mainline construction. Potential additional disruption on Yarnfield lane due to loss of rail connection at location.	-	<u>Crewe</u> A500 and Jack Mills Way remain in place. The realignment of Newcastle Road and Weston Lane is required (Additional realignment of Weston Lane compared to baseline). Diversion between Chorlton Lane and Newcastle Road adjusted compared with baseline. Existing Weston Lane Overbridge to be repurposed to provide maintenance and emergency access to HS2 Phase 2b tunnel portal. <u>Stone</u> Access would be provided off the M6 for HS2 mainline alignment works, however providing the Stone Railhead requires the realignment of Yarnfield lane and Eccleshall Road, including permanent access off the M6. The Yarnfield lane diversion will be constructed offline which will reduce the impact of construction at this location.	--	<u>Aldersey Rough</u> New temporary slip roads off the M6 during construction of the railhead / IMB-R for Northbound Access and Southbound diverge. Utilise Keele services as a controlled access to join southbound carriageway. A new junction will be created off Three Mile Lane to access the IMB-R / Railhead. <u>Stone</u> The realignment of Yarnfield lane is not required, however temporary slip roads will be required off the M6 to join Yarnfield lane for HS2 mainline construction. Potential additional disruption on Yarnfield lane due to loss of rail connection at location.	-	<u>Aldersey Rough</u> New temporary slip roads off the M6 during construction of the railhead / IMB-R for Northbound Access and Southbound diverge. Utilise Keele services as a controlled access to join southbound carriageway. A new junction will be created off Three Mile Lane to access the IMB-R / Railhead. <u>Stone</u> The realignment of Yarnfield lane is not required, however temporary slip roads will be required off the M6 to join Yarnfield lane for HS2 mainline construction. Potential additional disruption on Yarnfield lane due to loss of rail connection at location.	-
	Assess the required site access during construction and operation of the railhead / IMB-R	Access is provided directly off the M6.	N/A	Access is provided off A500 and Jack Mills way	-	<u>Stone Railhead</u> Access provided directly off the M6 <u>Crewe IMB-R</u> Access provided off A500 and Jack Mills way	-	Access assumed provided off the M6 around Keele services (subject to consultation with Highways England and MSO), with Three mile lane used to access railhead / IMB-R. There is a risk if a suitable agreement could not be reached, and a significant impact on Keele and surrounding local roads.	--	Access assumed provided off the M6 around Keele services (subject to consultation with Highways England and MSO), with Three mile lane used to access railhead / IMB-R. There is a risk if a suitable agreement could not be reached, and a significant impact on Keele and surrounding local roads.	--

Civils Geotechnics	Geotechnics	There are a number of infilled pits and ponds, including an infilled lake that could be a potential source of contamination. Soft Alluvium on the south-east side of footprint in Filly Brook valley, the Alluvium is underlain by River Terrace 1 Deposits. Alluvium is also shown along the south-west boundary (along M6 corridor). Solid geology is Mercia Mudstone Group. The majority of the excavated materials would be Class 2 railway embankment fill (if it can be stabilised) or, more likely, highway embankment fill. It is expected that this excavated material can largely be used in the platform for the IMBR.	N/A	<u>Crewe Railhead and IMB-R</u> There are a number of infilled pits and ponds that could be a potential source of contamination. There are Glaciolacustrine Deposits comprising of laminated silts and clays over the entire footprint. The majority of the excavated material would be landscape fill. <u>Pipe Ridware Maintenance Loop:</u> No notable superficial soils are present in the footprint, except at the extreme northern end of the maintenance loops (approx Ch 194+000 to 195+400). There is a major fault at Ch 195+000 with Mercia Mudstone to the south-east of the fault. Helsby Formation overlies Chester Formation to north-west of the fault. Maintenance loops are likely to be largely on medium to high embankment, with increased earthwork width which would mean an increase in the requirement for railway embankment fill in a part of the route where the large amount of material to be won from borrow pits is already a sensitive issue.	--	<u>Stone Railhead</u> No change from baseline <u>Crewe IMB-R</u> There are a number of infilled pits and ponds that could be a potential source of contamination. There are Glaciolacustrine Deposits comprising of laminated silts and clays over the entire footprint. The majority of the excavated material would be landscape fill. <u>Pipe Ridware Maintenance Loop:</u> No notable superficial soils are present in the footprint, except at the extreme northern end of the maintenance loops (approx Ch 194+000 to 195+400). There is a major fault at Ch 195+000 with Mercia Mudstone to the south-east of the fault. Helsby Formation overlies Chester Formation to north-west of the fault. Maintenance loops are likely to be largely on medium to high embankment, with increased earthwork width which would mean an increase in the requirement for railway embankment fill in a part of the route where the large amount of material to be won from borrow pits is already a sensitive issue.	--	<u>Aldersey Rough</u> No notable superficial soils are present within the footprint. Existing BGS BH logs suggest that there is Warwickshire Group composed of mudstone over the full depth of the excavation of the entire site. Within the new embankment footprint, local peat deposits are present near the River Lea Viaduct. A fault may be present at Ch 234+600 that crosses the embankment. Excavated materials would be Class 2 Railway Embankment fill (if it can be stabilised) or, more likely, Class 2 Highway embankment fill.	0	<u>Aldersey Rough</u> No notable superficial soils are present within the footprint. Existing BGS BH logs suggest that there is Warwickshire Group composed of mudstone over the full depth of the excavation of the entire site. Within the new embankment footprint, local peat deposits are present near the River Lea Viaduct. A fault may be present at Ch 234+600 that crosses the embankment. Excavated materials would be Class 2 Railway Embankment fill (if it can be stabilised) or, more likely, Class 2 Highway embankment fill. <u>Pipe Ridware Maintenance Loop:</u> No notable superficial soils are present in the footprint, except at the extreme northern end of the maintenance loops (approx Ch 194+000 to 195+400). There is a major fault at Ch 195+000 with Mercia Mudstone to the south-east of the fault. Helsby Formation overlies Chester Formation to north-west of the fault. Maintenance loops are likely to be largely on medium to high embankment, with increased earthwork width which would mean an increase in the requirement for railway embankment fill in a part of the route where the large amount of material to be won from borrow pits is already a sensitive issue.	--

Civils Structures	Structures	<u>Stone</u> To facilitate keeping Yarnfield Lane open during the construction of the Railhead / IMB-R at Stone a new structure is require to take Yarnfield Lane over the M6. The extents of Filly Brook Viaduct are significantly larger than required to accommodate the crossings underneath due to the S&C being located on the viaduct.	N/A	<u>Crewe</u> A new structure is required to take Weston Lane over the tracks to the IMB-R. An additional span is required to take Newcastle Road over the tracks to the IMB-R. As this is a highly congested area a structure with span 60-60-60m is required which may be structurally inefficient. Lengthening of footbridges are required compared to the baseline. A retaining wall along the headshunt is required to facilitate level difference between the headshunt and the mainline. <u>Stone</u> Removal of the IMB-R at stone removes the requirement for the M6 Yarnfield Lane Replacement Overbridge and allows Filly Brook Viaduct to be reduced considerably in length. There is also an opportunity to culvert Filly Brook and have a single span underbridge over the Norton Bridge to Stone Railway.	-	<u>Crewe</u> A new structure is required to take Weston Lane over the tracks to the IMB-R. An additional span is required to take Newcastle Road over the tracks to the IMB-R. As this is a highly congested area a structure with span 60-60-60m is required which may be structurally inefficient. Lengthening of footbridges are required compared to the baseline. A retaining wall along the headshunt is required to facilitate level difference between the headshunt and the mainline. <u>Stone</u> No change from baseline	--	<u>Aldersey Rough</u> Replacement of the Silverdale line structure over Network Rail WCML tracks with a 'like-for-like' structure will result in a structure that is non-compliant with HS2 standards as the structure at current is an open structure. The structure also has inadequate spatial clearance (both horizontally and vertically) to the Network Rail tracks. If Network Rail requires to meet the latest spatial requirements a 'special structure' will be required as to provide adequate clearance between the Network Rail lines at the Silverdale Line above. The height of Whitmoor Wood Retaining wall will be increased to a maximum of approximately 25m, which will limit the number of structural solutions available. Multiple structures are required to be replaced along the disused Silverdale line <u>Stone</u> Removal of the IMB-R at stone removes the requirement for the M6 Yarnfield Lane Replacement Overbridge and allows Filly Brook Viaduct to be reduced considerably in length. There is also an opportunity to culvert Filly Brook and have a single span underbridge over the Norton Bridge to Stone Railway.	---	<u>Aldersey Rough</u> Replacement of the Silverdale line structure over Network Rail WCML tracks with a 'like-for-like' structure will result in a structure that is non-compliant with HS2 standards as the structure at current is an open structure. The structure also has inadequate spatial clearance (both horizontally and vertically) to the Network Rail tracks. If Network Rail requires to meet the latest spatial requirements a 'special structure' will be required as to provide adequate clearance between the Network Rail lines at the Silverdale Line above. The height of Whitmoor Wood Retaining wall will be increased to a maximum of approximately 25m, which will limit the number of structural solutions available. Multiple structures are required to be replaced along the disused Silverdale line <u>Stone</u> Removal of the IMB-R at stone removes the requirement for the M6 Yarnfield Lane Replacement Overbridge and allows Filly Brook Viaduct to be reduced considerably in length. There is also an opportunity to culvert Filly Brook and have a single span underbridge over the Norton Bridge to Stone Railway.	---

Costs	Civils Works	These are infrastructure costs only, and exclude: rail, land compensation/purchase, client own costs/fees, contingency & OB and any further layering or efficiencies the client may allow for. In every study, options are compared to hybrid bill discreetly.	N/A	Approx. +£32m compared with baseline	--	Approx. +£99m compared with baseline	---	Approx +£38m compared with baseline	--	Approx. +£71m compared with baseline	---
Safety	Assess the relative safety during construction	Some working at height for Yarnfield Lane and Eccleshall Road realignments. Working in close proximity to watercourses. Site bisected by operational NwR line. Utility diversions required.	N/A	Some Working at Height for Newcastle Road and Weston Lane (note working at height for longer compared to HS2 only, due to required lengthening of these options). Utility diversions required.	0	<u>Crewe</u> Some Working at Height for Newcastle Road and Weston Lane (note working at height for longer compared to HS2 only, due to required lengthening of these options). Utility diversions required. <u>Stone</u> Some working at height for Yarnfield Lane and Eccleshall Road realignments. Working in close proximity to watercourses. Site bisected by operational NwR line. Utility diversions required.	-	Working at height to construct Whitmore Wood retaining wall. Working in close proximity to West Coast Mainline. Working in close proximity to and diverting Watercourses. Utility diversions required including 132kv overhead line.	-	Working at height to construct Whitmore Wood retaining wall. Working in close proximity to West Coast Mainline. Working in close proximity to and diverting Watercourses. Utility diversions required including 132kv overhead line.	-
Environment		Refer to Environmental Matrix	N/A	Refer to Environmental Matrix	N/A	Refer to Environmental Matrix	N/A			Refer to Environmental Matrix	N/A

OPTIONS CONSIDERED:	Baseline – Option A8		Option A5		Option A1		Option A9.5*		Option A9.5	
OPTION DESCRIPTION	Railhead and IMB-R at Stone (CP3 design) No Maintenance Loops at Pipe Ridware		Railhead and IMB-R at Crewe With Maintenance Loops at Pipe Ridware		Railhead at Stone IMB-R at Crewe With Maintenance Loops at Pipe Ridware		Railhead and IMB-R at Aldersey's Rough Without Maintenance Loops at Pipe Ridware		Railhead and IMB-R at Aldersey's Rough With Maintenance Loops at Pipe Ridware	
	Overall rating		Overall rating		Overall rating		Overall rating		Overall rating	
Reason for overall rating (Civils):		N/A	Option A5 reduces the amount of work required at Stone, including the realignment and replacement of Yarnfield lane and Ecclestone Road. However, the impacts at Crewe for a combined Railhead / IMB-R make the construction morel complex in terms of programme and the complexity is increased by segregating the sites with a live operational railway following handover of the railhead to rail systems. There are worsenings in relation to water, with a pumping station required at Crewe. Additional structures are required with a lengthing of Newcastle Road overbridge and a new overbridge for Weston Lane. The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected. The total effects including the inclusion of Maintenance Loops at Pipe Ridware make this option cost +£32m compared with Option A8 (civils cost only).	-	Option A1 has the same impacts at Stone during construction and operation of the Railhead as the baseline, with additional impacts associated with the additional footprint for the IMB-R at Crewe. Impacts are generally increased due to not realising the efficiencies provided by combining the Railhead and IMB-R. The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected The combined effects associated with splitting the facilities across two sites and the inclusion of the Maintenance Loops makes this the most costly option considered at +£99m compared with Option A8 (civils cost only).	--	Option A9.5* reduces the amount of work required at stone, including the realignment and replacement of Yarnfield lane and Ecclestone Road. However, additional impacts associated with the construction of an additional three slip roads around Keele Services are present. There is a major worsening in relation to water and flood risk. Additional flooding is anticipated in the river Lea flood plain. The proposed IMB-R sits atop a watercourse which is altered by the site. Significant impact on culverts and Dab Green drop inlet expected due to the increase in retaining wall height for Whitmore Wood. Connection to WCML will not meet 1:1000 yr flood criteria, with the existing Madeley chord likely to require flood defences. Additional impact on already significant structures particularly Whitmore Wood retaining wall which will increase in height by an additional 5 m. Replacement of multiple structures along the disused Silverdale line with a particular risk associated with the re-provision of a like for like structure over the WCML, which does not meet current NwR spatial standards. A significant 132kv lattice tower HV overhead line diversion is required.	-	Option A9.5 reduces the amount of work required at stone, including the realignment and replacement of Yarnfield lane and Ecclestone Road. However, additional impacts associated with the construction of an additional three slip roads around Keele Services are present. There is a major worsening in relation to water and flood risk. Additional flooding is anticipated in the river Lea flood plain. The proposed IMB-R sits atop a watercourse which is altered by the site. Significant impact on culverts and Dab Green drop inlet expected due to the increase in retaining wall height for Whitmore Wood. Connection to WCML will not meet 1:1000 yr flood criteria, with the existing Madeley chord likely to require flood defences. Additional impact on already significant structures particularly Whitmore Wood retaining wall which will increase in height by an additional 5 m. Replacement of multiple structures along the disused Silverdale line with a particular risk associated with the re-provision of a like for like structure over the WCML, which does not meet current NwR spatial standards. A significant 132kv lattice tower HV overhead line diversion is required. The inclusion of the maintenance loops at Pipe Ridware also adds significant impacts particularly with the earthworks and additional imported material associated with reverting the mainline CP2 alignment in the 10km affected The total effects including the inclusion of Maintenance Loops at Pipe Ridware make this option cost +£70m compared with Option A8 (civils cost only).	--

Phase 2A C862 Strategic Evaluation of Railhead and IMB-R Locations – post CP3 design

Document no: C862-PBR-CL-REP-000-000034 (Appendix)

MDL Ref: K560

Revision	Date	Author	Checked by	Approved by	Revision Details:
P01	11/10/2017	Konstantinos Paraskevas	Andrew Spence	David Carter	For information

Railway Systems Option Comparison Matrix

Option Appraisal Assessment Criteria

- - -	Major worsening on the Comparator Scheme
- -	Moderate worsening on the Comparator Scheme
-	Minor worsening on Comparator Scheme
O	Neutral / no change to Comparator Scheme
+	Minor improvement on Comparator Scheme
+ +	Moderate improvement on Comparator Scheme
+ + +	Major improvement on Comparator Scheme
N/A	Not applicable

Location:		Phase 2A CA3									
Option name and description:		Combined Railhead/IMB-R Sift – EI 145									
OPTIONS CONSIDERED:		Baseline – Option A8		Option A5		Option A1		Option A9.5*		Option A9.5	
OPTION DESCRIPTION		Railhead and IMB-R at Stone (CP3 design) No Maintenance Loops at Pipe Ridware		Railhead and IMB-R at Crewe With Maintenance Loops at Pipe Ridware		Railhead at Stone IMB-R at Crewe With Maintenance Loops at Pipe Ridware		Railhead and IMB-R at Aldersey's Rough		Railhead and IMB-R at Aldersey's Rough With Maintenance Loops at Pipe Ridware	
Headings	Appraisal criteria	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING
Strategic Fit	Location and space for Railhead	Yes	N/A	Yes	O	Yes	O	Yes	O	Yes	O
	Approximate Size (Sq.m)	Stone IMB-R and Railhead IMB-R area: approx. 375,000m2 Connections: approx. 260,000m2	N/A	Crewe IMB-R and Railhead IMB-R Area: approx 325,000m2 Connections approx 125,000m2	O	Crewe IMB-R IMB-R Area: approx 325,000m2 Connections approx 125,000m2 Stone Railhead IMB-R area approx.:375,000m2 Connections: approx. 260,000m2	O	Aldersey Rough IMB-R and Railhead IMB-R area: approx 315,000m2 Connections and ancillaries: approx 415,000m2	O	Aldersey Rough IMB-R and Railhead IMB-R area: approx 315,000m2 Connections and ancillaries: approx 415,000m2	O
	Access to route from both directions	Yes - HS2 access from both directions	N/A	Yes - HS2 access from both directions	O	Yes - HS2 access from both directions	O	Yes - HS2 access from both directions	O	Yes - HS2 access from both directions	O
	Access to HS2 with no conflicting moves / with minimal delay between moves in both directions	Yes – No delays identified	N/A	Use of headshunt is required to access on to HS2 for trains heading northbound on HS2. Trains arriving from HS2 from the north would use the headshunt to reverse into the Railhead IMB-R	-	Crewe IMB-R Use of headshunt is required to access on to HS2 for trains heading northbound on HS2. Trains arriving from HS2 from the north would use the headshunt to reverse into the Railhead IMB-R Stone Railhead Yes – No delays identified	-	Use of headshunt is required to access on to HS2 for trains heading northbound on HS2. These trains would need to travel on the Up line until the north end of Madeley tunnel (approximately 4km) where they would use a facing perturbation crossover to cross on to the Down line. There needs to be active provision for this crossover (currently, at CP3 there is passive provision only). Trains arriving from HS2 from the north would use the headshunt into the Railhead/IMB-R.	-	Use of headshunt is required to access on to HS2 for trains heading northbound on HS2. These trains would need to travel on the Up line until the north end of Madeley tunnel (approximately 4km) where they would use a facing perturbation crossover to cross on to the Down line. There needs to be active provision for this crossover (currently, at CP3 there is passive provision only). Trains arriving from HS2 from the north would use the headshunt into the Railhead/IMB-R.	-

	Access to national rail route	Yes - North and South	N/A	Yes – North and South Trains arriving from the north would need to stop on the on the Independent lines clear of the turnout into the Railhead/IMBR before heading north again. This assumes that trains arriving are top and tailed with a loco at each end. If trains were not top and tailed a shunting loco would be required to leave the Railhead/IMBR and pull the train in. This movement would not be ideal as shunting locos would need to operate on both HS2 and NR infrastructure and be controlled by both signalling systems. Trains would not be allowed to propel (backwards) into the Railhead/IMBR.	- -	<u>Crewe IMB-R</u> Yes – North and South Trains arriving from the north would need to stop on the on the Independent lines clear of the turnout into the Railhead/IMBR before heading north again. This assumes that trains arriving are top and tailed with a loco at each end. If trains were not top and tailed a shunting loco would be required to leave the Railhead/IMBR and pull the train in. This movement would not be ideal as shunting locos would need to operate on both HS2 and NR infrastructure and be controlled by both signalling systems. Trains would not be allowed to propel (backwards) into the Railhead/IMBR. <u>Stone Railhead</u> Yes – North and South	- -	Yes - North and South	o	Yes - North and South	o
	Potential impact on on-network works (running lines)	2 crossovers and 2 turnouts on the Stone Railway	N/A	Works on the Up and Down Independent Lines	-	<u>Crewe IMB-R</u> Works on the Up and Down Independent Lines <u>Stone Railhead</u> 2 crossovers and 2 turnouts on the Stone Railway	-	2 crossovers and 2 turnouts on the WCML. Also, potential works due to the Silverdale Railway O/B replacement	-	2 crossovers and 2 turnouts on the WCML. Also, potential works due to the Silverdale Railway O/B replacement	-
	Location and space for neutral section	N/A (No electrification is assumed)	N/A	N/A (No electrification is assumed)	N/A	N/A (No electrification is assumed)	N/A	N/A (No electrification is assumed)	N/A	N/A (No electrification is assumed)	N/A
	Long term Maintenance/Operations	All facilities on single site, but unable to fit 800m length sidings within site. Minimal length access spurs required from HS2 mainline to IMB-R facilities.	N/A	Additional maintenance loops required. Connecting spur required to HS2 mainline and site constraints mean unable to fit 800m length sidings, but flat site. Change in comparison with comparator is not significant.	o	From maintenance delivery perspective this is identical to Option A5.	o	This Option provides reduced maintenance strategy flexibility. The maintenance working window at the southern end of Phase 2A is 3hr assuming an increased speed for engineering trains and OTMs. Any unplanned event (for example late running train) will potentially impact this working window.	-	This Option provides good maintenance strategy flexibility. The maintenance working window at the southern end of Phase 2A is 3hr and 40min assuming an increased speed for engineering trains and OTMs.	o
Construction Feasibility	Assess the relative complexity of construction	The construction of the Railhead is estimated to be 6 months. This does not differ from other locations. The main differentiator is the complexity of the HS2 construction when using this Railhead. This is described in the "relative construction programme" below.	N/A	The construction of the Railhead is estimated to be 6 months. This does not differ from other locations. The main differentiator is the complexity of the HS2 construction when using this Railhead. This is described in the "relative construction programme" below.	o	The construction of the Railhead is estimated to be 6 months. This does not differ from other locations. The main differentiator is the complexity of the HS2 construction when using this Railhead. This is described in the "relative construction programme" below. In this option the IMB-R requires 6 additional months for its construction.	- -	The construction of the Railhead is estimated to be 6 months. This does not differ from other locations. The only difference is the complexity around the recovery and re-instatement of the Silverdale railway The main differentiator is the complexity of the HS2 construction when using this Railhead. This is described in the "relative construction programme" below. Also, this layout requires one perturbation crossover north of the Madeley tunnel to be installed permanently (active provision).	-	The construction of the Railhead is estimated to be 6 months. This does not differ from other locations. The only difference is the complexity around the recovery and re-instatement of the Silverdale railway The main differentiator is the complexity of the HS2 construction when using this Railhead. This is described in the "relative construction programme" below. Also, this layout requires one perturbation crossover north of the Madeley tunnel to be installed permanently (active provision).	-
	Assess the relative construction programme	The site is located at the middle of the route. Can support two workfronts at the same time. No major construction risks.	N/A	The site is located at the north end of the route. Can support one workfront only. Major construction risks around the access to the Crewe tunnel approach works and the two tunnels. In case a there is a delay in the completion of the HS2 and the NR works in CA5 then the Railhead would be unable to	- -	For the construction programme we need to look at the Railhead location only. This is Stone. The site is located at the middle of the route. Can support two workfronts at the same time. No major construction risks.	o	The site is located between the Whitmore Heath and Madeley tunnels. It can support two workfronts. Major construction risk if one of the tunnels get delayed which will impact on all the Rail Systems installation programme.	-	The site is located between the Whitmore Heath and Madeley tunnels. It can support two workfronts. Major construction risk if one of the tunnels get delayed which will impact on all the Rail Systems installation programme.	-

				feed any materials to the route thus delaying the programme.		The only risk emerges from having the additional IMB-R works at the north end of the route which may raise logistics and resources complexities. However, these complexities are considered manageable.					
	Assess the relative disruption to existing infrastructure, e.g. rail, highways etc.	Minimum disruption to the Stone Railway since the required works are typical S&C works	N/A	Significant disruption to the Up and Down Independent Lines. However, these works can be incorporated within the CA5 work package and minimise the disruption	-	<u>Crewe IMB-R</u> Significant disruption to the Up and Down Independent Lines. However, these works can be incorporated within the CA5 work package and minimise the disruption <u>Stone Railhead</u> Minimum disruption to the Stone Railway since the required works are typical S&C works	- -	Small disruption on the WCML due to the required crossover works. However, the WCML is very busy in this area and therefore the disruption is considered significant. Also, there is a potential OLE modifications due to the Silverdale Railway O/B replacement.	- -	Small disruption on the WCML due to the required crossover works. However, the WCML is very busy in this area and therefore the disruption is considered significant. Also, there is a potential OLE modifications due to the Silverdale Railway O/B replacement.	- -
HS2 Operation Feasibility – Trains (HS2 and Network Rail)	Assess the relative flexibility and resiliency of the track layout	Access from Railhead onto HS2 trace available both northbound and southbound	N/A	Access from Railhead onto HS2 trace available both northbound and southbound	**O**	Access from Railhead onto HS2 trace available both northbound and southbound	**O**	Access from Railhead onto HS2 trace available both northbound and southbound	**O**	Access from Railhead onto HS2 trace available both northbound and southbound	**O**
Safety	Assess the relative safety during construction	No major safety issues identified.	N/A	Safety issues may rise due to the Crewe tunnel approach area being locked between the WCML and the Railhead reception line.	-	Safety issues may rise due to the Crewe tunnel approach area being locked between the WCML and the Railhead reception line.	-	No major safety issues identified.	**O**	No major safety issues identified.	**O**
Cost	Railway Systems Cost	£52.40M	N/A	£55.33M	-	£83.01M	- - -	£54.97	-	£61.67	- -
		Option A8		**Option A5**		**Option A1**		**Option A9.5***		**Option A9.5**	
Reason for overall rating:		**Baseline** <u>Construction Programme Risk</u> The risk for a potential delay in the construction programme is very low. This is due to the location of the Railhead which enables two workfronts and also being away from any major Civil Engineering works. Even if the tunnels handover gets delayed the southern part of the route will not be affected by that. Therefore, the programme is quite robust. <u>Access to the Railhead/IMB-R</u> The access to the Railhead/IMB-R is very simple with no complexities. <u>On Network Works</u> This Option requires some works on the Stone railway. However, these works are standard S&C works. <u>Cost</u> The total cost associated with this option is the lowest from all four options.	N/A	**Moderate worsening** <u>Construction Programme Risk</u> The risk for a potential delay in the construction programme is high. This is due to the Railhead being located at the north end of the route and therefore is can support only one workfront. The Railhead is north of the two tunnels and the HS2/NR tie-in works. If any of these Civil Engineering elements is delayed then the handover to the Rail Systems Contractors will be delayed and this will potentially cause a slip to the HS2 opening date. <u>Access to the Railhead/IMB-R</u> The access to the Railhead/IMB-R is very complex since top and tailed trains or shunting locos are required to carry out the train movements. This operations complexity is further increased due to the locos being required to operate on both HS2 and NR signalling systems. <u>On Network Works</u> This Option requires some works on the Basford Independent lines which will create significant disruption to the freight path heading in and out of the Basford sidings. These works may be accommodated within the CA5 works so the disruption can be minimised. <u>Cost</u>	- -	**Major worsening** <u>Construction Programme Risk</u> There is a construction programme risk related with the construction of two separate depots. The IMB-R will need to be operational by the HS2 opening date and this will potentially require early Civils handover. <u>Access to the IMB-R</u> The access to the IMB-R is very complex since top and tailed trains or shunting locos are required to carry out the train movements. This operations complexity is further increased due to the locos being required to operate on both HS2 and NR signalling systems. <u>On Network Works</u> This Option requires significant works on the Basford Independent lines and on the Stone railway. The Basford Independent lines works will create significant disruption to the freight path heading in and out of the Basford sidings. These works may be accommodated within the CA5 works so the disruption can be minimised. The overall combination of these works increases the cost of this option. <u>Cost</u> The total cost associated with this option is approximately £30M more than the baseline cost.	- - -	**Minor worsening** <u>Construction Programme Risk</u> The risk for a potential delay in the construction programme is relatively high. This is due to the Railhead being located between two tunnels and is connected to the HS2 network between a tunnel and a viaduct. If any of these Civil Engineering elements is delayed then the handover to the Rail Systems Contractors will be delayed and this will potentially cause a slip to the HS2 opening date. <u>On Network Works</u> This Option requires some works on the WCML with a potential for further works (if the Silverdale O/B requires replacement to new Standards). Also, the works on the Silverdale Railway are quite significant since this piece of railway needs to be reinstated according to the modern Standards. These works are much more than the On Network Works at Stone (baseline). <u>Cost</u> The total cost associated with this option is approximately £2.5M more than the baseline cost.	-	**Minor worsening** <u>Construction Programme Risk</u> The risk for a potential delay in the construction programme is relatively high. This is due to the Railhead being located between two tunnels and is connected to the HS2 network between a tunnel and a viaduct. If any of these Civil Engineering elements is delayed then the handover to the Rail Systems Contractors will be delayed and this will potentially cause a slip to the HS2 opening date. <u>On Network Works</u> This Option requires some works on the WCML with a potential for further works (if the Silverdale O/B requires replacement to new Standards). Also, the works on the Silverdale Railway are quite significant since this piece of railway needs to be reinstated according to the modern Standards. These works are much more than the On Network Works at Stone (baseline). <u>Cost</u> The total cost associated with this option is approximately £9M more than the baseline cost.	-

			The total cost associated with this option is approximately £3M more than the baseline cost.							

C861

HS2 Phase 2a West Midlands to Crewe

Combined railhead/IMB-R Sift - Environmental Matrix

Document no.: C861-ARP-EV-ASM-000-000074

This Revision	Date	Author	Checked by	Approved by
P01.8	11/10/17	Phill Martin Topic Leads	Nick Mitchard/Lauren Osmond	Nick Mitchard
P01.6	31/07/17	Phill Martin Topic Leads	Nick Mitchard	Nick Mitchard

Environmental Option Comparison Matrix

Option Appraisal Assessment Criteria

- - -	Major worsening on the Comparator Scheme
- -	Moderate worsening on the Comparator Scheme
-	Minor worsening on Comparator Scheme
O	Neutral / no change to Comparator Scheme
+	Minor improvement on Comparator Scheme
+ +	Moderate improvement on Comparator Scheme
+ + +	Major improvement on Comparator Scheme
N/A	Not applicable

Community Area and location:				CA3									
Option name and description:				Combine railhead/IMB-R Sift – EI222									
OPTIONS CONSIDERED:				**Baseline – Option A8** ***Stone railhead & IMB-R*** **No maintenance loops at Pipe Ridware**		**Option A5** ***Crewe railhead & IMB-R*** ***Pipe Ridware Maintenance Loops & 10km alignment changes***		**Option A1** ***Stone railhead & Crewe IMB-R*** ***Pipe Ridware Maintenance Loops & 10km alignment changes***		**Option A9.5*** ***Aldersey's Rough railhead & IMB-R*** **No maintenance loops at Pipe Ridware**		**Option A9.5** ***Aldersey's Rough railhead & IMB-R*** ***Pipe Ridware Maintenance Loops & 10km alignment changes***	
OPTION DESCRIPTION													
Key Sustainability Issue	**Topic**	**STAGE: Construction or Operation**	**Environmental Design Aim considered (incl. Topic and Ref no.) Comment**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**	**QUALITATIVE IMPACT DESCRIPTION and/or QUANTITIVE ASSESSMENT**	**RATING**
Greenhouse gas emissions and climate change	Climate change resilience and in-combination climate change impacts	Const	CC-4 & CC-5	As the climate change resilience assessment and the in-combination climate change impacts assessment are both undertaken at a route-wide level, with any effects and mitigation measures also identified at the route-wide level, the precise location of the railhead / IMB-R are not considered to affect the outcomes of either assessment.	N/A	As the climate change resilience assessment and the in-combination climate change impacts assessment are both undertaken at a route-wide level, with any effects and mitigation measures also identified at the route-wide level, the precise location of the railhead / IMB-R are not considered to affect the outcomes of either assessment.	o	As the climate change resilience assessment and the in-combination climate change impacts assessment are both undertaken at a route-wide level, with any effects and mitigation measures also identified at the route-wide level, the precise location of the railhead / IMB-R are not considered to affect the outcomes of either assessment.	o	As the climate change resilience assessment and the in-combination climate change impacts assessment are both undertaken at a route-wide level, with any effects and mitigation measures also identified at the route-wide level, the precise location of the railhead / IMB-R are not considered to affect the outcomes of either assessment.	o	As the climate change resilience assessment and the in-combination climate change impacts assessment are both undertaken at a route-wide level, with any effects and mitigation measures also identified at the route-wide level, the precise location of the railhead / IMB-R are not considered to affect the outcomes of either assessment.	o
		Op	CC-4 & CC-5	See above.	N/A	See above.	o	See above.	o	See above.	o	See above.	o
	Greenhouse gas emissions	Const	CC-1	The ES GHG assessment reports embodied construction carbon emissions for the railhead/IMB-R as 14,000 tCO_2e. Operational carbon emissions associated with the IMB-R were scoped out and considered minor in comparison to construction emissions.	N/A	Substantial increases in HGV movements associated with the construction of the railhead and IMB-R are considered to be a minor worsening for greenhouse gas emissions.	-	Substantial increases in HGV movements associated with the construction of the railhead and IMB-R are considered to be a minor worsening for greenhouse gas emissions.	-	Substantial increases in HGV movements associated with the construction of the railhead and IMB-R are considered to be a minor worsening for greenhouse gas emissions.	-	Substantial increases in HGV movements associated with the construction of the railhead and IMB-R are considered to be a minor worsening for greenhouse gas emissions.	-
		Op	CC-1	**Stone IMB-R** • Operation duration: Q1 2028 onwards • Operational staff: 100	N/A	No material change in operational carbon emissions are expected between Option A5 and Option A8. There is not enough information to	o	No material change in operational carbon emissions are expected between Option A1 and Option A8.	o	No material change in operational carbon emissions are expected between Option A5 and Option A8.	o	No material change in operational carbon emissions are expected between Option A5 and Option A8.	o

						comment on on-site / building energy used whilst the sites are up and running i.e. electricity use within buildings.		There is not enough information to comment on on-site / building energy used whilst the sites are up and running i.e. electricity use within buildings.		There is not enough information to comment on on-site / building energy used whilst the sites are up and running i.e. electricity use within buildings.		There is not enough information to comment on on-site / building energy used whilst the sites are up and running i.e. electricity use within buildings.	
	Energy use	Const	CC-1	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	N/A	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	-	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	-	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	-	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	-
		Op	CC-1	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	N/A	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	o	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	o	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	o	Note – energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption will also result in an increase in carbon emissions. Hence the conclusions presented above regarding carbon emissions stand for energy use as well.	o
Natural and cultural resource protection and environmental enhancement	Landscape/townscape	Const	(Topic 2- Generic Environmental Design Aims) HL-10, HL-12, HL-16 (Topic 13- Landscape) LV-1, LV-2, LV-3, LV-4, LV-6, LV-7, LV-9, LV-12, LV-18, LV-20 and LV-21.	Stone – landscape character There will be major adverse effects on the local landscape due to the construction activity and the presence of the Stone Railhead and compound (with night time lighting), site haul routes and materials stockpiles. Together these will reduce the scenic quality, tranquillity and character of the undulating open and rural landscape. The intactness of the historic planned estate landscape at Swynnerton Park will be reduced. Stone – visual There will be some moderate adverse effects on the dispersed residential receptors and recreational receptors east of Yarnfield. The works will result in a noticeable change to the views experienced by these receptors and introduce elements and features that appear uncharacteristic and out of scale in the rural landscape. Aldersey's Rough Considering the described proposals (IMB-R etc) in isolation, there will be no landscape or visual effects in this area. Crewe Considering the described proposals (IMB-R etc) in isolation, there will be no	N/A	Stone – landscape and visual Removal of the IMB-R and railhead in this option will remove all landscape and visual effects associated with the baseline design resulting in a major improvement in the Stone area. Aldersey's Rough – landscape and visual No change from baseline. Crewe – landscape character The works will reduce the scenic quality of the undulating, open rural fringe farmland south of the A500 Shavington Bypass. This will include the removal of some mature hedgerows and trees North of the bypass there will be more intense construction activity (including night time lighting), but this will take place next to the presence of existing rail works (at Basford Sidings), within the Crewe urban fringe. Overall there will be a minor worsening, compared to the baseline option. Crewe- visual There will be a moderate worsening in comparison to the baseline on receptors in and around Basford, Hough, Chorlton, Wychwood Park and Gonsley Green due to the presence of a number of different scheme elements within the views. New	-	Stone – landscape and visual This option will have similar effects to the baseline construction in this area, being similar in nature, scale and extents. Aldersey's Rough – landscape and visual No change from baseline Crewe – landscape character The works will reduce the scenic quality of the undulating, open rural fringe farmland south of the A500 Shavington Bypass. This will include the removal of some mature hedgerows and trees North of the bypass there will be more intense construction activity (including night time lighting), but this will take place next to the presence of existing rail works (at Basford Sidings), within the Crewe urban fringe. Overall there will be a minor worsening, compared to the baseline option. Crewe- visual There will be a major worsening in comparison to the baseline on receptors in and around Basford, Hough, Chorlton, Wychwood Park	---	Stone – landscape and visual Removal of the IMB-R and railhead in this option will remove all landscape and visual effects associated with the baseline design resulting in a major improvement in the Stone area. Aldersey's Rough – landscape character Compared to the baseline design this option will introduce substantial construction effects into an area of wooded farmland around Aldersey's Rough which will be unaffected by the baseline. It will also have a major worsening on the character of the farmland within and around the upper Lea Valley. As well as the adverse effects on scenic quality arising from the presence of the works, there will also be substantial effects in comparison to the baseline resulting from removal of mature hedgerows and trees including loss of trees within Hey Sprink Ancient Woodland (substantial increase in direct affects in comparison to the baseline), increased loss of trees within Whitmore Wood Ancient Woodland in comparison to the baseline and effects on the landscape around historic Old Madeley Manor.	---	Stone – landscape and visual Removal of the IMB-R and railhead in this option will remove all landscape and visual effects associated with the baseline design resulting in a major improvement in the Stone area. Aldersey's Rough – landscape character Compared to the baseline design this option will introduce substantial construction effects into an area of wooded farmland around Aldersey's Rough which will be unaffected by the baseline. It will also have a major worsening on the character of the farmland within and around the upper Lea Valley. As well as the adverse effects on scenic quality arising from the presence of the works, there will also be substantial effects in comparison to the baseline resulting from removal of mature hedgerows and trees including loss of trees within Hey Sprink Ancient Woodland (substantial increase in direct affects in comparison to the baseline), increased loss of trees within Whitmore Wood Ancient Woodland in comparison to the baseline and effects on the landscape around historic Old Madeley Manor. Aldersey's Rough (visual) There will be a major worsening in visual effects in comparison to the baseline on receptors along the edge of Madeley Park	---

				landscape or visual effects in this area. Pipe Ridware – *No maintenance loops* Considering the described proposals (IMB-R etc) in isolation, there will be no landscape or visual effects in this area.		visual receptors at a housing site north of the Shavington Bypass will also have close range views of the works to the IMBR and railhead site, and new views of the existing Basford sidings due to the removal of existing landscape mounds. Pipe Ridware – landscape character Construction of the additional maintenance loops together with the increased height of the embankments and viaducts will result in a minor worsening on the character of the rural farmland along a 10km section of the route. Pipe Ridware - visual There will be minor worsening in comparison to the baseline on visual receptors compared to the baseline design. This is due to the combined effects of constructing a number of elements along the 10km section of route. **The substantial improvement at Stone and the overall worsening of effects at Crewe and Pipe Ridware will result in minor worsening compared to the baseline option due to the housing introducing new visual receptors at close proximity to the works and due to the new works south of the A500 (new spur) worsening effects on existing receptors.**		and Gonsley Green due to the presence of a number of different scheme elements within the views. New visual receptors at a housing site north of the Shavington Bypass will also have close range views of the IMBR site and new views of the existing Basford sidings due to the removal of existing landscape mounds. Pipe Ridware – landscape character Construction of the additional maintenance loops together with the increased height of the embankments and viaducts will result in a minor worsening on the character of the rural farmland along a 10km section of route. Pipe Ridware - visual There will be minor worsening in comparison to the baseline on visual receptors compared to the baseline design. This is due to the combined effects of constructing a number of elements along the 10km section of route. **During construction there would be a minor worsening at Pipe Ridware, comparable effects at Stone, and a major worsening of effects at Crewe, resulting in an overall major worsening of effects.**		Aldersey's Rough (visual) There will be a major worsening in visual effects in comparison to the baseline on receptors along the edge of Madeley Park Wood and Manor Road and around the disused Stoke to Market Drayton Railway and Madeley Chord, around Aldersey's Rough and slight worsening in effects on receptors around Keele Services (construction of the M6 access road). Crewe – landscape and visual No change from baseline Pipe Ridware – *No maintenance loops* No change from baseline **The improvement at Stone will be outweighed by the major worsening at Aldersey's Rough – an area which will be unaffected by the baseline design.**		Wood and Manor Road and around the disused Stoke to Market Drayton Railway and Madeley Chord, around Aldersey's Rough and slight worsening in effects on receptors around Keele Services (construction of the M6 access road). Crewe – landscape and visual No change from baseline Pipe Ridware – landscape character Construction of the additional maintenance loops together with the increased height of the embankments and viaducts will result in a minor worsening on the character of the rural farmland along a 10km section of the route. Pipe Ridware - visual There will be minor worsening in comparison to the baseline on visual receptors compared to the baseline design. This is due to the combined effects of constructing a number of elements along the 10km section of route. **The improvement at Stone would be outweighed by the major worsening at Aldersey's Rough – an area which will be unaffected by the baseline design. A minor worsening at Pipe Ridware would also add to the increased landscape and visual effects in comparison to the baseline.**	
		Op		Stone – landscape character There will be some moderate adverse effects on the character of the gently sloping rural landscape, including on the historic planned Swynnerton Park estate landscape. The IMB-R and associated lighting will be a noticeable and discordant feature within the rural landscape. Stone – visual There will be moderate adverse effects on the dispersed residential receptors and recreational receptors east of Yarn, which will intensify the effects of the M6. Night time lighting will add to the sky glow from distant settlements and	N/A	Stone- landscape and visual Removal of the IMB-R in this option will remove all landscape and visual effects associated with the baseline design resulting in major improvement in the area. Aldersey's Rough No change from baseline Crewe – landscape character There will be minor worsening in landscape character in comparison to the baseline due to the introduction of additional rail infrastructure and associated works, including the realignment of Weston Lane, in the context of the urbanised nature of Crewe. Crewe- visual	0	Stone - landscape character Due to the scale and nature of construction works in this area, there maybe longer term effects on the landscape character (despite reinstatement of hedgerows / vegetation, etc). However there would be a reduction in scale of the built form, stemming from the removal of the IMB-R, which would result in a moderate improvement of effects in the area. Stone - visual Removal of the IMB-R and Railhead in this option will remove all visual effects associated with the baseline design, resulting in	- -	Stone- landscape and visual Removal of the IMB-R in this option will remove all landscape and visual effects associated with the baseline design resulting in moderate beneficial effects. Aldersey's Rough – landscape character Introduction of the IMB-R and associated infrastructure will have a major worsening on the landscape character of the upper Lea valley and Aldersey's Rough due to the introduction of uncharacteristic large scale infrastructure into an area which is unaffected by the baseline design. In addition to the presence of the IMB-R, the alterations to landform and extensive tree losses along the disused Stoke to Market Drayton Railway and Madeley	---	Stone- landscape and visual Removal of the IMB-R in this option will remove all landscape and visual effects associated with the baseline design resulting in moderate beneficial effects. Aldersey's Rough – landscape character Introduction of the IMB-R and associated infrastructure will have a major worsening on the landscape character of the upper Lea valley and Aldersey's Rough due to the introduction of uncharacteristic large scale infrastructure into an area which is unaffected by the baseline design. In addition to the presence of the IMB-R, the alterations to landform and extensive tree losses along the disused Stoke to Market Drayton Railway and Madeley Chord and	---

				dispersed properties, and light spill from vehicles on this unlit section of the M6, adding to the overall adverse visual effects in the area. <u>Aldersey's Rough</u> Considering the described proposals (IMB-R etc) in isolation, there will be no landscape or visual effects in this area. <u>Crewe</u> Considering the described proposals (IMB-R etc) in isolation, there will be no landscape or visual effects in this area. <u>Pipe Ridware– *No maintenance loops*</u> Considering the described proposals (IMB-R etc) in isolation, there will be no landscape or visual effects in this area.		There will be a minor/moderate moderate worsening in comparison to the baseline on receptors in and around Basford, Hough, Chorlton, Wychwood Park and Gonsley Green. This is due to the combined effects of different infrastructure elements visible in the views. North of the Shavington Bypass there will be a moderate worsening of effects resulting from the presence of the IMB-R close to new visual receptors within a new housing site (currently under construction - 2017). In addition, the removal of effects on receptors will be major in comparison as the existing landscape mounds which screen views of Basford sidings, will also affect views from residential receptors in this area. A new housing site (currently under construction -2017) will introduce new visual receptors very close to the IMB-R. <u>Pipe Ridware – landscape character</u> This option will lead to a negligible change in the character of the landscape compared to the baseline, due to the introduction of the additional maintenance loops and consequent increase in height and length of the embankments and viaducts. <u>Pipe Ridware - visual</u> There will be a minor worsening in visual effect in comparison to the baseline, due mostly to the taller structures and land formations required. Deepening of the Blithbury Central cutting will form a bigger and potentially more visible scar in the landscape. **During operation the major improvement at Stone is balanced by the worsening in landscape character and visual effects at Crewe (both sides of the A500 Shavington Bypass) and more minor worsening at Pipe Ridware.** **Overall, considering construction and operational effects, this option represents a neutral change to the comparator scheme.**		major improvement in the area. <u>Aldersey's Rough</u> No change from baseline <u>Crewe – landscape character</u> There will be a minor worsening on landscape character due to the introduction of additional rail infrastructure and associated works due to the presence of the IMB-R, and including the realignment of Weston Lane. In the context of the urban nature of the southern fringe of Crewe. <u>Crewe- visual</u> There will be a worsening in comparison to the baseline on receptors in and around Basford, Hough, Chorlton, Wychwood Park and Gonsley Green. This is due to the combined effects of different infrastructure elements visible in the views. There will also be the loss of existing landscape mounds at Jack Mills Way, which currently screen views of Basford sidings from residential receptors in the adjoining housing site North of the Shavington Bypass (under construction 2017). Overall there will be a moderate worsening effect. <u>Pipe Ridware – landscape character</u> This option will lead to a negligible change in the character of the landscape compared to the baseline, due to the introduction of the additional maintenance loops and consequent increase in height and length of the embankments and viaducts. <u>Pipe Ridware - visual</u> There will be a minor worsening in visual effects in comparison to the baseline, due mostly to the taller structures and land formations required. Deepening of the Blithbury Central cutting will form		Chord and within Hey Sprink Ancient Woodland and Whitmore Ancient Woodland will substantially change the appearance of the landscape compared to the baseline. Train movements on the currently disused Stoke to Market Drayton Railway and Madeley Chord, and vehicles accessing the IMB-R will reduce tranquillity (including round historic Old Madeley Manor). <u>Aldersey's Rough (visual)</u> This option will have major worsening in operational visual effects in comparison to the baseline (including in some instances at night) on people living in the dispersed farmsteads around Aldersey's Rough, people using footpaths around the Stoke to Market Drayton railway and Madeley Chord and residents along the edge of Madeley Park Wood and Manor Road. Around Keele Services there will be some minor worsenings in visual effects on receptors due to loss of vegetation opening up views to M6 and the new access road. <u>Crewe</u> No change from baseline <u>Pipe Ridware– *No maintenance loops*</u> No change from baseline **During operation, the improvement at Stone will be outweighed by the major worsening at Aldersey's Rough – an area which will be unaffected by the baseline design.**		within Hey Sprink Ancient Woodland and Whitmore Ancient Woodland will substantially change the appearance of the landscape compared to the baseline. Train movements on the currently disused Stoke to Market Drayton Railway and Madeley Chord, and vehicles accessing the IMB-R will reduce tranquillity (including round historic Old Madeley Manor). <u>Aldersey's Rough (visual)</u> This option will have major worsening in operational visual effects in comparison to the baseline (including in some instances at night) on people living in the dispersed farmsteads around Aldersey's Rough, people using footpaths around the Stoke to Market Drayton railway and Madeley Chord and residents along the edge of Madeley Park Wood and Manor Road. Around Keele Services there will be some minor worsenings in visual effects on receptors due to loss of vegetation opening up views to M6 and the new access road. <u>Crewe</u> No change from baseline <u>Pipe Ridware – landscape character</u> This option will lead to a negligible change in the character of the landscape compared to the baseline, due to the introduction of the additional maintenance loops and consequent increase in height and length of the embankments and viaducts. <u>Pipe Ridware - visual</u> There will be a minor worsening in visual effect in comparison to the baseline, due mostly to the taller structures and land formations required. Deepening of the Blithbury Central cutting will form a bigger and potentially more visible scar in the landscape. **During operation, the improvement at Stone would be outweighed by the major worsening at Aldersey's Rough – an area which will be unaffected by the baseline design. A minor worsening at Pipe Ridware would also add to the increased landscape and visual effects in comparison to the baseline.**	

								a bigger and potentially more visible scar in the landscape. **During operation the moderate improvement at Stone will be outweighed by the combination of the minor worsening at Pipe Ridware and the moderate worsening at Crewe.**					
	Cultural heritage	Const	CH-1 to CH-4	Stone - *Stone railhead & IMB-R* High adverse impacts will result from the removal of archaeological remains at Darlaston Pool and former trackways at Darlaston Park as a result of the construction of the railhead. Medium adverse impacts will result from the partial removal of the remains of field systems west of Walton and Darlaston as a result of the construction of the railhead alongside other elements of the Proposed Scheme. Minimal adverse impacts on the settings of Bury Bank Hillfort scheduled monument and Saxon's Lowe scheduled monument will result from the construction of the railhead. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* Construction of the alignment only at Stone will remove the impact on archaeological remains at Darlaston Pool and reduce the impacts on field systems west of Walton and Darlston and on the settings of Bury Bank Hillfort scheduled monument and Saxon's Lowe scheduled monument. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead & IMB-R* The construction of the railhead and IMB-R at Crewe will introduce medium adverse impacts as a result of the partial removal of archaeological remains at Greenbank Farm. Pipe Ridware – *Pipe Ridware Maintenance Loops* The introduction of maintenance loops at Pipe Ridware will require a substantial increase in the height and mass of the Pipe Ridware embankment. This will result in an increased impact on the setting of Woodhouse Farmhouse	+	Stone – *Stone railhead* Construction of the railhead at Stone will result in the same adverse effects as the baseline case with the exception that adverse setting effects on Bury Bank Hillfort scheduled monument and Saxon's Lowe scheduled monument will not be permanent and will cease on removal of the railhead. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe IMB-R* The construction of the IMB-R at Crewe will introduce medium adverse impacts as a result of the partial removal of archaeological remains at Greenbank Farm. Pipe Ridware – *Pipe Ridware Maintenance Loops* The introduction of maintenance loops at Pipe Ridware will require a substantial increase in the height and mass of the Pipe Ridware embankment. This will result in an increased impact on the setting of Woodhouse Farmhouse.	-	Stone – *No facilities* Construction of the alignment only at Stone will remove the impact on archaeological remains at Darlaston Pool and reduce the effects on field systems west Walton and Darlston and on the settings of Bury Bank Hillfort scheduled monument and Saxon's Lowe scheduled monument. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* Construction of the new connection to the Madeley Spur west of the WCML has potential to have medium adverse impact upon archaeological deposits associated with Madeley palaeolake. Works on the line of the former North Staffordshire Railway – Stoke, Silverdale and Market Drayton line has potential to have high adverse impact upon railway heritage features such as bridges and culverts. Construction of the railhead and IMB-R has potential to have a medium adverse impact on the setting of the listed buildings at Stoneylow Farm. Construction of the railhead and IMB-R will also result in increased noise and visual intrusion at Stoneylow Farm. This will constitute an additional adverse impact beyond the baseline case. There is insufficient information to identify whether the construction of the railhead and IMB-R will result in an impact on buried archaeological remains at Aldersey's Rough. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* The introduction of maintenance loops at Pipe Ridware will require a substantial increase in the height and mass of the Pipe Ridware	-	-

										No change from baseline		embankment. This will result in an increased impact on the setting of Woodhouse Farmhouse.	
		Op		Stone – *Stone railhead & IMB-R* No significant effects will result from the operation of the IMB-R Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead & IMB-R* No change from baseline Pipe Ridware – *Pipe Ridware Maintenance Loops* The introduction of maintenance loops at Pipe Ridware will result in increased setting effects at Woodhouse Farm potentially increasing the scale of impact at this location.	-	Stone – *Stone railhead* No change from baseline Aldersey's Rough – *No facilities* No change from baseline Crewe – *Crewe IMB-R* No change from baseline Pipe Ridware – *Pipe Ridware Maintenance Loops* The introduction of maintenance loops at Pipe Ridware will result in increased setting effects at Woodhouse Farm potentially increasing the scale of impact at this location	-	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* The introduction of the IMB-R in this area will result in increased intrusion and setting effect at Stoneylow Farm. This will constitute an additional adverse impact beyond the baseline case. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change from baseline.	-	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* The introduction of the IMB-R in this area will result in increased intrusion and setting effect at Stoneylow Farm. This will constitute an additional adverse impact beyond the baseline case. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* The introduction of maintenance loops at Pipe Ridware will result in increased setting effects at Woodhouse Farm potentially increasing the scale of impact at this location	-
	Biodiversity	Const	EC-1, EC-2, EC-3, EC-4, EC-5, EC-6, EC-13 & EC-14.	Stone – *Stone railhead & IMB-R* Designated sites – 100% loss of Pool House Wood Local Wildlife Site (LWS) in conjunction with the Proposed Scheme and the railhead at this location, 70% loss of Filly Brook (west of Stone) LWS to Norton bridge to Stone sidings. Habitats – Woodland and grassland priority habitats lost within the above named LWSs. Important hedgerows and approximately 7 ponds lost . Permanent realignment of two sections of Filly Brook through the IMB-R site and at Norton Bridge to Stone Reception sidings. Protected/ notable species – Potential for European Protected Species (EPS) on unsurveyed land within railhead/ IMB-R site, including great crested newt (GCN), bats and otter. Potential habitat will be lost for other protected species including reptiles. The loss of Pool House Wood will remove habitat for a population of white-letter hairstreak, a notable invertebrate species.	N/A	Stone – *No facilities* Designated sites – Loss of Pool House Wood LWS reduced to approximately 40%. Loss of Filly Brook (west of Stone) avoided. Major improvement on baseline. Habitats – Reduction in loss of woodland and grassland priority habitats within above named LWSs. Loss of important hedgerow and ponds similar to baseline as these occur within land in the area between HS2 mainline, M6 and Yarnfield Lane which will be lost to construction even without presence of railhead/ IMB-R. Length of realignment of Filly Brook reduced due to removal of Norton Bridge to Stone Reception sidings. Major improvement on baseline. Protected/ notable species – Reduced potential impacts to bats, otter and white-letter hairstreak due to reduction in loss of woodland and trees and reduced realignment of Filly Brook, in areas close to Norton Bridge to Stone railway. Potential impacts to EPS and other species similar for railhead/ IMB-R location as majority of this area still lost to construction. Major improvement on baseline.	++	Stone – *Stone railhead* Designated sites – Same impact as baseline. Habitats – Same impact as baseline. Protected/ notable species – Same impact as baseline. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe IMB-R* Designated sites – Basford Brook and Mere Gutter LWS in close proximity to works to west of IMB-R and to northern end of Weston Lane realignment. No direct impacts and embedded mitigation in form of CoCP would avoid indirect impacts. Habitats – Within IMB-R valuable habitats comprise mature trees, numerous ponds and hedgerows including an Important hedge.	--	Stone – *No facilities* Designated sites – Loss of Pool House Wood LWS reduced to approximately 40%. Loss of Filly Brook (west of Stone) avoided. Major improvement on baseline. Habitats – Reduction in loss of woodland and grassland priority habitats within above named LWSs. Loss of important hedgerow and ponds similar to baseline as they occur within land in the area between HS2 mainline, M6 and Yarnfield Lane which is assumed to be lost to construction even without presence of railhead/ IMB-R. Length of realignment of Filly Brook reduced due to removal of Norton Bridge to Stone Reception sidings. Major improvement on baseline. Protected/ notable species – Reduced potential impacts to bats, otter and white-letter hairstreak due to reduction in loss of woodland and trees and reduced realignment of Filly Brook, in areas close to Norton Bridge to Stone railway. Potential impacts to EPS and other species similar for railhead/ IMB-R location as majority of this area still lost to construction. Major improvement on	---	Stone – *No facilities* Designated sites – Loss of Pool House Wood LWS reduced to approximately 40%. Loss of Filly Brook (west of Stone) avoided. Major improvement on baseline. Habitats – Reduction in loss of woodland and grassland priority habitats within above named LWSs. Loss of important hedgerow and ponds similar to baseline as they occur within land in the area between HS2 mainline, M6 and Yarnfield Lane which is assumed to be lost to construction even without presence of railhead/ IMB-R. Length of realignment of Filly Brook reduced due to removal of Norton Bridge to Stone Reception sidings. Major improvement on baseline. Protected/ notable species – Reduced potential impacts to bats, otter and white-letter hairstreak due to reduction in loss of woodland and trees and reduced realignment of Filly Brook, in areas close to Norton Bridge to Stone railway. Potential impacts to EPS and other species similar for railhead/ IMB-R location as majority of this area still lost to construction. Major improvement on baseline. Aldersey's Rough – *Aldersey's Rough railhead &*	---

				Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.		Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead & IMB-R* Designated sites – Basford Brook and Mere Gutter LWS in close proximity to works to west of railhead/ IMB-R and to northern end of Weston Lane realignment. No direct impacts and embedded mitigation in form of CoCP would avoid indirect impacts. No worsening on baseline. Habitats – Within railhead/ IMB-R valuable habitats comprise mature trees, numerous ponds and hedgerows including an Important hedge. Realignment of Weston Lane causes additional loss of potential priority habitats in form of semi-improved grassland (unsurveyed) and small strip of woodland. Moderate worsening on baseline. Protected/ notable species – Additional habitats to be lost support seven confirmed GCN ponds within railhead/ IMB-R, two confirmed non-breeding bat roosts in buildings at north end of Weston Lane realignment. Further potential bat roosts in trees are lost. Major worsening on baseline. Pipe Ridware – *Pipe Ridware Maintenance Loops* Designated sites – Pipe Wood Lane hedge LWS occurs to the north of the maintenance loops along Pipe Lane. It is assumed that any extension of construction boundary to the north of the mainline would not reach this LWS and no additional impact is anticipated. No change on baseline. Habitats – Maintenance loops assumed to result in small extensions to width of construction boundary that will result in additional loss and fragmentation of open arable farmland habitats including farm ponds and severance of a number of minor watercourses and drains. Minor worsening on baseline. Protected/ notable species – Additional losses of habitat through small extensions to construction boundary could potentially		Realignment of Weston Lane causes additional loss of potential priority habitats in form of semi-improved grassland (unsurveyed) and small strip of woodland. Moderate worsening on baseline. Pipe Ridware – *Pipe Ridware Maintenance Loops* Designated sites – Pipe Wood Lane hedge LWS occurs to the north of the maintenance loops along Pipe Lane. It is assumed that any extension of construction boundary to the north of the mainline would not reach this LWS and no additional impact is anticipated. No change on baseline. Habitats – Maintenance loops assumed to result in small extensions to width of construction boundary that will result in additional loss and fragmentation of open arable farmland habitats including farm ponds and severance of a number of minor watercourses and drains. Minor worsening on baseline. Protected/ notable species – Additional losses of habitat through small extensions to construction boundary could potentially increase impacts to EPS and other notable species. Minor worsening on baseline.		baseline. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* Designated sites – Additional small losses of Whitmore Wood LWS, Hey Sprink (Wood SW of) LWS as a result of new connection to Stoke to Market Drayton railway. Habitats – In comparison to baseline scheme, there would be increased losses of ancient woodland at Whitmore Wood, Hey Sprink (Wood SW of), unnamed wood South of Hey Sprink. There would be new impacts in the form of the loss of an area of ancient woodland at Hey Sprink, and the loss of an area of potential ancient woodland at Aldersley's Rough.There would be substantial additional loss of non-ancient broadleaved woodland along the Stoke to Market Drayton railway line which forms a valuable green corridor. Further substantial loss of grassland priority habitat (floodplain grazing marsh) would occur to construct the embankment for the new connection to the Stoke to Market Drayton railway, to the west of the HS2 mainline. Additional impacts occur to several minor watercourses that feed into the River Lea. Protected/ notable species – Additional woodland, grassland, hedgerows and ponds to be lost assumed to support a wide range of species including a meta-population of GCN (unsurveyed), a valuable bat assemblage using disused rail corridor for commuting and woodland/ trees for roosting and foraging, and population of otter along watercourses and adjacent terrestrial habitat. Additional impacts to notable bird species are also likely. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No Maintenance Loops* No change to baseline.		*IMB-R* Designated sites – Additional small losses of Whitmore Wood LWS, Hey Sprink (Wood SW of) LWS as a result of new connection to Stoke to Market Drayton railway. Habitats – In comparison to baseline scheme, there would be increased losses of ancient woodland at Whitmore Wood, Hey Sprink (Wood SW of), unnamed wood South of Hey Sprink. There would be new impacts in the form of the loss of an area of ancient woodland at Hey Sprink, and the loss of an area of potential ancient woodland at Aldersley's Rough.There would be substantial additional loss of non-ancient broadleaved woodland along the Stoke to Market Drayton railway line which forms a valuable green corridor. Further substantial loss of grassland priority habitat (floodplain grazing marsh) would occur to construct the embankment for the new connection to the Stoke to Market Drayton railway, to the west of the HS2 mainline. Additional impacts occur to several minor watercourses that feed into the River Lea. Protected/ notable species – Additional woodland, grassland, hedgerows and ponds to be lost assumed to support a wide range of species including a meta-population of GCN (unsurveyed), a valuable bat assemblage using disused rail corridor for commuting and woodland/ trees for roosting and foraging, and population of otter along watercourses and adjacent terrestrial habitat. Additional impacts to notable bird species are also likely. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* Designated sites – Pipe Wood Lane hedge LWS occurs to the north of the maintenance loops along Pipe Lane. It is assumed that any extension of construction boundary to the north of the mainline would not reach this LWS and no additional impact is anticipated. No change on baseline. Habitats – Maintenance loops assumed to result in small extensions to width of construction boundary that will result in	

						increase impacts to EPS and other notable species. Minor worsening on baseline.						additional loss and fragmentation of open arable farmland habitats including farm ponds and severance of a number of minor watercourses and drains. Minor worsening on baseline. Protected/ notable species – Additional losses of habitat through small extensions to construction boundary could potentially increase impacts to EPS and other notable species. Minor worsening on baseline.	
		Op		Permanent illumination of the IMB-R is likely to negatively impact nocturnal wildlife such as bats and barn owl. Mortality of bats and barn owl is also likely to result from collisions with trains operating at night as part of maintenance activities on the sidings, headshunt etc. The magnitude of these impacts will be related to the proximity of the IMB-R to high quality semi-natural habitats such as woodland, species-rich grassland, watercourses and mature hedgerows which are likely to be utilised regularly by foraging or commuting bats and barn owl. The context of the IMB-R in relation to existing urban areas/ other illuminated infrastructure is also relevant, with development of the maintenance base in a more rural location likely to cause a greater increase in artificial light levels with a resultant greater impact upon nocturnal wildlife. The IMB-R location is relatively rural and it is in close proximity to valuable semi-natural habitats, although the presence of the M6 along one side of the location is likely to result in an existing moderate baseline level of disturbance to nocturnal wildlife.	N/A	The Crewe IMB-R location is closer to an existing large urban area than the baseline option. Existing levels of artificial illumination are likely to be greater at Crewe and there is poorer connectivity to high quality semi-natural habitats compared to the baseline. Operational impacts on nocturnal wildlife are therefore likely to be less than the baseline option	+	The Crewe IMB-R location is closer to an existing large urban area than the baseline option. Existing levels of artificial illumination are likely to be greater at Crewe and there is poorer connectivity to high quality semi-natural habitats compared to the baseline. Operational impacts on nocturnal wildlife are therefore likely to be lesser than the baseline option.	+	The Aldersley's Rough IMB-R location is within one of the most ecologically valuable landscapes that are impacted by the Proposed Scheme. The network of ancient woodland, priority habitat grassland, green corridor provided by the disused railway and other mature tree lines and hedgerows, occurs in a rural location and it is likely to be used more by valuable wildlife species than the area surrounding the baseline option. Operational impacts on nocturnal wildlife are therefore likely to be greater than the baseline option.	---	The Aldersley's Rough IMB-R location is within one of the most ecologically valuable landscapes that are impacted by the Proposed Scheme. The network of ancient woodland, priority habitat grassland, green corridor provided by the disused railway and other mature tree lines and hedgerows, occurs in a rural location and it is likely to be used more by valuable wildlife species than the area surrounding the baseline option. Operational impacts on nocturnal wildlife are therefore likely to be greater than the baseline option.	---
	Water and flood risk	Const	WR-1, WR-2, WR-3, WR-4, WR-5, WR-6, WR-7, WR-8, WR-9 & WR-10	**Surface Water** Stone – *Stone railhead & IMB-R* Construction of the railhead and IMB-R, as well as the Proposed Scheme will require the de-culverting of the Filly	N/A	**Surface Water** Stone – *No facilities* No significant differences from baseline scenario. Filly Brook is still required to be de-culverted due to the initial impact	--	**Surface Water** Stone – *Stone railhead* As per baseline due to the railhead located at Stone within this option.	--	**Surface Water** Stone – *No facilities* No significant differences from baseline scenario. Filly Brook Brook is still required to be de-culverted due to the initial	---	**Surface Water** Stone – *No facilities* No significant differences from baseline scenario. Filly Brook Brook is still required to be de-culverted due to the initial impact	---

			.	Brook in this area and will provide a more natural channel. A flood compensation / storage reservoir to the west of the M6 provides an opportunity to reduce flood risk, although these structures will require culverting of short lengths of previously open channel. This is not anticipated to have a detrimental effect on the asset. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No requirement for maintenance loops in this option and therefore no impacts have been reported. **Groundwater** <u>Stone – *Stone railhead & IMB-R*</u> Aquifer: The area of the railhead and IMB-R, overlies Secondary B aquifer and a small portion on Secondary A aquifer. Potential construction impacts on the aquifers will be mitigated by following the CoCP. Groundwater abstraction: SPZ: No interaction with public water supplies (not in an SPZ). Other: The private water supply at Little Micklow is likely to be impacted and a solution will be agreed with the owner. The precise location of the private water abstraction at Micklow House Farm is not known though it is assumed that it is likely to be impacted and a solution will be agreed with the owner. The private abstraction at Walton Heath Farm is likely to be impacted by construction works and a solution will be agreed with the owner. Gw-sw interaction: Springs: Potential impact on water quality of potential springs at Micklow		arising from the Meaford South embankment being constructed ontop of the watercourse culvert. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – Railhead and IMB-R</u> An additional area required for the railhead and IMB-R is located within flood zone 2.This may increase flood risk downstream on the Basford Brook. The site also sits atop of a water course that drains the site area. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Widening the land take to accommodate the maintenance loops will require the Woodhouse Culvert to be lengthened in comparison to the baseline. Raising Pyford North embankment will increase the length of Ashby Stitch culvert. Raising the River Trent viaduct and southern end of Pipe Ridware embankment may further lengthen the Wood House culvert. Changing the Blithbury South cutting to a 'shallow embankment' may be a minor positive for the underlying aquifer. Lowering Blithbury Central cutting will require Blithbury Drop Inlet and Blithbury West Drop inlet to become inverted siphons. An additional culvert at Wood end culvert would also be required. Dab Green Drop Inlet culvert depth increases by approximatley 10m. Whitmore Wood Culvert would become a drop inlet culvert. **Groundwater** <u>Stone – *No facilities*</u> Aquifer: No major change in comparison to the baseline. Groundwater abstraction: No change to the baseline. Gw-sw interaction: Springs: No change to the baseline. Other: No change to the baseline. <u>Aldersey's Rough – *No facilities*</u> There are no potential impacts to aquifers or groundwater receptors near Aldersey's		<u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – IMB-R</u> An additional area required for the railhead and IMB-R is located within flood zone 2.This may increase flood risk downstream on the Basford Brook. The site also sits atop of a water course that drains the site area. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Widening the land take to accommodate the maintenance loops will require the Woodhouse Culvert to be lengthened in comparison to the baseline. Raising Pyford North embankment will increase the length of Ashby Stitch culvert. Raising the River Trent viaduct and southern end of Pipe Ridware embankment may further lengthen the Wood House culvert. Changing the Blithbury South cutting to a 'shallow embankment' may be a minor positive for the underlying aquifer. Lowering Blithbury Central cutting will require Blithbury Drop Inlet and Blithbury West Drop inlet to become inverted siphons. An additional culvert at Wood end culvert would also be required. Dab Green Drop Inlet culvert depth increases by approximatley 10m. Whitmore Wood Culvert would become a drop inlet culvert. **Groundwater** <u>Stone – *Stone railhead*</u> <u>Aquifer:</u> No change to the baseline. Groundwater abstraction: No change to the baseline. Gw-sw interaction: Springs: No change to the baseline. Other: No change to the baseline. <u>Aldersey's Rough – *No facilities*</u>		impact arising from the Meaford South embankment being constructed ontop of the watercourse culvert. <u>Aldersey's Rough – *Aldersey's Rough railhead & IMB-R*</u> The IMB-R is located atop an existing partially culverted watercourse, which is a minor tributary of the River Lea. Due to the widening of the Stoke to Market Drayton Railway, three existing culverts will require lengthening and replacing / upgrading. Dabgreen Drop Inlet, Whitmore Wood and Madeley Park Culvert will all require lengthening. A new channel diversion and culvert on the River Lea tributary will also be required. A Spur form WCML to Stoke to Market Drayton Line will not be protected to 1m above 1000 year flood level The new WCML spur causes significant impact on the floodplain of the River Lea as it blocks the area off with the only possible crossing being the three cell culvert for the 14m wide drainage system for the field. This option will see an increase in flood risk in comparison to the baseline option, which already possesses adverse impacts. Reinstatement of Madeley Chord causes possible introduction of flood defences due to 1 in 1000 year requirements. Additional culvert required beneath spur from HS2 to Stoke to Market Drayton Line near end of mainline viaduct to convey surface water flows <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No change to baseline **Groundwater** <u>Stone – *No facilities*</u> Aquifer: No major change in comparison to the baseline. Groundwater abstraction:		arising from the Meaford South embankment being constructed ontop of the watercourse culvert. <u>Aldersey's Rough – *Aldersey's Rough railhead & IMB-R*</u> The IMB-R is located atop an existing partially culverted watercourse, which is a minor tributary of the River Lea. Due to the widening of the Stoke to Market Drayton Railway, three existing culverts will require lengthening and replacing / upgrading. Dabgreen Drop Inlet, Whitmore Wood and Madeley Park Culvert will all require lengthening. A new channel diversion and culvert on the River Lea tributary will also be required. A Spur form WCML to Stoke to Market Drayton Line will not be protected to 1m above 1000 year flood level The new WCML spur causes significant impact on the floodplain of the River Lea as it blocks the area off with the only possible crossing being the three cell culvert for the 14m wide drainage system for the field. This option will see an increase in flood risk in comparison to the baseline option, which already possesses adverse impacts. Reinstatement of Madeley Chord causes possible introduction of flood defences due to 1 in 1000 year requirements. Additional culvert required beneath spur from HS2 to Stoke to Market Drayton Line near end of mainline viaduct to convey surface water flows <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – Pipe Ridware Maintenance Loops</u> Widening the land take to accommodate the maintenance loops will require the Woodhouse Culvert to be lengthened in comparison to the baseline. Raising Pyford North embankment will increase the length of Ashby Stitch culvert. Raising the River Trent viaduct and southern end of Pipe Ridware embankment may further lengthen the Wood House culvert. Changing the Blithbury South cutting to a 'shallow	

				Bungalow and Micklow House Farm will be removed with embedded mitigation and following the CoCP. Other: Potential temporary impact on water quality of Filly Brook will be removed with embedded mitigation and following the CoCP. <u>Aldersey's Rough – *No facilities*</u> There are no potential impacts to aquifers or groundwater receptors near Aldersey's Rough due to the IMB-R or railhead. <u>Crewe – *No facilities*</u> There are no potential impacts to aquifers or groundwater receptors near Crewe due to the IMB-R or railhead. <u>Pipe Ridware – *No maintenance loops*</u> There are no potential impacts to aquifers or groundwater receptors near Pipe Ridware due to the IMB-R or railhead. **<u>WFD</u>** <u>Stone – *Stone railhead & IMB-R*</u> No impacts within the footprint of the railhead/IMB-R. However numerous channel modifications along Filly Brook. <u>Aldersey's Rough – *No facilities*</u> No impacts at Aldersey's Rough. Minor impacts to Unnamed tributary of the River Lea where the route crosses the WCML. <u>Crewe – *No facilities*</u> No impacts at Crewe. Minor impacts to Unnamed tributary of Mere Gutter 7, north of Chorlton. However, no WFD implications as affected watercourse scoped out of assessment (low value). <u>Pipe Ridware – *No maintenance loops*</u> Minor impacts to Luth Burn. However, no WFD implications as affected watercourse scoped out of assessment (low value).		Rough due to the IMB-R or railhead. <u>Crewe – Crewe railhead & IMB-R</u> Aquifer: The area of the railhead and IMB-R, overlies Unproductive material (non-aquifer). No major change in comparison to the baseline. Groundwater abstraction: SPZ: No impacts, similar to the baseline. Other: No impacts in comparison to the baseline. Gw-sw interaction: Springs: No impacts in comparison to the baseline. Other: No impacts in comparison to the baseline are expected. <u>Pipe Ridware – Pipe Ridware Maintenance Loops</u> Aquifer Slight widening of the mainline, minor worsening compared to the baseline but will be mitigated through embedded mitigation and CoCP. Abstractions Non change to baseline Groundwater-surface water interaction No change to the baseline **<u>WFD</u>** <u>Stone – *No facilities*</u> Reduced amount of channel modification along Filly Brook compared with the baseline option. Minor improvement from baseline. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *Crewe railhead & IMB-R*</u> Additional watercourse adversely affected relative to baseline. Worsening from the baseline. • **Unnamed tributary of Gresty Brook:** - this watercourse (north of A500 Shavington Bypass) is within the footprint of the railhead/IMB-R. Loss of river channel		There are no potential impacts to aquifers or groundwater receptors near Aldersey's Rough due to the IMB-R or railhead. <u>Crewe – Crewe IMB-R Aquifer:</u> The area of the IMB-R, overlies Unproductive material (non-aquifer). No major change in comparison to the baseline. Groundwater abstraction: SPZ: No impacts in comparison to the baseline. Gw-sw interaction: Springs: No impacts in comparison to the baseline. Other: No impacts in comparison to the baseline are expected. <u>Pipe Ridware – Pipe Ridware Maintenance Loops</u> Aquifer Slight widening of the mainline, minor worsening compared to the baseline but will be mitigated through embedded mitigation and CoCP. Abstractions Non change to baseline Groundwater-surface water interaction No change to the baseline **<u>WFD</u>** <u>Stone – *Stone railhead*</u> No change from baseline (assuming construction and operation programme for the railhead means that cumulatively the compound will be in place for more than 4 years). <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *Crewe IMB-R*</u> Additional watercourse adversely affected relative to baseline. Worsening from the baseline.		No change to the baseline. Gw-sw interaction: Springs: No change to the baseline. Other: No change to the baseline. <u>Aldersey's Rough – Aldersey's Rough railhead & IMB-R</u> Aquifer: The area of the railhead and IMB-R would be mostly over Secondary A aquifer (negative in comparison to the baseline) but will be mitigated by CoCP and drainage design. Groundwater abstraction: Not within an SPZ – no change to the baseline. Potential impact to groundwater quality at unlicensed private abstractions at Stonylow Farm and Lower Stonylow Farm. A negative in comparison to the baseline. Gw-sw interaction: Springs: potential spring east of Netherset Hey could be impacted during construction Baseflow and water quality to the River Lea – via the Secondary A aquifer has potential to be impacted. A negative in comparison to the baseline. <u>Crewe – *No facilities*</u> Potential groundwater impacts: no change to the baseline. <u>Pipe Ridware – *No maintenance loops*</u> No change to baseline **<u>WFD</u>** <u>Stone – *No facilities*</u> Reduced the amount of channel modification along Filly Brook compared with the baseline option. Minor improvement from baseline. <u>Aldersey's Rough – *Aldersey's Rough railhead & IMB-R*</u> Additional adverse impacts over the baseline. Additional watercourses also adversely affected relative to baseline. Worsening from the baseline. • **River Lea:** - realignment of tributary of River Lea		embankment' may be a minor positive for the underlying aquifer. Lowering Blithbury Central cutting will require Blithbury Drop Inlet and Blithbury West Drop inlet to become inverted siphons. An additional culvert at Wood end culvert would also be required. Dab Green Drop Inlet culvert depth increases approximatley. 10m. Whitmore Wood Culvert would become a drop inlet culvert. **Groundwater** <u>Stone – *No facilities*</u> Aquifer: No major change in comparison to the baseline. Groundwater abstraction: No change to the baseline. Gw-sw interaction: Springs: No change to the baseline. Other: No change to the baseline. <u>Aldersey's Rough – Aldersey's Rough railhead & IMB-R</u> Aquifer: The area of the railhead and IMB-R would be mostly over Secondary A aquifer (negative in comparison to the baseline) but will be mitigated by CoCP and drainage design. Groundwater abstraction: Not within an SPZ – no change to the baseline. Potential impact to groundwater quality at unlicensed private abstractions at Stonylow Farm and Lower Stonylow Farm. A negative in comparison to the baseline. Gw-sw interaction: Springs: potential spring east of Netherset Hey could be impacted during construction Baseflow and water quality to the River Lea – via the Secondary A aquifer has potential to be impacted. A negative in comparison to the baseline. <u>Crewe – *No facilities*</u> Potential groundwater impacts: no change to the baseline. <u>Pipe Ridware – Pipe Ridware Maintenance Loops</u> Aquifer	

						impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). Pipe Ridware – *Pipe Ridware Maintenance Loops* No WFD implications as affected watercourses scoped out of assessment (low value). No change from baseline.		• **Unnamed tributary of Gresty Brook:** - this watercourse (north of A500 Shavington Bypass) is within the footprint of the railhead/IMB-R. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). Pipe Ridware – *Pipe Ridware Maintenance Loops*No WFD implications as affected watercourses scoped out of assessment (low value). No change from baseline.		around embankment for the use/reinstatement of the railway (Stoke to Market Drayton), but expected to have a negligible impact • **Unnamed tributary of River Lea 4:** - diversions and new track and access road culverts Stoke to Market Drayton spur link crosses. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). • **Unnamed tributary of the River Lea 5:** - upstream extent of watercourse is within the footprint of the railhead/IMB-R. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). - new culvert and loss of online pond on mid-reach of watercourse where track to IMB-R crosses. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse) - change in drainage regime in upper catchment (runoff diverted to pond and drains), potentially impacting aquatic biota/habitat and hydromorphology. • **2 x unnamed tributaries (to north west of Aldersey's Rough and along northern boundary of Hey Sprink)** - additional watercourses affected relative to baseline. New culverts on lower reaches of both watercourses where track to IMB-R crosses. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change to baseline		Slight widening of the mainline, minor worsening compared to the baseline but will be mitigated through embedded mitigation and CoCP. Abstractions Non change to baseline Groundwater-surface water interaction No change to the baseline **WFD** Stone – *No facilities* Reduced the amount of channel modification along Filly Brook compared with the baseline option. Minor improvement from baseline. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* Additional adverse impacts over the baseline. Additional watercourses also adversely affected relative to baseline. Worsening from the baseline. • **River Lea:** - realignment of tributary of River Lea around embankment for the use/reinstatement of the railway (Stoke to Market Drayton), but expected to have a negligible impact • **Unnamed tributary of River Lea 4:** - diversions and new track and access road culverts Stoke to Market Drayton spur link crosses. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). • **Unnamed tributary of the River Lea 5:** - upstream extent of watercourse is within the footprint of the railhead/IMB-R. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). - new culvert and loss of online pond on mid-reach of watercourse where track to IMB-R crosses. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse) - change in drainage regime in upper catchment (runoff diverted to pond and drains), potentially impacting aquatic biota/habitat and hydromorphology. • **2 x unnamed tributaries (to north west of Aldersey's Rough and along northern boundary of Hey Sprink)** - additional watercourses affected relative to baseline. New culverts on lower reaches of	

												both watercourses where track to IMB-R crosses. Loss of river channel impacting aquatic biota/habitat, physico-chemical water quality and hydromorphology (localised adverse). Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* No WFD implications as affected watercourses scoped out of assessment (low value). No change from baseline.	
		Op		**Surface Water** Stone – *Stone railhead & IMB-R* Operation of the Railhead and IMB-R is not anticipated to have any detrimental effects on surface water as the site design incorporates all necessary fuel storage / drainage interceptors to ensure no impact on water quality. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	**Surface Water** Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – Railhead and IMB-R Operation of the Railhead and IMB-R is not anticipated to have any detrimental effects on surface water as the site design incorporates all necessary fuel storage / drainage interceptors to ensure no impact on water quality. Design accounts for modification to SuDS along Jack Mills way so impacts on surface water runoff are likely to be negligible. Pipe Ridware – *Pipe Ridware Maintenance Loops* No operational impacts are anticipated.	o	**Surface Water** Stone – *Stone railhead* No operational impacts are anticipated Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – IMB-R Operation of the Railhead and IMB-R is not anticipated to have any detrimental effects on surface water as the site design incorporates all necessary fuel storage / drainage interceptors to ensure no impact on water quality. Design accounts for modification to SuDS along Jack Mills way so impacts on surface water runoff are likely to be negligible. Pipe Ridware – *Pipe Ridware Maintenance Loops* No operational impacts are anticipated.	o	**Surface Water** Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey Rough (CA_4) – IMB-R and Railhead Operation of the Railhead and IMB-R is not anticipated to have any detrimental effects on surface water as the site design incorporates all necessary fuel storage / drainage interceptors to ensure no impact on water quality. Ballast with the spur will be within the 1,000 yr event may be effected. Pipe Ridware – *No maintenance loops* No change to baseline.	o	**Surface Water** Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey Rough (CA_4) – IMB-R and Railhead Operation of the Railhead and IMB-R is not anticipated to have any detrimental effects on surface water as the site design incorporates all necessary fuel storage / drainage interceptors to ensure no impact on water quality. Ballast with the spur will be within the 1,000 yr event may be effected. Pipe Ridware – *Pipe Ridware Maintenance Loops* No operational impacts are anticipated.	o
Creating sustainable communities	Air quality	Const	AQ-2 & AQ-4.	Stone – Stone railhead & IMB-R Impacts from construction dust emissions at Micklow House Farm and Whitemoor Farm close to the facility. Impacts from construction traffic emissions at properties along Yarnfield Land and close to the M6 motorway. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* A reduction in construction-related impacts from dust and road traffic at Micklow House Farm, Whitemoor Farm and properties along Yarnfield Land and Eccleshall Road through the reduction in construction activity and HGV traffic on public highway. Aldersey's Rough – *No facilities* No change from baseline. Crewe – Crewe railhead & IMB-R	--	Stone – Stone railhead Potential greater impacts from construction traffic emissions at Micklow House Farm, Whitemoor Farm and properties along Yarnfield Land, Eccleshall Road and close to the M6 motorway, from the additional HGV traffic on public highway off approximately 70,000 HGV movements. Aldersey's Rough – *No facilities*	--	Stone – *No facilities* A reduction in construction-related impacts from dust and road traffic at Micklow House Farm, Whitemoor Farm and properties along Yarnfield Land, Eccleshall Road and close to the M6 motorway, through the reduction in construction activity and HGV traffic on public highway. Aldersey's Rough – Aldersey's Rough railhead & IMB-R	-	Stone – *No facilities* A reduction in construction-related impacts from dust and road traffic at Micklow House Farm, Whitemoor Farm and properties along Yarnfield Land, Eccleshall Road and close to the M6 motorway, through the reduction in construction activity and HGV traffic on public highway. Aldersey's Rough – Aldersey's Rough railhead & IMB-R	--

				Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.		Greater impacts from construction dust emissions due to a greater number of properties close to the facility along the B5071 Crewe Road, compared to the baseline. Likely adverse impacts from construction traffic along the A500 Shavington Bypass and Jack Mills Way, as well as other local roads in the area due to construction traffic routeing from the likely additional 65,000 HGV movements. Pipe Ridware – Pipe Ridware Maintenance Loops Potential greater impacts from construction traffic emissions at properties in Pipe Ridware, compared to the baseline, through the additional HGV traffic on public highway of approximately 210,000 HGV movements.		No change from baseline. Crewe – Crewe IMB-R Likely adverse impacts from construction traffic along the A500 Shavington Bypass and Jack Mills Way, as well as other local roads in the area due to construction traffic routeing through additional 65,000 HGV movements. Pipe Ridware – Pipe Ridware Maintenance Loops Potential greater impacts from construction traffic emissions at properties in Pipe Ridware, compared to the baseline, through the additional HGV traffic on public highway of approximately 210,000 HGV movements.		Potential greater impacts from construction dust and traffic emissions at Hey Sprink Ancient Woodland and The Gables, Lane Cottage, Racecourse Farm, New Yew Tree Farm and Yew Tree Farm and Bromley Green properties between the facility and the new access road at M6 Keele services, compared to the baseline, from the additional construction activity and approximately 160,000 HGV movements on public highway. Crewe – *No facilities* No change from baseline. Pipe Ridware – *No maintenance loops* No change from baseline.		Potential greater impacts from construction dust and traffic emissions at Hey Sprink Ancient Woodland and The Gables, Lane Cottage, Racecourse Farm, New Yew Tree Farm and Yew Tree Farm and Bromley Green properties between the facility and the new access road at M6 Keele services, compared to the baseline, from the additional construction activity and approximately 160,000 HGV movements on public highway. Crewe – *No facilities* No change from baseline. Pipe Ridware – Pipe Ridware Maintenance Loops Potential greater impacts from construction traffic emissions at properties in Pipe Ridware on Pipe Lane and Quintons Orchard compared to the baseline, through the additional HGV traffic on public highway of approximately 210,000 HGV movements.	
		Op		Stone – Stone railhead & IMB-R Impacts from operational traffic emissions along Yarnfield Lane and the M6 motorway. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* Slight reduction of impacts from operational traffic emissions in the area. Aldersey's Rough – *No facilities* No change from baseline. Crewe – Crewe railhead & IMB-R Impacts from operational traffic emissions along the A500 Shavington Bypass, Jack Mills Lane and other local roads, as well as diversions in the area. Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline.	0	Stone – Stone railhead No change from baseline. Aldersey's Rough – *No facilities* No change from baseline. Crewe – Crewe IMB-R Impacts from operational traffic emissions along the A500 Shavington Bypass, Jack Mills Lane and other local roads, as well as diversions in the area. Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline.	0	Stone – *No facilities* Slight reduction of impacts from operational traffic emissions in the area. Aldersey's Rough – Aldersey's Rough railhead & IMB-R Impacts from operational traffic emissions on the new access road at the above properties between the facility and the M6 Keele services compared to the baseline, and properties on Three Mile Lane. Crewe – *No facilities* No change from baseline. Pipe Ridware – *No maintenance loops* No change from baseline.	0	Stone – *No facilities* Slight reduction of impacts from operational traffic emissions in the area. Aldersey's Rough – Aldersey's Rough railhead & IMB-R Impacts from operational traffic emissions on the new access road at the above properties between the facility and the M6 Keele services compared to the baseline, and properties on Three Mile Lane. Crewe – *No facilities* No change from baseline. Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline.	0
	Sound and vibration	Const	SV-01, SV03 and SV-04	Stone Stone – *Stone railhead & IMB-R* (spatial scope: 219+700 to 223+500) Impacts near Micklow House Farm, Ecceshall Road and Whitemoor Farm (Approx. 10 properties) Aldersey Rough – *No facilities* (Spatial scope: 233+700 to 235+600) Impacts at properties close to Hey House and Manor Road (approx. 5 properties) Crewe – *No facilities* (Spatial scope:	N/A	Stone – *No facilities* The construction impacts identified are as a result of the construction of the main alignment, removing the railhead and IMB-R at Stone will not change the construction SNV impacts compared to baseline (Impacts at Approx. 10 properties). Aldersey Rough – *No facilities* No change in construction SNV compared to baseline (impacts at approx. 5 properties).	- -	Stone – *Stone railhead* No change in construction SNV compared to baseline (Impacts at Approx. 10 properties). Aldersey Rough – *No facilities* No change in construction SNV compared to baseline (impacts at approx. 5 properties). Crewe – *Crewe IMB-R* Potential new impacts at Properties near Jack Mills Way,	- -	Stone – *No facilities* No change in construction SNV compared to baseline (Impacts at Approx. 10 properties). Aldersey Rough – *Aldersey's Rough railhead & IMB-R* Potential new impacts at Madeley Park Wood and Manor Road during the chord works, Stoneylow Farm and Bromley Green (Approx. 15 properties, making the total approx. 20 properties).	-	Stone – *No facilities* No change in construction SNV compared to baseline (Impacts at Approx. 10 properties). Aldersey Rough – *Aldersey's Rough railhead & IMB-R* Potential new impacts at Madeley Park Wood and Manor Road during the chord works, Stoneylow Farm and Bromley Green (Approx. 15 properties, making the total approx. 20 properties). Crewe – *No facilities*	-

				242+000 to 248+000) Impacts across the approx. 180 properties. No impacts are associated with a railhead or IMB-R. Pipe Ridware – *No maintenance loops* (Spatial scope: 193+800 - 195+500): Construction noise impacts are identified at the closest properties to the Proposed Scheme (Approx. 10 properties), and Ridware Theatre.		Crewe – Crewe railhead & *IMB-R* Potential new impacts at Properties near Jack Mills Way, Weston Road and adjacent to the new roads (access rails) serving the depot (additional impacts at approx. 75 properties, making the total approx. 265 properties). Pipe Ridware – *Pipe Ridware Maintenance Loops* During peak construction months, potential new impacts at Properties on Lichfield Road A515, serving Pyford North Embankment transfer node, and A513 Rugeley Road, Bourne Embankment transfer node, (additional impacts at approx. 7 properties, making the total approx. 17 properties).		Weston Road and adjacent to the new roads (access rails) serving the depot (additional impacts at approx. 75 properties, making the total approx. 265 properties). Pipe Ridware – *Pipe Ridware Maintenance Loops* During peak construction months, potential new impacts at Properties on Lichfield Road A515, serving Pyford North Embankment transfer node, and A513 Rugeley Road, Bourne Embankment transfer node, (additional impacts at approx. 7 properties, making the total approx. 17 properties).		Crewe – *No facilities* No change in construction SNV compared to baseline. Pipe Ridware – *No maintenance loops* No change to baseline.		No change in construction SNV compared to baseline. Pipe Ridware – *Pipe Ridware Maintenance Loops* During peak construction months, potential new impacts at properties on the A515 Lichfield Road, serving Pyford North Embankment transfer node, and A513 Rugeley Road, Bourne Embankment transfer node, (additional impacts at approx. 7 properties, making the total approx. 17 properties).	
		Op		Stone Stone – *Stone railhead & IMB-R* (spatial scope: 219+700 to 223+500) No impacts Aldersey Rough – *No facilities* (Spatial scope: 233+700 to 235+600) Impacts at properties close to Hey House and Manor Road (approx. 5 properties) Crewe – *No facilities* (Spatial scope: 242+000 to 248+000) Impacts across the approx. 60 properties. Pipe Ridware – *No maintenance loops* (Spatial scope: 193+800 - 195+500) Operational noise impacts are identified at the closest properties to the Proposed Scheme (Approx. 10 properties), and Ridware Theatre.	N/A	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead & IMB-R* No change in operational SNV compared to baseline. Pipe Ridware – *Pipe Ridware Maintenance Loops* No change in operational SNV compared to baseline.	o	Stone – *Stone railhead* No change in operational SNV compared to baseline. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe IMB-R* No change in operational SNV compared to baseline. Assuming that the noise mitigation at Mill Lane, Lane End Farm (Chorlton) will not be compromised by the access roads serving the depot. Pipe Ridware – *Pipe Ridware Maintenance Loops* No change in operational SNV compared to baseline.	o	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey Rough – *Aldersey's Rough railhead & IMB-R* No change in operational SNV compared to baseline. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change to baseline.	o	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey Rough – *Aldersey's Rough railhead & IMB-R* No change in operational SNV compared to baseline. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* No change in operational SNV compared to baseline.	o
	Community integrity (inc disproportionate impacts)	Const	CO-1, CO-2, CO-6, CO-9 & CO-12.	Stone – *Stone railhead & IMB-R* The construction of the Stone railhead/IMB-R (along with the Yarnfield North embankment and Yarlet North cutting) will require the demolition of two residential properties – Little Micklow and Brook House. Other residential properties and community facilities are located at a considerable distance from the railhead/IMB-R and so will be subject to limited in-combination impacts. The M6 will be located between the works and properties and community facilities to the south, which mean it is unlikely that	N/A	Stone – *No facilities* Two residential properties (Little Micklow and Brook House) would not require demolition. These two properties could be subject to in-combination impacts. No further residential properties or community facilities will be affected under this option. Aldersey's Rough – *No facilities* No change from baseline. Crewe – *Crewe railhead & IMB-R* Potential in-combination impacts on residential properties on Crewe Road (up to approximately 70) and proposed residential properties close to B5071 Jack Mills Way	--	Stone – *Stone Railhead* Same as baseline. Aldersey's Rough – *No facilities* No change from baseline. Crewe – *IMB-R* Potential in-combination impacts on residential properties on Crewe Road (up to approximately 70) and proposed residential properties close to B5071 Jack Mills Way due to visual, noise and HGVs (committed development Basford West Allocation and approved outline application 13/0336N).	---	Stone – *No facilities* Two residential properties (Little Micklow and Brook House) would not require demolition. These two properties could be subject to in-combination effects. No further residential properties or community facilities will be affected under this option. Crewe – *No facilities* No change from baseline. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* Potential new in-combination impacts on residential properties at Stoney Lowe	o	Stone – *No facilities* Two residential properties (Little Micklow and Brook House) would not require demolition. These two properties could be subject to in-combination effects. No further residential properties or community facilities will be affected under this option. Crewe – *No facilities* No change from baseline. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* Potential new in-combination impacts on residential properties at Stoney Lowe Farm and Bromley Green.	-

				residents and users will experience impacts from the railhead/IMB-R construction Aldersey's Rough – *No facilities* No impacts in this area due to the facilities located elsewhere. Impacts from the Proposed Scheme in this area include: Minor in-combination impacts on residential receptors around Madeley Park Wood. Crewe – *No facilities* No impacts in this area due to the facilities located elsewhere. Impacts from the Proposed Scheme in this area include: In-combination impacts on residential properties on Casey Lane, Newcastle Road and Chorlton Lane south of Crewe. Pipe Ridware – *No maintenance loops* No impacts in this area as no change in alignment. Impacts from the Proposed Scheme in this area include: Construction of the River Trent viaduct and Pipe Ridware embankment will result in sounds and visual effects on five properties for up to one year and two months in total. Construction of the route will result in a number of in-combination impacts at nearby residential properties and community facilities.		due to visual, noise and HGV impacts (committed development Basford West Allocation and approved outline application 13/0336N). The construction of the IMB-R spur and road realignments would likely increase impacts around Chorlton, Basford, Newcastle Road, Hough, and Wychwood Park. Pipe Ridware – *Pipe Ridware Maintenance Loops* Construction of maintenance loops at Pipe Ridware will increase visual impacts at residential properties in Pipe Ridware, Quintings Orchard and along Pipe Lane due to the raising of the route, increasing the severity of overall in-combination impacts in Pipe Ridware. Residential properties along the site haul route, A51 and A515 will experience increased HGV impacts throughout the area for up to 15 months . Wider route raising (where on embankment/viaduct) or lowering (where in cutting) is also likely to increase in-combination impacts due to increase amount of earthworks required, increases in site haul movements, views of taller plant and activities at the following locations: - Residential propertiessouth and westof Kings Bromley - Trentside Meadows - residential properties at Hadley Gate		The construction of the IMB-R spur and road realignments would likely increase impacts around Chorlton, Basford, Newcastle Road, Hough, and Wychwood Park Pipe Ridware - Pipe Ridware Maintenance Loops Construction of maintenance loops at Pipe Ridware will increase visual impacts at residential properties in Pipe Ridware, Quintings Orchard and along Pipe Lane due to the raising of the route, increasing the severity of overall in-combination impacts in Pipe Ridware. Residential properties along the site haul route, A51 and A515 will experience increased HGV impacts throughout the area for up to 15 months. Wider route raising (where on embankment/viaduct) or lowering (where in cutting) is also likely to increase in-combination impacts due to increase amount of earthworks required, increases in site haul movements, views of taller plant and activities at the following locations: - Residential properties south and west of Kings Bromley - Trentside Meadows - residential properties at Hadley Gate		Farm and Bromley Green. Likely increase in in-combination impacts at Hey House, Madeley Park Wood and Manor Road Pipe Ridware – *No maintenance loops* No change to baseline.		Likely increase in in-combination impacts at Hey House, Madeley Park Wood and Manor Road. Pipe Ridware – Pipe Ridware Maintenance Loops Construction of maintenance loops at Pipe Ridware will increase visual impacts at residential properties in Pipe Ridware, Quintings Orchard and along Pipe Lane due to the raising of the route, increasing the severity of overall in-combination impacts in Pipe Ridware. Residential properties along the site haul route, A51 and A515 will experience increased HGV impacts throughout the area for approximately 10 months and 15 months respectively. Wider route raising (where on embankment/viaduct) or lowering (where in cutting) is also likely to increase in-combination impacts due to increase amount of earthworks required increases in site haul movements, views of taller plant and activities at the following locations: - Residential properties south and west of Kings Bromley - Trentside Meadows - residential properties at Hadley Gate	
		Op		Stone – *Stone railhead & IMB-R* The construction of the Stone railhead/IMB-R (along with the Yarnfield North embankment and Yarlet North cutting) will require the demolition of two residential properties – Little Micklow and Brook House. Other residential properties and community facilities are located at a considerable distance from the railhead/IMB-R and so will be subject to limited in-combination impacts. The M6 will be located between the works and properties and community facilities to the south, which mean it is unlikely that residents and users will experience	--	Stone – *Stone alignment only* No operation impacts. Aldersey's Rough – *No facilities* As baseline. Crewe – Crewe railheads and IMB-R Potential in-combination impacts on residential properties on Crewe Road and proposed residential properties close to B5071 Jack Mills Way due to visual and noise. Pipe Ridware – *Pipe Ridware Maintenance Loops* Operation of the maintenance loops may increase in in-combination impacts on	-	Stone – *Stone Railhead* As operational effects for the Baseline (A8) – no operational impacts. Aldersey's Rough – *No facilities* As baseline. Crewe IMB-R Potential in-combination impacts on residential properties on Crewe Road and proposed residential properties close to B5071 Jack Mills Way due to visual and noise. Pipe Ridware – *Pipe Ridware Maintenance Loops*	-	Stone – *Stone alignment only* No operation impacts. Aldersey Rough - Aldersey's Rough railhead and IMB-R Potential new in-combination impacts on two residential properties on Stoney Lowe Farm. Likely increase in in-combination impacts at Hey House Madeley Park Wood and Manor Road.. Crewe – *No facilities* As baseline. Pipe Ridware – *No maintenance loops* No change to baseline.	--	Stone – *Stone alignment only* No operation impacts. Aldersey Rough - Aldersey's Rough railhead and IMB-R Potential new in-combination impacts on two residential properties on Stoney Lowe Farm. Likely increase in in-combination impacts at Hey House, Madeley Park Wood and Manor Road.. Crewe – *No facilities* As baseline. *Pipe Ridware – Pipe Ridware Maintenance Loops* Operation of the maintenance loops may	--

				impacts from the railhead/IMB-R construction Aldersey's Rough – *No facilities* No impacts in this area due to the facilities located elsewhere. Impacts from the Proposed Scheme in this area include: Minor in-combination impacts on residential receptors around Madeley Park Wood. Crewe – *No facilities* No impacts in this area due to the facilities located elsewhere. Impacts from the Proposed Scheme in this area include: In-combination impacts on residential properties on Casey Lane, Newcastle Road and Chorlton Lane south of Crewe. Pipe Ridware – *No maintenance loops* No impacts in this area as no change in alignment. Impacts from the Proposed Scheme in this area include: Construction of the River Trent viaduct and Pipe Ridware embankment will result in sounds and visual effects on five properties for up to one year and two months in total. Construction of the route will result in a number of in-combination impacts at nearby residential properties and community facilities.		residential properties in Pipe Ridware, Quintings Orchard and along Pipe Lane		Operation of the maintenance loops may increase in in-combination impacts on residential properties in Pipe Ridware, Quintings Orchard and along Pipe Lane				increase in in-combination impacts on residential properties in Pipe Ridware, Quintings Orchard and along Pipe Lane .	
	Transport accessibility / severance	Const		Stone – *Stone railhead & IMB-R* Construction requires embedded mitigation including: • the realignment of Yarnfield Lane; and • the diversion of FP 33 around the footprint of the railhead. Some disruption along M6 will occur due to an increase in construction traffic required for the construction of the railhead and IMB-R. This will involve reduced speeds and some limited lane restrictions and closures. Yarnfield Lane will be constructed off-line, but some lane restrictions and speed reductions during tie-ins will be required. Substantial volumes of haulage traffic will be generated however vast majority of this can be carried by rail and via the M6 vastly limiting impact on local road	N/A	Stone – *No facilities* Access from the M6 will still be required for the mass haul for the construction of the Proposed Scheme. Yarnfield Lane realignment will no longer be required through this option. Option A5 would present an option to reduce the length of diversion of FP33 due to the removal of the railhead/IMB-R at this location. This option has the following approximate effects on Mass Haul in the Stone area -Site haul +297,340m³ Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead & IMB-R* Construction access will be via the A500 and Jack Mills Way. A substantial number of	- -	Stone – *Stone railhead* This option has the following approximate effects on Mass Haul in the Stone area -Site haul +297,340m³ This would create approximately an additional 69,962 HGV movements on the public highway in the Stone area Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe IMB-R* Construction access will be via the A500 and Jack Mills Way and additional traffic movements	- -	Stone – *No facilities* Access from the M6 will still be required for the mass haul for the construction of the Proposed Scheme. Yarnfield Lane realignment will no longer be required through this option. Option A5 would present an option to reduce the length of diversion of FP33 due to the removal of the railhead/IMB-R at this location. This option has the following approximate effects on Mass Haul in the Stone area -Site haul +297,340m³ Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* Access from the M6 would be required at Keele services for the construction of the railhead and IMB-R at this location. Additional disruption will occur within this	-	Stone – *No facilities* Access from the M6 will still be required for the mass haul for the construction of the Proposed Scheme. Yarnfield Lane realignment will no longer be required through this option. Option A5 would present an option to reduce the length of diversion of FP33 due to the removal of the railhead/IMB-R at this location. This option has the following approximate effects on Mass Haul in the Stone area -Site haul 297,340m³ Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* Access from the M6 would be required at Keele services for the construction of the railhead and IMB-R at this location. Additional disruption will occur within this option along M6 with reduced speeds and restrictions around Keele. New diversions of two footpaths would be required in this option.	- -

				network. Access from M6 will be utilised for construction traffic only <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No requirement for maintenance loops in this option and therefore no impacts have been reported.		additional traffic movements would be required for the construction of the railhead and IMB-R within this option. This option has the following approximate effects on Mass Haul in the Crewe area -Site haul 233.175m³ -Road haul 273,093m³ This would create approximately an additional 64,257 HGV movements on the public highway in the Crewe area. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Maintenance loops would be required at Pipe Ridware as part of this option and a considerable number of additional traffic movements would be required during construction. This option has the following approximate effects on Mass Haul in the Pipe Ridware area -Site haul 589,383m³ -Road haul 895,583m³ This would create approximately an additional 210,725 HGV movements on the public highway in the Pipe Ridware area. **Approximate net effect on mass haul compared to the baseline:** **- Internal haul -1,188773m³** **- Site haul +1,119,898m³** **- Road haul +273,093m³** **- Import +895,583m³** **- Export +0m³** **This option would create approximately an additional 274,983 HGV movements on the public highway.**		would be required for the construction of the railhead and IMB-R. This option has the following approximate effects on Mass Haul in the Crewe area -Site haul 233.175m³ -Road haul 273,093m³ This would create approximately an additional 64,257 HGV movements on the public highway in the Crewe area. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Maintenance loops would be required at Pipe Ridware as part of this option and a considerable number of additional traffic movements would be required during construction including. This option has the following approximate effects on Mass Haul in the Pipe Ridware area -Site haul 589,383m³ -Road haul 895,583m³ This would create approximately an additional 210,725 HGV movements on the public highway in the Pipe Ridware area. **Approximate net effect on mass haul compared to the baseline:** **- Internal haul +2,072,978m³** **- Site haul +822,558m³** **- Road haul +273,093m³** **- Import +1,192,923m³** **- Export 0m³** **This option would create approximately an additional 344,945 HGV movements on the public highway.**		option along M6 with reduced speeds and restrictions around Keele. New diversions of two footpaths would be required in this option. This option has the following approximate effects on Mass Haul in the Alderley's Rough area -Site haul 171,973m³ -Road haul 675,556m³ This would create approximately an additional 158,954 HGV movements on the public highway in the Alderley's Rough area. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No change to baseline. **Approximate net effect on mass haul compared to the baseline:** **- Internal haul -765,407m³** **- Site haul +469,407m³** **- Road haul +0m³** **- Import +599,947m³** **- Export +75,609m³** **This option would create approximately an additional 158,954 HGV movements on the public highway.**		This option has the following approximate effects on Mass Haul in the Alderley's Rough area -Site haul 171,973m³ -Road haul 675,556m³ This would create approximately an additional 158,954 HGV movements on the public highway in the Alderley's Rough area. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Maintenance loops would be required at Pipe Ridware as part of this option and a considerable number of additional traffic movements would be required during construction including. This option has the following approximate effects on Mass Haul in the Pipe Ridware area -Site haul 589,383m³ -Road haul 895,583m³ This would create approximately an additional 210,725 HGV movements on the public highway in the Pipe Ridware area. **Approximate net effect on mass haul compared to the baseline:** **- Internal haul -765,407m³** **- Site haul +1,058,696m³** **- Road haul +0m³** **- Import +1,495,530m³** **- Export +75,609m³** **This option would create approximately an additional 369,680 HGV movements on the public highway.**	
		Op		<u>Stone – *Stone railhead & IMB-R*</u> M6 southbound access to the IMB-R would be required within this option. Yarnfield Lane would be realigned offline maintaining the same capacity as existing. FP33 would be permanently diverted around the IMB-R in this option.	N/A	<u>Stone – *No facilities*</u> The permanent southbound access will be removed within this option due to the IMB-R located at Crewe. Option A5 will see a reduction in operational traffic around Stone due to the IMB-R located at Crewe. The diversion of FP33 would be reduced in comparison to the baseline. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under	-	<u>Stone – *Stone railhead*</u> The permanent southbound access will be removed within this option due to the IMB-R located at Crewe. Option A5 will see a reduction in operational traffic around Stone due to the IMB-R located at Crewe. The diversion of FP33 would be reduced in comparison to the baseline.	-	<u>Stone – *No facilities*</u> The permanent southbound access will be removed within this option due to the IMB-R located at Crewe. Option A5 will see a reduction in operational traffic around Stone due to the IMB-R located at Crewe. The diversion of FP33 would be reduced in comparison to the baseline. <u>Aldersey's Rough – *Aldersey's Rough railhead & IMB-R*</u>	-	<u>Stone – *No facilities*</u> The permanent southbound access will be removed within this option due to the IMB-R located at Crewe. Option A5 will see a reduction in operational traffic around Stone due to the IMB-R located at Crewe. The diversion of FP33 would be reduced in comparison to the baseline. <u>Aldersey's Rough – *Aldersey's Rough railhead & IMB-R*</u>	-

				The IMB-R will not generate significant volumes of operational traffic, and traffic generation will generally be outside peak hours. The location of IMB-R would be half way between Fradley and Crewe and would therefore result in optimal journey times for track maintenance. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No requirement for maintenance loops in this option and therefore no impacts have been reported.		this option and therefore no impacts have been reported. <u>Crewe – *Crewe railhead & IMB-R*</u> Access will be made to the IMB-R via A500 and Jack Mills Way and a diversion of Basford would be required. Addition operational traffic around Crewe would result from locating the IMB-R at Crewe in comparison to the baseline. Due to the location of IMB-R not positioned in the central section of the scheme, longer journey times would result for track maintenance at the southern end of the scheme. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Additional access to maintenance loops required, increasing the operational traffic in the area. Low level additional trips would be required to access the maintenance loops at Pipe Ridware.		<u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *Crewe IMB-R*</u> Access will be made to the IMB-R via A500 and Jack Mills Way and a diversion of Basford would be required. Addition operational traffic around Crewe would result from locating the IMB-R at Crewe in comparison to the baseline. Due to the location of IMB-R not positioned in the central section of the scheme, longer journey times would result for track maintenance at the southern end of the scheme. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Additional access to maintenance loops required, increasing the operational traffic in the area. Low level additional trips would be required to access the maintenance loops at Pipe Ridware.		Addition operational traffic around Aldersey's Rough would result from locating the IMB-R in the area in comparison to the baseline option. Due to the location of IMB-R not positioned in the central section of the scheme, longer journey times would result for track maintenance at the southern end of the scheme. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No change to baseline.		Addition operational traffic around Aldersey's Rough would result from locating the IMB-R in the area in comparison to the baseline option. Due to the location of IMB-R not positioned in the central section of the scheme, longer journey times would result for track maintenance at the southern end of the scheme. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Additional access to maintenance loops required, increasing the operational traffic in the area. Low level additional trips would be required to access the maintenance loops at Pipe Ridware.	
	Health & wellbeing	Const	HL-5.	<u>Stone – Stone railhead & IMB-R</u> The Stone railhead (and associated lighting) will be visible from residential dwellings along Yarnfield Lane and at the north-eastern edge of Yarnfield. Construction traffic, including HGVs, will be present on Yarnfield Lane, and residential properties will be affected by construction traffic noise. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No requirement for maintenance loops in this option and therefore no impacts	N/A	<u>Stone – *No facilities*</u> Reduced visual impacts in the area in comparison to the baseline. No re-alignment of Yarnfield Lane and potential reduction in construction traffic on Yarnfield Lane. No change in noise impacts on residential properties. <u>Aldersey's Rough – *No facilities*</u> No change from baseline. <u>Crewe – Crewe railhead & IMB-R</u> Increase in construction traffic, including HGVs, along Jack Mills Lane. Potential noise impacts at properties near Jack Mills Way, Weston Road and adjacent to the new roads (access rails) serving the depot. Visual impacts at properties to the southern edge of Crewe and Basford. <u>Pipe Ridware – Pipe Ridware Maintenance Loops</u> Increase in construction traffic, including	-	<u>Stone – Stone railhead</u> Similar effects as baseline as railhead will not need to be converted into the IMB-R at this location, but will need to be reinstated back to its original condition. Potential increase in construction traffic along the M6 and Yarnfield Lane. <u>Aldersey's Rough – *No facilities*</u> No change from baseline. <u>Crewe – Crewe IMB-R</u> Increase in construction traffic, including HGVs, along Jack Mills Lane. Potential noise impacts at properties near Jack Mills Way, Weston Road and adjacent to the new roads (access rails) serving the depot. Visual impacts at properties to the southern edge of Crewe and Basford.	-	<u>Stone – *No facilities*</u> Reduced visual impacts in the area in comparison to the baseline. No re-alignment of Yarnfield Lane and potential reduction in construction traffic on Yarnfield Lane. No change in noise impacts on residential properties. <u>Aldersey's Rough – Aldersey's Rough railhead & IMB-R</u> Potential noise impacts at Madeley Park Wood, Manor Road, Stoneylow Farm and Bromley Green. Reduced visual impacts in the area. No change in noise impacts on residential properties. Visual impacts along the edge of Madeley Park Wood and Manor Road. <u>Crewe – *No facilities*</u> No change from baseline. <u>Pipe Ridware – *No maintenance loops*</u> No change from baseline.	o	<u>Stone – *No facilities*</u> Reduced visual impacts in the area in comparison to the baseline. No re-alignment of Yarnfield Lane and potential reduction in construction traffic on Yarnfield Lane. No change in noise impacts on residential properties. <u>Aldersey's Rough – Aldersey's Rough railhead & IMB-R</u> Potential noise impacts at Madeley Park Wood, Manor Road, Stoneylow Farm and Bromley Green. Reduced visual impacts in the area. No change in noise impacts on residential properties. Visual impacts along the edge of Madeley Park Wood and Manor Road. <u>Crewe – *No facilities*</u> No change from baseline. <u>Pipe Ridware – Pipe Ridware Maintenance Loops</u>	-

				have been reported.		HGVs, in Pipe Ridware. Visual impacts at residential properties in the area.		Pipe Ridware – Pipe Ridware Maintenance Loops Increase in construction traffic, including HGVs, in Pipe Ridware. Visual impacts at residential properties in the area.				Increase in construction traffic, including HGVs, in Pipe Ridware. Visual impacts at residential properties in the area.	
		Op		Stone – Stone railhead & IMB-R The Stone IMB-R and associated lighting will be visible from residential dwellings along Yarnfield Lane and at the north-eastern edge of Yarnfield. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – Stone alignment only No change in noise impacts. Reduction in visual impacts and lighting. Aldersey's Rough – *No facilities* No change from baseline. Crewe – Crewe railhead & IMB-R Increase in journey times due to longer highway diversions in the area. No change in noise impacts. Visual impacts and lighting at properties around the southern edge of Crewe. Visual impacts at properties in Basford. Pipe Ridware – Pipe Ridware Maintenance Loops Increase in journey times in the area. No change in noise impacts. Visual impacts will be increased in the Pipe Ridware location.	o	Stone – Stone railhead No change in noise impacts. Reduction in visual impacts and lighting. Aldersey's Rough – *No facilities* No change from baseline. Crewe – Crewe IMB-R Increase in journey times due to longer highway diversions in the area. No change in noise impacts. Visual impacts and lighting at properties around the southern edge of Crewe. Visual impacts at properties in Basford. Pipe Ridware – Pipe Ridware Maintenance Loops Increase in journey times in the area. No change in noise impacts. Visual impacts will be increased in the Pipe Ridware location.	o	Stone – *No facilities* No change in noise impacts. Reduction in visual impacts and lighting. Aldersey's Rough – Aldersey's Rough railhead & IMB-R Visual impacts and lighting along the edge of Madeley Park Wood and Manor Road. Crewe – *No facilities* No change from baseline. Pipe Ridware – *No maintenance loops* No change from baseline.	o	Stone – *No facilities* No change in noise impacts. Reduction in visual impacts and lighting. Aldersey's Rough – Aldersey's Rough railhead & IMB-R Visual impacts and lighting along the edge of Madeley Park Wood and Manor Road. Crewe – *No facilities* No change from baseline. Pipe Ridware – Pipe Ridware Maintenance Loops Increase in journey times in the area. No change in noise impacts. Visual impacts will be increased in the Pipe Ridware location.	o
	Socio-economic factors	Const	SE-1 & SE-2.	Stone - Stone Railhead & IMB-R One business unit, a dog training business at Brookhouse Farm will be affected through locating the railhead at Stone as it will require demolition. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* No requirement to demolish Brook House Farm which consists of one business accommodation unit thus reduced land take with no effect on socio-economic resources. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – Crewe railhead & IMB-R Landtake would cover approx. 60% of Basford West outline planning permission for employment and is likely to prevent it from being implemented (Ref: 14/0378N). B2 and B8, 1,042,500sqft – 1321 jobs. Additional land required at Weston Lane could impact upon Basford Hall Farm (planning permission for 2 live/work units). Significant land take effects on socio-economic resources.	--	Stone – Stone railhead No change from baseline Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – Crewe IMB-R Landtake cover approx. 60% of Basford West outline planning permission for employment and is likely to prevent it from being implemented implemented (Ref: 14/0378N). B2 and B8, 1,042,500sqft – 1321 jobs. Additional land required Weston Lane could impact upon Basford Hall Farm (planning permission for 2 live/work units). Significant land take effects on socio-economic resources.	---	Stone – *No facilities* No requirement to demolish Brook House Farm which consists of one business accommodation unit thus reduced land take with no effect on socio-economic resources. Aldersey's Rough – Aldersey's Rough railhead & IMB-R Potential for indirect effects on sensitive socio-economic resource (Cudmore Fisheries and Lakeside Café) during construction as a result of proximity to the revised construction boundary. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change to baseline.	+	Stone – *No facilities* No requirement to demolish Brook House Farm which consists of one business accommodation unit thus reduced land take with no effect on socio-economic resources. Aldersey's Rough – Aldersey's Rough railhead & IMB-R Potential for indirect effects on sensitive socio-economic resource (Cudmore Fisheries and Lakeside Café) during construction as a result of proximity to the revised construction boundary. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline.	+

						Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline		Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline				
		Op		Stone - Stone Railhead & IMB-R No effect on socio-economic resources Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – Crewe railhead & IMB-R No change from baseline Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline	0	Stone – Stone railhead No change from baseline Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – Crewe IMB-R No change from baseline Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline	0	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – Aldersey's Rough railhead & IMB-R No change from baseline Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change to baseline.	0	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – Aldersey's Rough railhead & IMB-R No change from baseline Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – Pipe Ridware Maintenance Loops No change from baseline.	0
Sustainable consumption and production	Agriculture, soil & land use	Const	AS-1 & AS-3	Stone – *Stone railhead & IMB-R* • 80ha of BMV agricultural land (predominantly Subgrade 3a) required during construction • No forestry land • 10 holdings affected, 8 of which are significantly affected both during construction and following restoration of land used temporarily. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead and IMB-R* • A further 62ha of predominantly Subgrade 3b agricultural land required.- No change in significance compared to baseline scheme • No forestry land required; no change to baseline scheme • A further 1 or 2 agricultural holdings north of the A500 would be affected - a slight worsening of case compared to the baseline scheme Pipe Ridware – *Pipe Ridware Maintenance Loops* • 20.0ha of BMV agricultural land in Grade 2 and Subgrade 3a - slight increase in adverse effect compared to the baseline scheme • No forestry land required and no change to baseline scheme • The same holdings would be affected but the area of land required and, in some instances, noise and disturbance	++	Stone – *Stone railhead temporary effects* • 80ha of BMV agricultural land (predominantly Subgrade 3a) required during construction - No change compared to temporary baseline scheme • Forestry land - no change to baseline scheme • 10 holdings affected, 8 of which are significantly affected both during construction and following restoration of land used tempoaryliy. **Permanent effect, post restoration** No impacts on agricultural land, soil or forestry and a considerable improvement on the baseline scheme. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe IMB-R* • A further 62ha of predominantly Subgrade 3b agricultural land required.- No change in significance compared to baseline	-	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* • 40ha of agricultural land of variable quality required. Marked increase in effect compared to baseline scheme but partially offset by the reduction in effect at Stone • Forestry land would be affected – an increase in effect compared to baseline scheme • Five agricultural holdings would be affected, two of which would be significantly affected Overall assessment is a reduction in adverse effects on farm holdings compared to baseline scheme Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change to baseline.	++	Stone – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* • 40ha of agricultural land of variable quality required. Marked increase in effect compared to baseline scheme but partially offset by the reduction in effect at Stone • Forestry land would be affected – an increase in effect compared to baseline scheme • Five agricultural holdings would be affected, two of which would be significantly affected Overall assessment is a reduction in adverse effects on farm holdings compared to baseline scheme Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* • 20.0ha of BMV agricultural land in Grade 2 and Subgrade 3a - slight increase in adverse effect compared to the baseline scheme	+

						effects would all be greater – overall a marginal increase in adverse effects compared to the baseline scheme		scheme • No forestry land required; no change to baseline scheme • A further 1 or 2 agricultural holdings north of the A500 would be affected - a slight worsening of case compared to the baseline scheme Pipe Ridware – *Pipe Ridware Maintenance Loops* • 20.0ha of BMV agricultural land in Grade 2 and Subgrade 3a - slight increase in adverse effect compared to the baseline scheme • No forestry land required and no change to baseline scheme • The same holdings would be affected but the area of land required and, in some instances, noise and disturbance effects would all be greater – overall a marginal increase in adverse effects compared to the baseline scheme				• No forestry land required and no change to baseline scheme • The same holdings would be affected but the area of land required and, in some instances, noise and disturbance effects would all be greater – overall a marginal increase in adverse effects compared to the baseline scheme	
		Op		The operation of the railway will not introduce new significant effects on agriculture. It is not considered likely that the operation of the IMB-R will have any significant effect on agriculture, forestry or soils	N/A	The operation of the railway will not introduce new significant effects on agriculture. It is not considered likely that the operation of the IMB-R will have any significant effect on agriculture, forestry or soils	0	The operation of the railway will not introduce new significant effects on agriculture. It is not considered likely that the operation of the IMB-R will have any significant effect on agriculture, forestry or soils	0	The operation of the railway will not introduce new significant effects on agriculture. It is not considered likely that the operation of the IMB-R will have any significant effect on agriculture, forestry or soils	0	The operation of the railway will not introduce new significant effects on agriculture. It is not considered likely that the operation of the IMB-R will have any significant effect on agriculture, forestry or soils	0
	Land quality	Const	LQ-1 & LQ-6.	<u>Stone – Stone railhead & IMB-R</u> There are former pits and quarries adjacent to the north of Yarnfield Lane (approximately 280m northwest of Pool House Farm and 620m and 680m northwest of Pool House Farm). Infilled ponds are located adjacent to the south of Yarnfield Lane and 10m south of Pool House Farm. The material used to backfill ponds or pits are likely to be variable and poorly compacted. This area is in farmland which may have potential contamination sources. Remediation may be required. Historic landfill (Pool House Farm Landfill) licensed to accept household waste is located east of the M6 in the proposed footprint of the Stone railhead and IMB-R (approximately 120m northwest of Pool House Farm). There is potential for the migration of	N/A	<u>Stone – *No facilities*</u> Land quality impacts at Stone reduced substantially due to the railhead and IMB-R located at Crewe within this option. Some of the land quality impacts affected under the baseline option will still be impacted by the route of the Proposed Scheme. There is no requirement to demolish the Yarnfield Lane M6 bridge, which could further minimise the requirement for excavation in the area of the former pits and quarries and an infilled pond (located adjacent to the north and south or Yarnfield Lane). <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – Crewe railhead & IMB-R</u> Increased impacts at Crewe, including:	–	<u>Stone – Stone railhead</u> As per baseline due to the location of the railhead at Stone. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – Crewe IMB-R</u> Increased impacts at Crewe, including: Several infilled ponds located within the footprint of the IMB-R (including site 5-134). A fuel point (5-255) and tank (5-145) is located in the footprint of Basford Hall Sidings which may require remediation if significant contaminants migrate if ground disturbance occurs. In addition, there is potential for contamination within the sidings	- -	<u>Stone – *No facilities*</u> Reduced impacts at Stone, however compound facilities will still be present between the M6 and route of the Proposed Scheme, so the potential for the release of contaminants from the former pits or quarries and ponds is present. A Transfer Node is located in the area of Pool House Farm Landfill, so remediation may be required if significant contamination is encountered. There is no requirement to demolish the Yarnfield Lane M6 bridge, which could minimise the requirement for excavation in the area of the former pits and quarries and an infilled pond (located adjacent to the north and south or Yarnfield Lane). <u>Aldersey's Rough – Aldersey's Rough</u>	+	<u>Stone – *No facilities*</u> Reduced impacts at Stone, however compound facilities will still be present between the M6 and route of the Proposed Scheme, so the potential for the release of contaminants from the former pits or quarries and ponds is present. A Transfer Node is located in the area of Pool House Farm Landfill, so remediation may be required if significant contamination is encountered. There is no requirement to demolish the Yarnfield Lane M6 bridge, which could minimise the requirement for excavation in the area of the former pits and quarries and an infilled pond (located adjacent to the north and south or Yarnfield Lane). <u>Aldersey's Rough – Aldersey's Rough railhead & IMB-R</u>	+

				landfill ground gases and leachate from the landfill if disturbed. Remediation may be required. This option is not located in an MSA. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No requirement for maintenance loops in this option and therefore no impacts have been reported.		Several infilled ponds located within the footprint of the railhead and IMB-R (including site 5-134). A fuel point (5-255) and tank (5-145) is located in the footprint of Basford Hall Sidings which may require remediation if significant contaminants migrate if ground disturbance occurs. In addition, there is potential for contamination within the sidings from many years of rail use, which could migrate to the railhead area. An area of land along Weston Lane at Brook House intersects with a former pit or quarry. One infilled pond is also located on Chorlton Lane, adjacent to the west of the WCML. The material used to backfill ponds, pits and quarries are likely to be variable and poorly compacted. Remediation may be required if significant contamination is encountered. Adjacent to the east of Basford Brook is Yew Tree Farm Landfill and the land required for this option appears to extend beyond Basford Brook into the landfill. This landfill was licensed to accept industrial and household waste between 1960 and 1972. There is potential for the migration of landfill ground gases and leachate from the landfill if disturbed. Remediation may be required if significant contamination is encountered. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Minor increase in land required, but does not intercept any new contaminated sites, so no impact is anticipated. It overlies an MSA for sand and gravel, although no material increase in impact is anticipated.		from many years of rail use, which could migrate to the railhead area. An area of land along Weston Lane at Brook House intersects with a former pit or quarry. One infilled pond is also located on Chorlton Lane, adjacent to the west of the WCML. The material used to backfill ponds, pits and quarries are likely to be variable and poorly compacted. Remediation may be required if significant contamination is encountered. Adjacent to the east of Basford Brook is Yew Tree Farm Landfill and the land required for this option appears to extend beyond Basford Brook into the landfill. This landfill was licensed to accept industrial and household waste between 1960 and 1972. There is potential for the migration of landfill ground gases and leachate from the landfill if disturbed. Remediation may be required if significant contamination is encountered. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Minor increase in land required, but does not intercept any new contaminated sites, so no impact is anticipated. It overlies an MSA for sand and gravel, although no material increase in impact is anticipated.		<u>railhead & IMB-R</u> No industrial facilities / activities or pollution incidents at the location of proposed railhead and IMB-R within this option. A small number of infilled ponds are in the footprint of the railhead and IMB-R to the north and northwest of Aldersey's Rough. The disused railway (4-39) connects to the proposed railhead and IMB-R at Aldersey's Rough and there is a possibility that the land may be affected by oils and fuels contaminant migration from the existing railway line through shallow deposits. If there is a requirement for shallow excavation there, works may intercept contamination which would require treatment or landfill disposal. Additional land is required along route of pylons, however there are no areas of concern. Additional land required around Keele Services runs parallel with a petrol station at the southern boundary of the services. The M6 has potential to contain contamination below leaking drains and from fuel spills. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *No maintenance loops*</u> No change to baseline.		No industrial facilities / activities or pollution incidents at the location of proposed railhead and IMB-R within this option. A small number of infilled ponds are in the footprint of the railhead and IMB-R to the north and northwest of Aldersey's Rough. The disused railway (4-39) connects to the proposed railhead and IMB-R at Aldersey's Rough and there is a possibility that the land may be affected by oils and fuels contaminant migration from the existing railway line through shallow deposits. If there is a requirement for shallow excavation there, works may intercept contamination which would require treatment or landfill disposal. Additional land is required along route of pylons; however there are no areas of concern. Additional land required around Keele Services runs parallel with a petrol station at the southern boundary of the services. The M6 has potential to contain contamination below leaking drains and from fuel spills. <u>Crewe – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported. <u>Pipe Ridware – *Pipe Ridware Maintenance Loops*</u> Minor increase in land required, but does not intercept any new contaminated sites, so no impact is anticipated. It overlies an MSA for sand and gravel, although no material increase in impact is anticipated.	
		Op		<u>Stone – Stone railhead & IMB-R</u> Contamination sources will be dealt with during the construction phase so will not be present during operation. Based on the location of the historic Pool House Farm Landfill within the fthe land required, there is a potential that contamination would require management during operation. IMB-R is not located within an MSA, so mineral sterilisation / isolation will not occur. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no	N/A	<u>Stone – *No facilities*</u> Contamination sources will be dealt with during the construction phase so will not be present during operation. This option would require no additional management other than that proposed for the route of the Proposed Scheme as there would be not permanent maintenance facility in this area. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported.	o	<u>Stone – Stone railhead</u> Contamination sources will be dealt with during the construction phase so will not be present during operation. This option would require no additional management other than that proposed for the route of the Proposed Scheme as there would be not permanent maintenance facility in this area. <u>Aldersey's Rough – *No facilities*</u> No facilities are located in this area under this option and therefore no impacts have been reported.	o	<u>Stone – *No facilities*</u> Contamination sources will be dealt with during the construction phase so will not be present during operation. This option would require no additional management other than that proposed for the route of the Proposed Scheme as there would be not permanent maintenance facility in this area. <u>Aldersey's Rough – railhead & IMB-R</u> Potential contamination sources associated with the additional land required adjacent to the petrol filling station (M6 Keele Services) will be dealt with during the construction phase so will not be present during operation.	o	<u>Stone – *No facilities*</u> Contamination sources will be dealt with during the construction phase so will not be present during operation. This option would require no additional management other than that proposed for the route of the Proposed Scheme as there would be not permanent maintenance facility in this area. <u>Aldersey's Rough – railhead & IMB-R</u> Potential contamination sources associated with the additional land required adjacent to the petrol filling station (M6 Keele Services) will be dealt with during the construction phase so will not be present during operation.	o

				impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.		Crewe – Crewe railhead & IMB-R Contamination sources will be dealt with during the construction phase so will not be present during operation. There are no MSA's within the South Cheshire area, so mineral sterilisation / isolation will not occur. Pipe Ridware – *Pipe Ridware Maintenance Loops* Contamination sources will be dealt with during the construction phase so will not be present during operation.		Crewe – Crewe IMB-R Contamination sources will be dealt with during the construction phase so will not be present during operation. There are no MSA's within the South Cheshire area, so mineral sterilisation / isolation will not occur. Pipe Ridware – *Pipe Ridware Maintenance Loops* Contamination sources will be dealt with during the construction phase so will not be present during operation.		with during the construction phase so will not be present during operation. Aldersey's Rough railhead and IMB-R is not located within an MSA, so mineral sterilisation / isolation will not occur. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change to baseline.		Aldersey's Rough railhead and IMB-R is not located within an MSA, so mineral sterilisation / isolation will not occur. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* Contamination sources will be dealt with during the construction phase so will not be present during operation.	
	Waste & material resources	Const		Construction of the railhead will produce waste from earthworks associated with the preparation of the site and a range of construction wastes from the building of the main railhead. Construction waste will also be produced from associated works (not directly associated with the main build) such as changes to the road network.	N/A	Railhead/IMB-R access routes are 'longer' than for baseline, which may increase construction waste compared to baseline. Construction of Pipe Ridware maintenance loops also likely to increase waste arisings compared to baseline. Changes to vertical alignment may enhance reuse opportunities resulting from embankment construction but route-wide impact not assessed. Overall assessment is minor worsening because of additional construction waste (compared to baseline), arising from need to construct Pipe Ridware maintenance loops and associated 10km of alignment works.	-	Construction of Crewe IMB-R likely to increase construction waste arisings compared to baseline, which provides for 're-use' of railhead. Reinstatement works associated with railhead may also generate additional waste. Construction of Pipe Ridware maintenance loops also likely to increase waste arisings compared to baseline. Changes to vertical alignment may enhance reuse opportunities resulting from embankment construction but route-wide impact not assessed. Overall assessment is moderate worsening because of additional construction waste (compared to baseline) arising from construction of separate railhead and IMB-R (rather than conversion of former) and additional construction waste (compared to baseline), arising from need to construct Pipe Ridware maintenance loops and associated 10km of alignment works.	--	Railhead/IMB-R is located further from HS2 mainline trace than baseline, which may increase construction waste compared to baseline. Construction of the railhead will produce waste from earthworks associated with the preparation of the site and a range of construction wastes from the building of the railhead/IMB-R. Overall assessment is no change to baseline.	o	Railhead/IMB-R is located further from HS2 mainline trace than baseline, which may increase construction waste compared to baseline. Construction of Pipe Ridware maintenance loops also likely to increase waste arisings compared to baseline. Changes to vertical alignment may enhance reuse opportunities resulting from embankment construction but route-wide impact not assessed. Overall assessment is minor worsening because of additional construction waste (compared to baseline), arising from need to construct Pipe Ridware maintenance loops and associated 10km of alignment works.	-
		Op		Operation of IMB-R will produce operational wastes arising from its staffing and use.	N/A	Operation of IMB-R will produce operational wastes. Staffing levels and use assumed to be the same as baseline. No change.	o	Operation of IMB-R will produce operational wastes. Staffing levels and use assumed to be the same as baseline. No change.	o	Operation of IMB-R will produce operational wastes. Staffing levels and use assumed to be the same as baseline. No change.	o	Operation of IMB-R will produce operational wastes. Staffing levels and use assumed to be the same as baseline. No change.	o
	Committed Development	Const	Avoid/ minimise impacts on approved planning	Stone – *Stone railhead & IMB-R* East of 221+000: Located to the south of the existing Norton Bridge to Stone Railway the construction boundary will impact approx. 5-10 % of a strategic	N/A	Stone – *No facilities* Relocating the railhead and IMB-R to Crewe will reduce the impact on committed developments in the Stone area, namely **Policy Stone 2 - West & South of Stone**	- - -	Stone – *Stone railhead* Same as baseline. Aldersey's Rough – *No facilities* No facilities are located in this area	- - -	Stone – *No facilities* Relocating the railhead and IMB-R to Aldersey's Rough will reduce the impact on committed developments in the Stone area, namely **Policy Stone 2 - West &**	o	Stone – *No facilities* Relocating the railhead and IMB-R to Aldersey's Rough will reduce the impact on committed developments in the Stone area, namely **Policy Stone 2 - West & South of**	o

			applications and allocated sites.	development location for housing - **Policy Stone 2 - West & South of Stone** (delivery of approx. 500 new homes, 40% affordable**). Map ref CA3/18.** The masterplan of this development shows this area is to be used for green infrastructure – the development is therefore still viable. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.		(delivery of approx. 500 new homes, 40% affordable**). Map ref CA3/18.** Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead & IMB-R* Additional impact of railhead and IMB-R being located at Crewe in comparison to the baseline. Considerably greater impacts compared with baseline on the three substantial approved planning applications (mainly employment and residential use) which overlay an employment allocation for a regional warehouse and distribution park. One will be unviable, and others will lose between 25% and 60% of allocated site. • 12/1959N - Class B8 (Storage and Distribution) / B2 (General Industrial and B1 (Light Industrial/Office) with Ancillary Offices, Construction of Access Roads, Ecological Mitigation Works and Associated Structural Landscaping and Car Parking. **(unviable)** • 14/0378N B2 (general industry) and B8 (storage and distribution) comprising 1,042,500 ft² **(covers 60% of site)** • 13/0336N Outline application for residential development (up to 370 units), Offices (B1), local centre comprising food and non-food retail (A1) and restaurant/public house (A3/A4), hotel (C1), car showroom and associated works **(covers 25% of site)** • • Employment allocation E.3.1 BASFORD WEST (gross area about 55 ha) will be developed for a regional warehouse and distribution park **(covers 60% of site)** New Weston Lane Overbridge Additional impacts compared with baseline: • East of 246+500 the increased construction boundary would make application 14/3374N unviable (Proposed alterations		under this option and therefore no impacts have been reported. Crewe – *Crewe IMB-R* Additional impact of railhead and IMB-R being located at Crewe in comparison to the baseline. Considerably greater impacts compared with baseline on the three substantial approved planning applications (mainly employment and residential use) which overlay an employment allocation for a regional warehouse and distribution park. One will be unviable, and others will lose between 25% and 60% of allocated site. • 12/1959N - Class B8 (Storage and Distribution) / B2 (General Industrial and B1 (Light Industrial/Office) with Ancillary Offices, Construction of Access Roads, Ecological Mitigation Works and Associated Structural Landscaping and Car Parking. **(unviable)** • 14/0378N B2 (general industry) and B8 (storage and distribution) comprising 1,042,500 ft² **(covers 60% of site)** • 13/0336N Outline application for residential development (up to 370 units), Offices (B1), local centre comprising food and non-food retail (A1) and restaurant/public house (A3/A4), hotel (C1), car showroom and associated works **(covers 25% of site)** • • Employment allocation E.3.1 BASFORD WEST (gross area about 55 ha) will be developed for a regional warehouse and distribution park **(covers 60% of site)**		**South of Stone** (delivery of approx. 500 new homes, 40% affordable**). Map ref CA3/18.** Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* *No committed developments affected through locating the railhead and IMB-R at Aldersey's Rough.* Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No change to baseline.		**Stone** (delivery of approx. 500 new homes, 40% affordable**). Map ref CA3/18.** Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* *No committed developments affected through locating the railhead and IMB-R at Aldersey's Rough.* Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance Loops* No committed developments affected as no substantial change in the land take in the area.	

						and extension to form granny annexe). Map ref. CA5/27 (new impact from baseline). • The increased construction boundary adjacent to alignment at 246+600 means that 14/0256N (Conversion of a redundant barn into two residential dwellings with office facilities) no longer looks viable (new impact from baseline). Pipe Ridware – *Pipe Ridware Maintenance Loops* No committed developments affected as no substantial change in the land take in the area.		New Weston Lane Overbridge Additional impacts compared with baseline: • East of 246+500 the increased construction boundary would make application 14/3374N unviable (Proposed alterations and extension to form granny annexe). Map ref. CA5/27 (new impact from baseline). • The increased construction boundary adjacent to alignment at 246+600 means that 14/0256N (Conversion of a redundant barn into two residential dwellings with office facilities) no longer looks viable (new impact from baseline). Pipe Ridware – *Pipe Ridware Maintenance Loops* No committed developments affected as no substantial change in the land take in the area.				
		Op		n/a	N/A	n/a	N/A	n/a	N/A	n/a	N/A	n/a	N/A
	Planning Policy	Const	Avoid/ minimise impacts on protected areas within planning policy	Stone – *Stone railhead & IMB-R* The railhead and IMB-R are located within Green Belt (which runs north from the existing Norton Bridge to Stone Railway). Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *No maintenance loops* No requirement for maintenance loops in this option and therefore no impacts have been reported.	N/A	Stone – *No facilities* The railhead and IMB-R are no longer at this area and will remove impact within the Green Belt at this location. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe railhead & IMB-R* New Weston Lane Overbridge will require an extended construction boundary resulting in a slight additional land take within Green Gap land (Policy 4.17 NE.4 GREEN GAPS- Crewe & Nantwich Local Plan) (approx. location adjacent to 246+600). Pipe Ridware – *Pipe Ridware Maintenance Loops* Same as baseline – negligible increase in footprint results in no additional impacts.	+	Stone – *Stone railhead* The railhead and IMB-R are no longer at this area and will remove impact within the Green Belt at this location. Aldersey's Rough – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Crewe – *Crewe IMB-R* New Weston Lane Overbridge will require an extended construction boundary resulting in a slight additional land take within Green Gap land (Policy 4.17 NE.4 GREEN GAPS- Crewe & Nantwich Local Plan) (approx. location adjacent to 246+600). Pipe Ridware – *Pipe Ridware Maintenance Loops* Same as baseline – negligible increase in footprint results in no additional impacts.	+	Stone – *No facilities* The railhead and IMB-R are no longer at this area and will remove impact within the Green Belt at this location. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* New location of railhead and IMB-R, and new access roads to M6 are entirely within Green Belt Land (ASP6 – Rural Area Spatial Policy) (identified in the Newcastle-under-Lyme and Stoke-on-Trent Core Spatial Strategy). and are further away from the alignment than the baseline option, increasing the overall foot print. The increased construction boundary for this option is also within Green Belt land. The land take within the Green Belt at this location is greater than the Green Belt land required for the baseline option. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported.	- -	Stone – *No facilities* The railhead and IMB-R are no longer at this area and will remove impact within the Green Belt at this location. Aldersey's Rough – *Aldersey's Rough railhead & IMB-R* New location of railhead and IMB-R, and new access roads to M6 are entirely within Green Belt Land (ASP6 – Rural Area Spatial Policy) (identified in the Newcastle-under-Lyme and Stoke-on-Trent Core Spatial Strategy). and are further away from the alignment than the baseline option, increasing the overall foot print. The increased construction boundary for this option is also within Green Belt land. The land take within the Green Belt at this location is greater than the Green Belt land required for the baseline option. Crewe – *No facilities* No facilities are located in this area under this option and therefore no impacts have been reported. Pipe Ridware – *Pipe Ridware Maintenance*	- -

										Pipe Ridware – *No maintenance loops* No change to baseline.		*Loops* Same as baseline – negligible increase in footprint results in no additional impacts.	
		Op		n/a	N/A	n/a	N/A	n/a	N/A	n/a	N/A	n/a	N/A
				Overall rating		**Overall rating**		**Overall rating**		**Overall rating**		**Overall rating**	
Reason for overall rating:				Option A8 would impact on the landscape character of the area and would result in visual effects on the dispersed residential receptors east of Yarnfield. There would be a substantial impact on agricultural land holdings due to the rural nature of the location, also impacting on potential areas of European Protected Species, loss of Pool House Wood LWS and partial loss of Filly Brook LWS. The area required for this option has known areas of land quality constraints including infilled pits and quarries as well as a historic landfill site and so remediation is likely to be required. This option would impact on archaeological remains, would result in the removal of field systems and would affect the setting of scheduled monuments in the area. This option will require works to Filly Brook to deculvert the watercourse but will provide a betterment compared to existing conditions. An area of committed development will be impacted by the Norton Bridge to Stone Sidings (up to 10% of the land) but will still be viable. The demolition of Little Micklow and Brookhouse Farm will be required through this option and would have a minor impact on socio-economics of the area due to the location of a dog training business at the latter. This option would require the realignment of Yarnfield Lane as well as permanent accesses off the M6.	N/A	**Improvements:** - Option A5 would see a considerable reduction in landscape character effects at Stone through locating the railhead and IMB-R to Crewe. - A reduction in the number of agricultural land and holdings affected is evident within this option due to the removal of facilities at Stone and relocation to Crewe. - An improvement for biodiversity and ecology due to the avoidance of LWSs present in the Stone area and the reduced potential for impacting protected species due to the less rural context of Crewe. **Worsenings:** - Option A5 would see an increased number of visual receptors overall due to the proximity of properties in the Crewe area. An increase in landscape character and visual impact would also be seen in Pipe Ridware resulting from the increased vertical alignment for the introduction of the maintenance loops. - Land quality issues would be substantially reduced at Stone within the option however due to the number of infilled pits, quarries, landfill sites and the presence of the WCML at Crewe, this option is a worsening in comparison to the baseline during construction. - Locating the temporary and permanent maintenance facilities to Crewe and the introduction of the Pipe Ridware maintenance loops would have effects on the setting listed buildings at Pipe Ridware and likely archaeological remains Crewe. - An increased impact for water and flood risk due to the Crewe area being located within Flood Zone 2 and the Gresty Brook being adversely affected due to loss of river channel. - Additional community affects are likely at Crewe with in-combination effects on residential properties along Crewe Road	-	**Improvements:** - An improvement in biodiversity and ecology during operation due to the IMB-R located at closer to an urban environment where existing levels of artificial lighting will be greater than that of the baseline. **Worsenings:** - Option A5 would introduce increased number of visual receptors near Crewe due to the IMB-R (major worsening during construction, moderate worsening during operation). An increase in landscape character and visual impact would also be seen in Pipe Ridware resulting from the increased vertical alignment for the introduction of the maintenance loops. - An increased impact on agricultural land use is evident within this option in comparison to the baseline due to the additional land required at Crewe in addition to that already impacted at Stone through the location of the railhead. - An increased impact on ecology and biodiversity is apparent within this option during construction due to the comparative impacts at Stone to the baseline, as well as additional impacts at Crewe and Pipe Ridware. - A moderate worsening for land quality during construction due to the impact of land quality constraints of infilled pits, quarries, landfill sites and the WCML in both the Stone and Crewe locations. - Cultural Heritage sees a slight increase in impact in comparison to the baseline due to the increase in	--	**Improvements:** - An improvement is seen in comparison to the baseline for agricultural land use affected due to the substantial reductions at Stone and fewer holdings affected overall. - Option A9.5* possesses slight improvements in land quality due to the reduction of remediation required at Stone and the smaller number of infilled ponds, pits, quarries affected overall. - No committed developments affected through construction of Option A9.5* and a reduction is seen in the Stone area. **Worsenings:** - Option A9.5* would have increased landscape character impacts during construction at Aldersey's Rough in comparison to the baseline as this is currently unaffected area by the Proposed Scheme. Increased loss of ancient woodland as well as dispersed visual receptors in the vicinity in comparison to the baseline during both construction and operation. - Option A9.5* has increased impacts during construction in comparison to the baseline for water and flood risk due to the IMB-R sitting atop an existing and partially culverted tributary of the River Lea, additional culverts required on the Stoke to Market Drayton Railway, a new channel diversion and a culvert on the tributary of the River Lea. The new WCML spur also causes significant impacts on the flood plain of the River Lea with increased flood risk in the area. - Potential new in-combination impacts on residential properties at Stoney Lowe Farm and Bromley Green, as well as likely increase in in-combination impacts at Hey House. This option would however see a	--	**Improvements:** - An improvement is seen in comparison to the baseline for agricultural land use affected due to the substantial reductions at Stone and fewer holdings affected overall despite the introduction of maintenance loops within this option. - Option A9.5 possesses slight improvements in land quality due to the reduction of remediation required at Stone and the smaller number of infilled ponds, pits, quarries affected overall. - No committed developments affected through construction of Option A9.5 and a reduction is seen in the Stone area. **Worsenings:** - Option A9.5 would have increased landscape character impacts during construction at Aldersey's Rough in comparison to the baseline as this is currently unaffected area by the Proposed Scheme. Increased loss of ancient woodland as well as dispersed visual receptors in the vicinity in comparison to the baseline during both construction and operation. - Option A9.5 has increased impacts during construction in comparison to the baseline for water and flood risk due to the IMB-R sitting atop an existing and partially culverted tributary of the River Lea, additional culverts required on the Stoke to Market Drayton Railway, a new channel diversion and a culvert on the tributary of the River Lea. The new WCML spur also causes significant impacts on the flood plain of the River Lea with increased flood risk in the area. The widening and deepening of culverts due to the vertical alignment change near Pipe Ridware is also required. - Potential new in-combination impacts on residential properties at Stoney Lowe Farm and Bromley Green, as well as likely increase in	--

			and Jack Mills Way, largely due to the substantial increased HGV movements during construction on the local road network and via site haul routes. In-combination effects are also present at Pipe Ridware due to the increase in vertical alignment following the introduction of the maintenance loops. - There would be a substantial increase in committed developments compared to the baseline due to the presence committed developments in Crewe impacting on a number of developments would be unviable with this option.		land required during the construction phase due to facilities located at Stone, Crewe and works at Pipe Ridware. - During construction of Option A1, water and flood risk would have substantial impacts in comparison to the baseline due to the similar effects at Stone but additional effects at Crewe of being located within Flood Zone 2 and affecting an additional watercourse (Gresty Brook) due to loss of water channel. - Additional community affects would be present within this option in comparison to the baseline due to in-combination effects of residential properties on Crewe Road and Jack Mills Way as well as the effects at Stone, largely due to the substantial increased HGV movements during construction on the local road network and site haul routes. In-combination effects are also present in the Pipe Ridware area due to the increase in vertical alignment following the introduction of the maintenance loops. - There would be a substantial increase in committed developments in comparison to the baseline due to the presence committed developments in Crewe, some of which will be made unviable, in addition to those affected at Stone.		reduction in demolitions of two properties in the Stone area, as well as no further in-combination effects at Stone. This would result in an overall rating similar to that of the baseline. - Substantial increases in HGV movements during construction are evident in this option on the local road network and site haul routes. Additional disruptions are likely to occur along M6 with reduced speeds and restrictions around Keele and access required from the M6 in addition to those already required at Stone as part of the Proposed Scheme.		in-combination impacts at Hey House sees an increase in impact in comparison to the baseline option during construction. - Substantial increases in HGV movements during construction are evident in this optionon the local road network and site haul routes. Additional disruptions are likely to occur along M6 with reduced speeds and restrictions around Keele and access required from the M6 in addition to those already required at Stone as part of the Proposed Scheme. This would also have an increased impact on air quality overall due to a greater amount of emissions resulting from the construction traffic movemenTS.	

Assumptions

Cultural Heritage

- It has been assumed that minor alterations to vertical alignment to embankments and viaducts either side of the Pipe Ridware embankment maintenance loops will not result in sufficiently substantive changes to be worth considering in this sift

Landscape / Townscape

- The housing development in Southern Crewe under construction along Jack Mills Way (and within Basford West Masterplan) is included in the baseline Option A8.
- The baseline description takes no account of the other elements of the Proposed Scheme and focuses only on the IMB-R and Railhead.
- The construction activities associated with a combined IMB-R and railhead will be similar in scale, extents and nature to works to fabricate an IMB-R or railhead on their own
- The scores/colours attributed to the ratings column (o,+++, -- etc) are based on our professional judgement of the effects. These are influenced by (and not based entirely on) the indicative descriptions (minor/moderate/major) used to depict the level of effects.

Water and flood risk (Surface water)

- It is assumed all side slopes are maintained and thus lowering or raising of embankments will affect the overall width of land take.

- We assume FZ2 in south Crewe area is incorrect following FRA undertaken for Whitby Way.

Waste and Material Resources
- IMB-R maintenance activities assumed to be the same regardless of its location.

Ecology
- Assumption - In the absence of detailed map regression analysis, it is assumed that Aldersley's Rough woodland is ancient in origin.

Community Assumptions limitations:
- Assumed build out of proposed residential properties at Basford West allocation where land is not directly taken for the scheme.

Limitations:

Cultural Heritage
- Lack of information on buried archaeology at Aldersey's Rough is a limitation.

Socio-economics
- The assessment does not take into account the potential for affected businesses to relocate
- Assessment is based on committed development information available at CP_3 stage.

Ecology
- Limitation – The exact land take of the new options is not clear at this stage and impacts have therefore been assessed by comparing the various sketch plans by eye against the ecological data held in GIS. As a result any quantification of potential impacts are estimates only.

Community Assumptions limitations:
- assessment of impacts based on professional judgement with no access to modelled outputs (traffic, air quality, noise and vibration).
- Checked against the SNV sift, but other in-combination assessments unavailable at the time of writing

Land Quality
- Limited coverage of historical maps available on GIS for Aldersey's Rough area.

Appendix B – Attendance Sheet

Scheme Design Working Group

Date : 18th October 17	Venue : Arup Campus
Attendee	**Signature**
TIM TAYLOR	
NICK MITCHARD	
JOAN BROWNHILL	
SIMON WHEELER	
A. ZWOLINSKA - JONES	
Richard W. Smith (LAP)	
L KUNCEWICZ	
D. EDWARDS	
I. DAVIS	
K. PARASKEVAS	
LAILA ZIDAN C862 WSP	
D CARTER	
H ROLFE	
M. CONTE	
Jo Lucas	
E. Dixon	
C. RICHARDS	
OWEN KELLY	
DAMIAN SMITH	
Rania G. HILL	
Tim Hackett	
Maureen Law	
NEIL HARRISON	

Appendix C – Stone Railhead/IMB-R Layout

Fit for Acceptance

Rev	Description	Drawn	Checked	Con App	HS2 App
P06	CP3 Issue	JSY 09/02/2017	DCA 09/02/2017	AAR 09/02/2017	
P05	CP2+ Issue	JSY 07/12/2016	DCA 07/12/2016	AAR 07/12/2016	
P04	Car parking spaces increased as per PDS	JSY 10/08/2016	DCA 10/08/2016	AAR 10/08/2016	
P03	Internal Layout reviewed & amended	JSY 04/08/2016	DCA 04/08/2016	04/08/2016	AAR
P02	Internal Layout reviewed & amended	JSY 19/07/2016	DCA 19/07/2016	DCA 19/07/2016	

HS2 accepts no responsibility for any circumstances which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incompletely in any way.

Scale with caution as distortion can occur.

Legends/Notes:

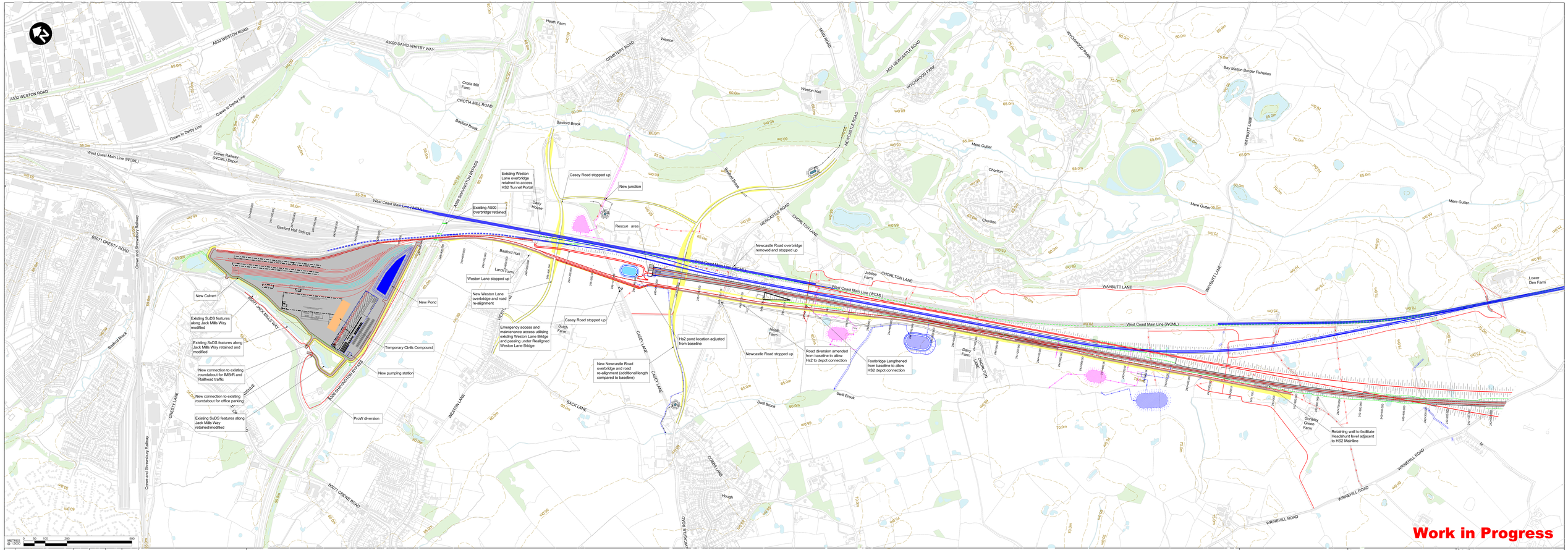
1. For legend refer to drawing HS2-HS2-IM-DSC-000-000001
2. All dimensions are in metres
3. All infrastructure shown as part of the Railhead will remain for the IMBR except for that marked as temporary
4. New S&C provided on the NBS line and the reception sidings are Network Rail S&C
   New S&C provided within the Railhead and IMBR are HS2 S&C
5. Refer to track drawing C862-PBR-RT-DPL-WS04-000001 for the Network Rail connections.

- Network Rail and Network Rail controlled infrastructure
- High Speed 2 Mainline and HS2 controlled infrastructure
- Temporary tracks used during the Rail Systems construction Railhead phase and removed prior to the IMBR phase
- IMBR internal access roads
- Vehicle Crossing 1 — Vehicle Crossing point (for internal HS2 staff (and Network Rail by local agreement) only)

Registered in England
Registration No. 06791686
Registered office:
2 Snow Hill,
Queensway,
Birmingham, B4 6GA

Zone	Marston to Stone
Project/Contract	P2A Railway Systems
Design Stage	Hybrid Bill - Interim Preliminary Design
Discipline/Function	Construction and Logistics
Drawing Title	Rail Systems Railhead Stone
Drawn	JSY
Checked	DCA
Approved	AAR
Date	26/05/2016
Scale	1:2500
Size	A1
Creator/Originator	Parsons Brinckerhoff
Drawing No.	C862-PBR-CL-DPL-WS04-000014
Rev.	P06

Appendix D – Crewe Railhead/IMB-R Layout



METRES @ 1:5000 — 0 50 100 200 300

Rev	Description	Drawn	Checked	Con App	HS2 App
P01					

Legends/Notes:

Scale with caution as distortion can occur.

Registered in England Registration No. 06791686 Registered office: One Canada Square, Canonmills, Birmingham, B4 6GA

Over Arup and Partners International Ltd

Creator/Originator: XXXXXXX

Zone	Infrastructure Maintenance Base / Railhead
Design Stage	Initial Preliminary Design
Drawing Title	HS2 P2A - IMB-R/Railhead Sift Crewe IMB-R / Railhead Option A5
Project/Contract	P2A Civils Design & Environmental Services
Discipline/Function	Engineering
Drawn	FRW
Checked	AW
Approved	XXX
Date	15/08/2017
Scale	1:5000
Size	A1+
Drawing No.	C861-ARP-EN-DSK-000-000004
Rev.	

Appendix E – Stone Railhead Layout

Rail Systems Construction Railhead

Work-in-progress

Rev	Description	Drawn	Checked	Con App	HS2 App
P00.1		---	KP 30/06/2017	DCA 30/06/2017	

Scale with caution as distortion can occur.

Legends/Notes:

1. For legend refer to drawing HS2-HS2-IM-DSC-000-000001
2. All dimensions are in metres
3. New S&C provided on the NBS line and the reception sidings are Network Rail S&C
   New S&C provided within the Railhead and IMBR are HS2 S&C
4. Refer to track drawing C862-PBR-RT-DPL-WS04-000001 for the Network Rail connections.

- Network Rail and Network Rail controlled infrastructure
- High Speed 2 Mainline and HS2 controlled infrastructure
- IMBR internal access roads
- Vehicle Crossing 1 — Vehicle Crossing point (for internal HS2 staff (and Network Rail by local agreement) only)

Registered in England
Registration No. 06791686
Registered office:
2 Snow Hill,
Queensway,
Birmingham, B4 6GA

Zone	Route Wide
Project/Contract	P2A Railway Systems
Design Stage	Hybrid Bill - Interim Preliminary Design
Discipline/Function	Construction and Logistics
Drawing Title	Stone Railhead only
Drawn	JSY
Checked	KP
Approved	DCA
Date	26/05/2016
Scale	AS SHOWN
Size	A1
Creator/Originator	Parsons Brinckerhoff
Drawing No.	C862-PBR-CL-DPL-000-000055
Rev.	P00.1

Appendix F – Crewe IMB-R Layout

Rev	Description	Drawn	Checked	Con App	HS2 App
P01					

Scale with caution as distortion can occur.

Legends/Notes:

Registered in England
Registration No. 06791686
Registered office:
2 Snow Hill,
Queensway,
Birmingham, B4 6GA

Creator/Originator
Ove Arup & Partners International Ltd

Zone	Infrastructure Maintenance Base
Project/Contract	P2A Civils Design & Environmental Services
Design Stage	Initial Preliminary Design
Discipline/Function	Engineering
Drawing Title	HS2 P2A - IMB-R/Railhead Sift Crewe IMB-R Only Option A1
Drawn	FRW
Checked	AW
Approved	XXX
Date	15/08/2017
Scale	1:5000
Size	A1+
Drawing No.	C861-ARP-EN-DSK-000-000003
Rev.	P01

Appendix G – Aldersey's Rough Railhead/IMB-R Layout

Minor junction upgrade to allow occasoinal maintenance vehicle

Temporary M6 Slip roads (modify existing Keele Services slips)

Controlled access to M6 through Keele Services

Minor junction upgrade to allow occasoinal maintenance vehicle

Existing overhead utility raised to providedclearance

Cutting

Temporary M6 Slip roads (modify existing Keele Services slips)

Existing Culvert Refurbished

Replacement Underbridge

New Culvert

Replacement Culvert

New Culvert

8m retaining wall to facilitate level difference between depot to NwR and depot to HS2

New Underbridge

Embankment

New Pond

Fence and perimeter drainage ditch around embankments

Fence and perimeter drainage ditch around embankments/cuttings

Cutting

Potential flood defences required

Replacement overbridge over WCML

Temporary Civils compound

Madeley Park Culvert(additional length compared to CP3 design)

New Culvert

Embankment

New culvert

Whitmore Wood Culvert(additional length compared to CP3 design)

Realigned access track and public right of way compared to CP3

Headshunt ~ 2m below existing track. Bridge remediation/ new Manor Road bridge required.

New Pond

New bridge (additional length compared to CP3 design)

Dab green drop inlet, extended compared to CP3

New connection off WCML on embankment

Up to 25m Retaining Wall (moved into Whitmore Wood approx 12m compared to CP3)

Embankment

Watercourse diversion

New Pond

Fence and perimeter drainage ditch along top of retaining wall

Maintenance access track to new attenuation pond

Maintenance access track to new attenuation pond

Work in Progress

METRES @ 1:10000 0 100 200 500 1000

Rev	Description	Drawn	Checked	Con App	HS2 App
P01					

Legends/Notes:

Registered in England
Registration No. 06791686
Registered office:
2 Snow Hill,
Queensway,
Birmingham, B4 6GA

hs2 engine for growth

Creator/Orlginator
Ove Arup & Partners International Ltd

Zone
Imfrastructure Maintenance Base / Railhead

Project/Contract
P2A Civils design & Environmental Services

Design Stage
Initial Preliminary Design

Discipline/Functlon
Engineering

Drawing Title
HS2 P2A - IMB-R/Railhead Sift
Aldersey Rough IMB-R and Railhead
Option A9.5

Drawn	Checked	Approved
SB	AW	XXX

Date	Scale	Size
15/08/2017	1:10,000	A1

Drawing No. C861-ARP-EN-DSK-000-000005

Rev. P01

Appendix H – C862: Maintenance Aspects of Phase 2a Railhead/IMB-R SIFT

C862: Maintenance Aspects of Phase 2a Railhead/IMB-R SIFT

Document no.: C862-PBR-MN-NOT-000-000002

Revision	Author	Date	Issued for/Revision details
-	Andy Clayton	28/06/17	Initial Draft
P01	Andy Clayton	31/07/17	Updated Draft
P01b	Andy Clayton	18/09/17	Feedback incorporated

Contents

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List of Figures

Acronyms and Abbreviations

Acronym	Explanation
BHI	Basford Hall Independent Lines (ELR)
DIPD	Draft Initial Preliminary Design
ECS	Empty Coaching Stock
ELR	Engineer's Line Reference
ETCS	European Train Control System
HCM	Newcastle-under-Lyme Branch (ELR)
IMB-R	Infrastructure Maintenance Base (Rail Connected)
LWR	Long Welded Rail
NBS	Norton Bridge to Stone (ELR)
NR	Network Rail
NRCI	Network Rail Controlled Infrastructure
OCS	Overhead Contact System
OTM	On Track Machine
PRS	Project Requirements Specification
RSD	Rolling Stock Depot
SLW	Single Line Working

1 Introduction

1.1 Purpose and Scope of Document

1.1.1 A strategic SIFT is to be undertaken to compare three potential locations for the Phase 2a construction railhead that will subsequently converted into an Infrastructure Maintenance Base Rail Connected (IMB-R).

1.1.2 This Technical Note reviews the location from a maintenance perspective. It also provides an indication of the impact of constructing a greater proportion of the route using a slab track-form. It is intended as an input into the over-arching document: "Phase 2A C862 Strategic Evaluation of Railhead and IMB-R Locations – Post CP3 Design" (C862-PBR-CL-REP-000-000034).

1.1.3 The following issues are deemed to be outside the scope of this Technical Note and have not been included within this review:

- Relative environmental impact of each location;
- Impact on construction and logistics of each proposed location;
- Impact on operations of each proposed location (i.e. operational requirements for loops and perturbation crossovers); and
- Relative costs of each facility.

1.1.4 The document consists of the following sections:

- Section 2 provides an overview of the purpose of infrastructure maintenance facilities;
- Section 3 provides an outline description of the potential locations for a maintenance facility;
- Section 4 assess the implications of the different maintenance facility locations;
- Section 5 reviews the impact of installing slab rather than a ballasted track-form;
- Section 6 summarises the assessments and draws a conclusion.

1.2 Baseline

1.2.1 Design development for HS2 is a continuous process with changes being made as the details are progressively defined. In order to undertake a maintenance assessment it is necessary to define a baseline configuration.

1.2.2 The following documents have been used to provide a baseline configuration for the purposes of this assessment:

- C862-PBR-RT-DSC-000-000001 Phase 2a C862 Route Diagram;
- 2RS02-WSP-RT-DSC-M000-000001 HS2 Phase 2b Route Diagram Manchester Leg;
- HS2-PBR-MN-REP-000-000001 HS2 Routewide Maintenance Facilities;
- HS2-PBR-MN-STR-000-00001 HS2 Asset Management Delivery Strategy (under review and not yet formally issued).

1.2.3 Input has also been received from the Rail Operations Asset Management Team.

1.2.4 Note that HS2-PBR-MN-REP-000-000001 is planned to be reviewed and updated during the second half of 2017. This document predates that review.

1.2.5 Reference has also been made to other documents and a full listing is included as Section 7 of this document.

1.2.6 The chainages used to define locations in this document are based on the buffer-stops at Euston being at 0km.

1.3 Basis of Assessment

Options

1.3.1 Three potential IMB-R locations have been identified for consideration in this document:

- Stone (approximate location 221km);
- Aldersey's Rough (approximate location 234km); and
- Crewe Basford Hall (approximate location 247km).

1.3.2 Although not suitable for an IMB-R, loops or sidings to stable engineering trains and/or On-Track Machines (OTMs) between shifts could be located at:

- Pipe Ridware (approximate location 193km)

1.3.3 The functional requirements of an IMB-R and a Loop are described in Section 2. The characteristics of each of these locations are considered further in Section3.

Assumptions

1.3.4 The key assumptions used in undertaking the analysis that supports this document are:

- Phase 2a will be constructed using a slab track-form (see Sub-Section 5.1 for further consideration of this assumption);
- Maintenance periods will be available from 00:00 to 04:59 Monday to Saturday (with

an extended period from 00:00 to 07:59 available on Sundays);

- Engineering trains and OTMs will be fitted with European Train Control System (ETCS) equipment allowing them to depart the IMB-R and follow the final passenger service train (which would be before the start of the maintenance period at 00:00 based on the currently anticipate timetable);
- Preferred minimum working time on site is 3 hours;
- Maximum length of engineering trains operating on HS2 main lines will be approximately:
  - 800m for a ballasted track-form (high-output track renewal trains);
  - 300m for a slab track-form (long welded rail (LWR) delivery trains).

1.3.5 It is HS2's intention to procure a fleet of OTMs with a maximum transit speed of at least 120 km/hr. These are assumed to have an average end-to-end journey speed of approximately 100 km/hr, including an allowance for acceleration and braking. This is a change to the assumptions used in earlier maintenance documents.

1.3.6 The opportunity for the potential use of Network Rail (NR) facilities, such as the yard at Crewe Basford Hall, to stable trains and plan delivery to HS2 infrastructure on a "just-in-time" basis for the start of the maintenance period, has not been included in this analysis. Further work is required to fully consider the potential impacts and risks.

2 Maintenance Facilities

2.1 Infrastructure Maintenance Bases – Rail Connected (IMB-R)

2.1.1 HS2-PBR-MN-REP-000-000001 (HS2 Routewide Maintenance Facilities) sets out the approach adopted for the provision of maintenance facilities and their currently envisaged locations.

2.1.2 IMB-Rs serve the following purposes:

- Provide a set of stabling points across the network to enable OTMs and engineering trains to transit to/from worksites and be clear of the HS2 mainlines prior to the start of passenger services;
- Provide storage areas for components with suitable access to enable the components to be delivered to the IMB-R;
- Provide welfare and accommodation facilities for infrastructure maintenance staff allocated to the area; and
- Support effective deployment of rapid response teams if an incident or infrastructure failure occurs.

2.1.3 Access to the HS2 mainline from the maintenance facilities is required in both directions and onto both up and down main lines (using crossovers located in close proximity to the access).

2.1.4 The Phase 2a maintenance facility requires access to/from Network Rail Controlled Infrastructure (NRCI) to enable the delivery of bulk materials, plus the delivery of any engineering trains and OTMs used in addition to the dedicated HS2 fleet.

2.1.5 In addition, good access to national road and rail networks is required. The road access should be suitable for the movement of abnormal loads.

2.1.6 Where possible, IMB-Rs will be located at sites either identified to be used as railheads during the construction phase or to share a site with the Rolling Stock Depots (RSD). This is in order to obtain the available efficiencies from shared facilities and access connections.

2.2 Loops

2.2.1 Loops are provided to support both maintenance and operational activities.

2.2.2 The purpose of the Loops is defined in the "Routewide Maintenance Facilities" as being to enable failed service trains to be recessed and to provide stabling facilities for engineering trains and OTMs closer to work-sites in order to maximise productive working time.

2.2.3 Their location is determined based on satisfying the requirements of both activities.

3 Potential Phase 2a IMB-R Location

3.1 Introduction

3.1.1 Three locations have been identified for potential maintenance facilities on Phase 2a.

3.1.2 Additionally, a potential site has been identified where either a loop or a maintenance siding could be located if required.

3.1.3 The following sub-sections consider each of these potential locations in turn.

3.2 Stone

3.2.1 Stone is located at chainage 221km and the proposed site is between the M6, HS2 trace and NR's Norton Bridge to Stone (NBS) railway line.

3.2.2 The outline maintenance facility specification set out in the "*Routewide Maintenance Facilities*" can be fitted into the available area.

3.2.3 Differences in the vertical profiles mean that there are a number of gradients within the site. The impact of these on starting and stopping vehicles will need to be considered during development of an Operational Concept for the site.

3.2.4 It is not possible to include any 800m length sidings within the site. A number of shorter sidings have been included and, if support of a ballasted track-form is required on Phase 2b (West), the long length renewal trains will need to be moved in sections from these sidings and assembled in the loop prior to dispatch.

3.2.5 This is not a significant issue as train assembly can be achieved prior to the start of the maintenance periods with the provision of suitable safe areas alongside the loop.

3.2.6 Rail connections to NRCI are available to the Norton Bridge to Stone (NBS) line in both directions. The current design includes reception sidings to enable trains delivering to the IMB-R to move clear of NRCI without delay.

3.2.7 The sketch below indicates the proposed layout configuration for the connection from the IMB-R to the HS2 main lines, which is via a loop.

3.2.8 Road connections are available to this site via the adjacent M6.

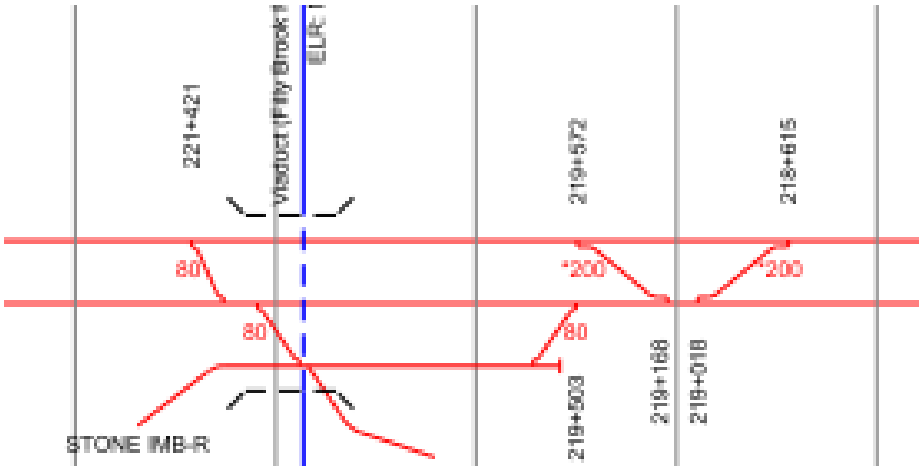

Figure 1 – HS2 Access Configuration at Stone

3.3 Aldersey's Rough

3.3.1 The proposed site at Aldersey's Rough is located alongside the former NR Newcastle-under-Lyme branch (HCM) with a junction onto HS2 at chainage 234km. The Newcastle-under-Lyme branch is currently disused.

3.3.2 The outline maintenance facility specification set out in the "*Routewide Maintenance Facilities*" can be fitted into the available area.

3.3.3 The following operational constraints have been identified:

- Connection to HS2 is between Whitmore Tunnel and Rive Lea Viaduct, with access to the north of the IMB-R provided via an 800m head-shunt using a crossover situated 4.7km north of the site (beyond Madeley Tunnel);
- Branch lines are required from both the HS2 and NRCI mainlines that will only be used by infrastructure maintenance traffic.

3.3.4 The nature of the connection to HS2 would result in the need for an increased number of engineering trains and OTMs that need to reverse direction having left the headshunt before travelling southwards to a worksite.

3.3.5 Rail connections to NRCI are available via the slow lines West Coast Main Line using the former Madeley Junction alignment onto the HCM line. The current design includes a head-shunt/run-round loop on the HCM line that will enable trains delivering to the IMB-R to move clear of NRCI without delay.

3.3.6 Differences in the vertical profiles mean that there are a number of gradients within the site. The impact of these on starting and stopping vehicles will need to be considered during development of an Operational Concept for the site.

3.3.7 Road connections to this site can be provided via the adjacent M6.

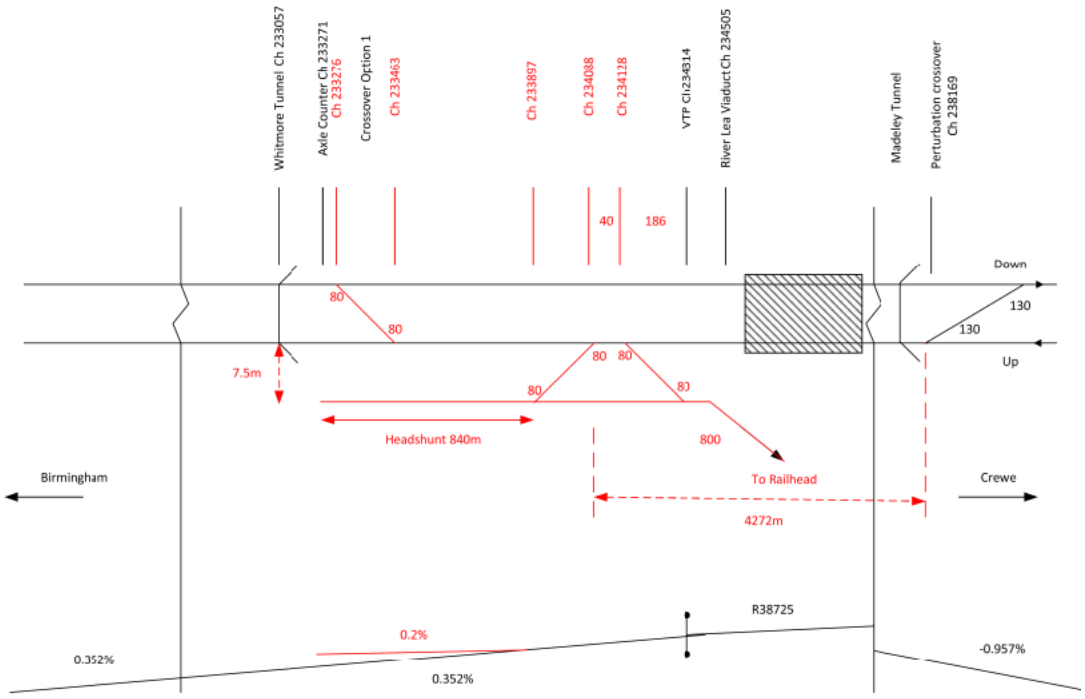

Figure 2 – HS2 Access Configuration at Aldersey's Rough

3.4 Crewe (Basford Hall)

3.4.1 Crewe (Basford Hall) is approximately at chainage 247km, located alongside the Basford Hall Independent lines (BHI). At this point the HS2 mainlines are in Crewe Tunnel underneath NR's Basford Hall yard. The spur connection to the proposed IMB-R site has a junction onto the HS2 mainline at chainage 244km.

3.4.2 The outline maintenance facility specification set out in the "*Routewide Maintenance Facilities*" can be fitted into the available area.

3.4.3 Access to the north of the IMB-R is via an 800m head-shunt.

3.4.4 This is not a significant issue provided engineering trains and OTMs can depart directly southwards from the IMB-R link line without entering the headshunt. Otherwise, there will be an increased number of engineering trains and OTMs that need to reverse direction having left the headshunt before travelling southwards to a worksite.

3.4.5 It is not possible to include any 800m length sidings within the site. A number of shorter sidings have been included and, if support of a ballasted track-form is required, the long

length renewal trains will need to be moved in sections from these sidings and assembled in the headshunt prior to dispatch.

3.4.6 This is not a significant issue as train assembly can be achieved prior to the start of the maintenance periods with the provision of suitable safe areas alongside the headshunt, noting that the ballasted track-form is to the north of this site.

3.4.7 Access to this location would effectively be via a 5km branch line only used by infrastructure maintenance traffic from Wrinehill Junction (spur to NRCI) until Phase 2b is brought into service.

3.4.8 The local topography allows a design to be developed avoiding the need for gradients.

3.4.9 The sketch below indicates the constraints imposed by the alignment of the HS2 trace and proximity of the neutral section such that a north facing headshunt has been provided rather than a loop.

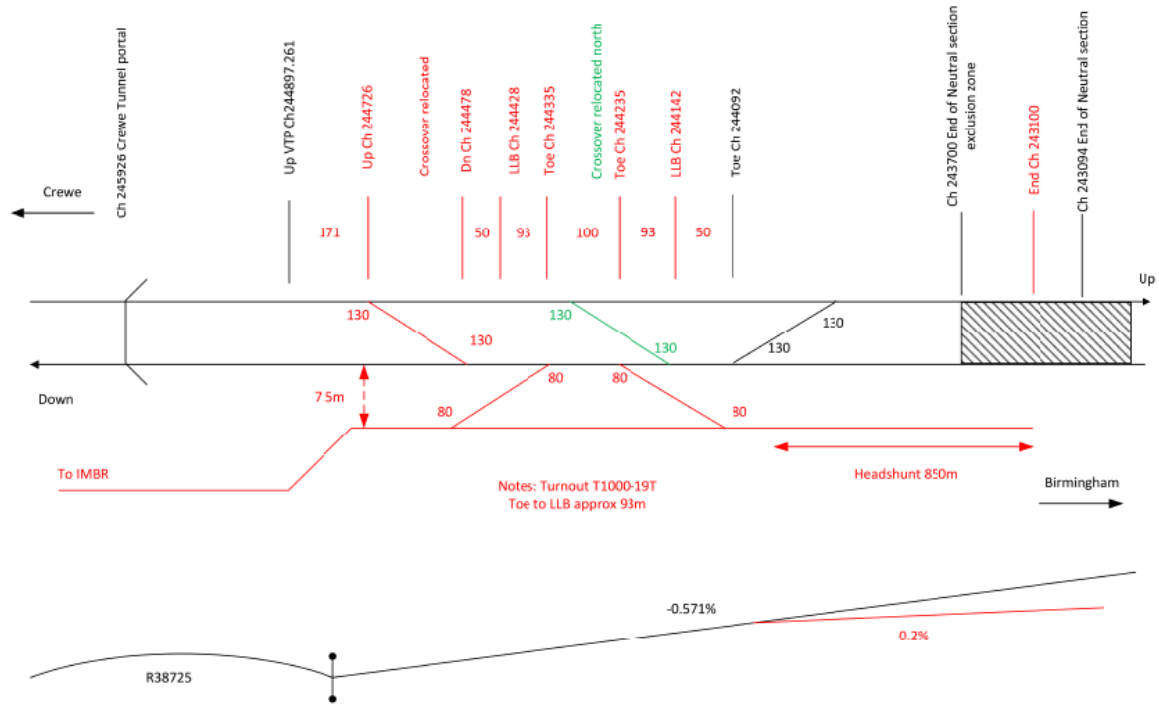

Figure 3 – HS2 Access Configuration at Crewe (Basford Hall)

3.4.10 Rail connections to NRCI are proposed via the Basford Hall Independent (BHI) lines. The design has yet to be developed such that it can be confirmed that trains using these connections will be able move clear of NRCI without delay.

3.4.11 Road connections to the site can be provided via the adjacent A500.

3.5 Pipe Ridware

3.5.1 As required by the Project Requirements Specification (PRS), the Draft Initial Preliminary Design (DIPD) included a set of Loops at Pipe Ridware (chainage 193km). The loops provided had both operational and maintenance related functional requirements (see sub-section 2.1.6).

3.5.2 The Pipe Ridware loops were removed following a value engineering exercise, based on an assessment that assumed the Phase 2a IMB-R would be located at Stone. The CP3 design configuration retains facing and trailing perturbation crossovers at Pipe Ridware.

3.5.3 The functional requirement for a facility to recess a failed service train has been provided in the design through use of the loop at Stone IMB-R. The failed service train may need to be moved into the IMB-R in order to enable the loop to be used to hold maintenance trains waiting to depart prior to the start of the maintenance period.

3.5.4 The site at Pipe Ridware has limited road access, no potential connections to NRCI and the local topography limits the available area without the extensive earthworks being undertaken. As such, the IMB-R specification described in sub-section 2.1 cannot be accommodated at this site.

4 Assessment of Phase 2a Site Time

4.1 Transit Times

4.1.1 Figure 4 below indicates the distances and assessed journey times for OTMs travelling between each of the principal Phase 2 (West) locations, including all four of the potential maintenance facility sites on Phase 2a.

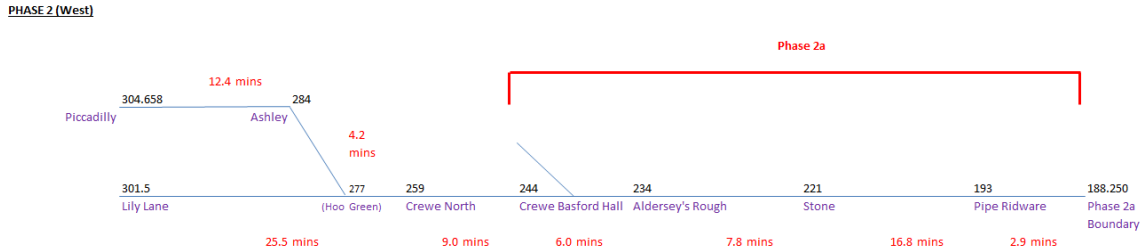

Figure 4 – Transit Times between Phase 2 (West) Locations

4.1.2 The table below summarises the assessment of these locations by considering the maximum transit time to a work-site prior to Phase 2b (West) starting services.

Combination of Maintenance Facilities	*Minimum Working Time (Southwards Transit)*	*Minimum Working Time (Northwards Transit)*
Crewe (Basford Hall) IMB-R	2 hours 50 minutes	4 hours 0 minutes
Crewe (Basford Hall) IMB-R and Pipe Ridware Loops	3 hours 30 minutes	4 hours 0 minutes
Aldersey's Rough IMB-R	3 hours 0 minutes	3 hours 50 minutes
Aldersey's Rough IMB-R and Pipe Ridware Loops	3 hours 40 minutes	3 hours 50 minutes
Stone IMB-R	3 hours 20 minutes	3 hours 40 minutes

Table 1 – Phase 2a Transit Times

4.2 Number of Departures/Arrivals per Shift

4.2.1 Based on a high-level assessment of the activity level it is anticipated that no more than two trains per day (on average) are likely to depart an IMB-R in the same direction, irrespective of the proposed IMB-R location.

4.2.2 This is not envisaged to cause a significant constraint at any of the three identified options for location of the IMB-R (Stone, Aldersey's Rough and Crewe).

4.3 Alternative Scenarios

4.3.1 A range of alternative approaches could be adopted to increase the available working time on site:

- Engineering trains and OTMs to depart the IMB-R prior to 00:00;
- Maintenance activities at the southern end of Phase 2a to be planned to be undertaken during the longer maintenance periods available on Saturday/Sunday nights;
- Reduced planned working time on site and increase resources to achieve similar output levels;
- Inclusion of a maintenance siding at Pipe Ridware in the outline design;
- Inclusion of a loop at Pipe Ridware in the outline design.

Dispatch Prior to Start of Maintenance Period

4.3.2 The last service train on HS2 is currently timetabled to arrive at its destination before 00:00. As all engineering trains and OTMs will be fitted with ETCS equipment they will be able to follow the last service train and depart prior to the start of the maintenance period.

4.3.3 This approach may require any conflicting Empty Coaching Stock (ECS) moves to be re-planned to use Single Line Working (SLW) over the other line, including any extended journey times due to the use of perturbation crossovers. It is anticipated that all ECS moves will be in the same direction at either end of the operational day.

4.3.4 There will be an adverse impact from adopting this approach if:

- Commercial decisions are made to extend the timetable such that passenger services continue to depart London later into the evening, resulting in the last train passing the IMB-R after midnight;
- Changes to the movement of ECS due to the need to adopt SLW mean that train-sets are late on depot and presented late for the following day's services.

Revised Planning Rules

4.3.5 Revised maintenance planning rules could be adopted for any sites at the southern end of Phase 2a such as:

- Maintenance work is not planned for any 5 hour midweek maintenance period and only planned to be undertaken during the longer 8 hour maintenance periods available during Saturday/Sunday nights (so ensuring that working shifts are greater than 3 hours);
- Maintenance work is planned to be undertaken within shorter working times on site, with either additional resources or additional shifts allocated to complete the activities.

4.3.6 Deploying a solution based on these types of planning rules will result in a reduction in flexibility. Only planning work for these areas using a single shift per week adds a constraint into the level of maintenance work that can be undertaken. Note that, currently the only potential maintenance "hot spot" identified is the retained perturbation crossovers at Pipe Ridware.

4.3.7 Planning to work within shorter periods of time on site reduces the flexibility to react to unforeseen events. Such events may include late running trains, equipment failures and emerging work scope changes.

4.3.8 More detailed understanding of the maintenance schedule will not be available until the Asset Management Delivery Plans are developed and detailed design undertaken. At this stage, it is assumed that all maintenance activities can be split such that they are deliverable within the available time if suitable resources are deployed.

Transit Speeds to/from Site and Stabling Point

4.3.9 It is understood that early discussions with the industry supply chain have indicated that an increase in maximum transit speed is feasible and that this approach will form part of the Plant Strategy for all engineering vehicles and OTMs procured for HS2.

4.3.10 Any engineering vehicles and OTMs that are not dedicated HS2 resources, i.e. hired as required from third parties, will probably not be designed to operate at these higher transit speeds (unless this become the industry norm) and require longer transit times.

4.3.11 The Plant Strategy is still under development and identification of which items of plant will be hired as required has not been finalised. This list of hired vehicles may include LWR delivery trains and rail grinders that are not fully utilised or bespoke designs for HS2.

4.3.12 It is estimated that between 5% and 10% of shifts will use lower speed vehicles and require adoption of an alternative solution.

Provision of Additional Facilities

4.3.13 The final group of potential solutions is the provision of an additional facility to enable engineering trains to be stabled closer to the southern end of Phase 2a. From work undertaken for the DIPD, it is assumed that this will be in the Pipe Ridware area where suitable connections can be made to the HS2 main lines.

4.3.14 From a maintenance perspective, it is anticipated that a siding to accommodate a 300m train will be sufficient as both Phase One and Phase 2a a are assumed to use a slab track-form. Full reinstatement of one or both loops is not required, unless this provides a positive operational benefit for recessing failed service trains.

4.3.15 Although this report does not include financial analysis, this solution is understood to introduce a significant additional construction cost due to the topography. There will also be an on-going additional OPEX cost to inspect, maintain and renew the stabling facility.

5 Use of Slab-Track

5.1 Introduction

5.1.1 The current version of "HS2 Routewide Maintenance Facilities" (HS2-PBR-MN-REP-000-000001), which sets out the functional requirements for the maintenance facilities, was developed on the basis that a ballasted track-form would be used by HS2, other than in the bored tunnels and at the terminus stations.

5.1.2 The latest position is that:

- Phase One will be constructed using a slab track-form throughout;
- Phase 2a will be constructed using a slab track-form throughout;
- Phase 2b (West) and Phase 2b (East) will be constructed using a ballasted track-form other than in the bored tunnels and at the terminus stations.

5.1.3 As such, it is currently anticipated that a ballasted track-form will be used on 108 track km of Phase 2b (West) as follows:

- From the northern portal of Crewe Tunnel (chainage 255km) to the connection with NRCI at Lily Lane (chainage 302km); and
- Southern section of the spur to Manchester Piccadilly from Hoo Green Junction (277km) to Ashley (284km).

5.1.4 It is noted that, at the time of drafting, the decisions with respect to the track-form to be used on Phase 2b (West) have not yet been finalised and the extent of slab track included in the design may increase.

5.1.5 This section considers the implications on the requirements for the maintenance facilities of changing from a ballasted track-form to a slab track-form.

5.2 Impact on Maintenance Activities

5.2.1 Use of slab-track instead of a ballasted track-form removes the requirements for activities such as:

- Regular attention to track alignment;
- Ballast profile management; and
- Use of high-output equipment for tracks renewal.

5.2.2 Other activities will be required to be undertaken less frequently due to the increased fixidity of the track, such as monitoring and adjustment of the position of the contact wire relative to the rails.

5.2.3 There will be a requirement for additional activities, such as jet-cleaning the track slab, but these will be less frequent than the eliminated activities noted above. The overall maintenance activity will decrease with the wider adoption of a slab track-form.

5.3 Impact on Functional Requirements of Maintenance Facilities

5.3.1 Adoption of a slab track-form will result in a reduction in the facilities to be provided at an IMB-R. This is primarily due to the elimination of ballast management activities.

5.3.2 Adoption of slab-track will remove the need for 800m length sidings. Renewals to assets such as rails and contact wires will still be required, but a single 300m siding will accommodate the necessary engineering trains.

5.3.3 This reduction in the length of stabling sidings from 800m to 300m affects IMB-Rs, loops and maintenance sidings.

5.3.4 There will be no need for storage facilities for sleepers, ballast or spoil. There will, though, be a new requirement for storage of pre-cast slab track units.

5.3.5 Use of a slab track-form will reduce the number of engineering trains and OTMs working from the IMB-Rs due to the elimination of ballast management activities, reducing the overall length of stabling sidings required.

5.3.6 Table 2 below summarises the changes in the IMB-R specification as a result of adopting slab-track with no requirement to support maintenance of a ballasted track-form.

Full IMB-R Specification	*Changes if Slab-Track Adopted*
Two 800m sidings (for high-output track renewal trains)	300m (maximum length engineering train)
750m stabling sidings (for other OTMs and engineering trains)	500m stabling sidings (for OTMs)
Facility to clean rail grinders (water, bund and concrete span)	Unchanged
Open storage area for Maintenance modules	Unchanged
Two-road plant workshop (80m x 30m)	Unchanged

Full IMB-R Specification	*Changes if Slab-Track Adopted*
100m double-ended siding (refuelling and cleaning) plus vehicle jacking platform	Unchanged
Administration and welfare building (50m x 50m ground area)	Unchanged (further details required to understand reduction in maintenance staff)
Turnout storage and build-up area (150m x 20m)	Turnout storage area (150m x 10m)
Open storage area for 1,200tonnes ballast plus 1,200 tonnes spoil	Not required
Open storage area for Rail Systems components (100m x 20m)	Unchanged (although items stored will change, e.g. slab units instead of sleepers)
Open storage area for Civils components (50m x 20m)	Unchanged
Covered storage areas for communications, train control, mechanical and electrical plus power components (50m x 50m)	Unchanged
Connections to Network Rail	Unchanged
Road connections (major road network)	Unchanged

Table 2 – Revised IMB-R Specification for Slab-Track

5.3.7 Note that the specifications in Table 2 do not include a requirement for a siding to stable a failed service train that had been recessed within the loop associated with the IMB-R (see Clause 3.5.3).

5.3.8 This requirement can be addressed by retaining an additional 400m siding from the construction railhead if a dedicated facility is required for this purpose.

5.3.9 The use of slab-track will not have an impact on the location of the maintenance facilities. OTMs and engineering trains will still need to transit to all the same locations to undertake maintenance work, such as inspecting the Overhead Contact System (OCS) and grinding rails.

5.4 Impact on Phase 2a

5.4.1 Construction of Phase 2a using slab-track will enable the revised IMB-R specification indicated in Table 2 above to be broadly adopted for the selected site.

5.4.2 It is currently envisaged that the high-output track renewal trains will still be required to renew the ballasted sections of Phase 2b (West) identified in Clause 5.1.3. As such, the requirement for an 800m long siding will need to be retained unless sufficient suitable locations on NRCI can be identified to support future HS2 renewal requirements.

5.4.3 Construction of Phase 2a in slab-track rather than using a ballasted form has no significant impact on relative advantages of each of the proposed IMB-R sites.

5.5 Impact on Phase 2a of Phase 2b (West) Using Slab-Track

5.5.1 Constructing all Phase 2b (West) leg using a slab track-form will remove the need for 800m sidings at the IMB-R on Phase 2a (see Clause 5.4.2) and as part of the maintenance facility at Crewe North RSD.

5.5.2 The revised functional requirement for the facility at Crewe North RSD is envisaged to require two sidings:

- A siding with a minimum length of 300m (able to accommodate a long-welded rail train with locomotives and chute wagons at both ends); and
- Additional siding capacity (preferably configured as a second siding) with a minimum length of 100m (to accommodate OTMs).

5.5.3 A maintenance facility will still be required on the spur to Manchester Piccadilly and its functional requirements are unchanged.

5.5.4 Construction of Phase 2b (West) using slab-track has no impact on the three locations identified as possible sites for a Phase 2a IMB-R.

6 Conclusions

6.1 Configuration

6.1.1 The requirements of the IMB-R specification, as set out in the "*Routewide Maintenance Facilities*" document, can be accommodated within the available footprint of all three sites. This also means that the revised specifications for a slab track-form, as set out in Table 2 , can be accommodated at all three sites.

6.1.2 Site constraints at Stone and Crewe (Basford Hall) mean that high-output renewal trains will need to be stabled in two sections within the IMB-R and the train then assembled prior to departure. This is not a significant issue as train assembly can be achieved prior to the start of the maintenance periods with the provision of suitable safe areas.

6.1.3 The locations of the available areas at Aldersey's Rough and Crewe (Basford Hall) relative to the HS2 infrastructure means that there will need to be additional dedicated sections of infrastructure to gain access to the IMB-Rs. These will require monitoring and maintenance.

6.1.4 The local topography at Stone and Aldersey's Rough results in a number of changes in level and significant gradients. The impact of these on starting and stopping vehicles will need to be considered during development of an Operational Concept for the site.

6.1.5 Connections to NRCI and the major road network are available at each of the three sites.

6.1.6 No concerns have been identified with respect to the minimum site working time of 3 hours if the IMB-R is located at either Aldersey's Rough or Stone. One of the alternative approaches described in sub-section 4.3 will be required if the IMB-R is located at Crewe (Basford Hall).

6.1.7 At this stage, no constraints on site working times have been identified due to the envisaged number of trains that are required per shift and the anticipated departure headways for any of the proposed IMB-R sites.

6.1.8 No impact has been identified at this stage on potential Phase 2b (West) maintenance facility sites as a consequence of any of the Phase 2a options.

6.2 Impact of Slab-Track

6.2.1 From a maintenance perspective, it is not envisaged that constructing Phase 2b (West) using a slab-track form throughout will impact on either the number or location of maintenance facilities.

6.2.2 An increase in the use of slab-track will enable the size of the IMB-Rs to be reduced.

6.3 Summary

6.3.1 Three potential sites for maintenance facilities have been identified on Phase 2a:

- Stone;
- Aldersey's Rough; and
- Crewe (Basford Hall).

6.3.2 No significant differences have been identified between the potential sites in terms of safety of operations. This will require reassessing as the final site layouts are developed.

6.3.3 None of the proposed sites are either completely eliminated or selected in preference to the others on the basis of this assessment.

6.3.4 Table 3 below provides a comparison summary of the three potential IMB-R sites, using Stone as the reference base.

Criteria	*Stone (Reference)*	*Aldersey's Rough*	*Crewe (Basford Hall)*
Available footprint	Yes	Yes	Yes
Fit 800m sidings	No	Yes	No
Dedicated infrastructure required to access site	Adjacent to trace	Connection required	Connection required
Site topography	Consider within Operational Concept	Consider within Operational Concept	No gradients
Connections to Network Rail	Available (via NBS)	Available (via WCML Slows)	Available (via Independents)
Connections to road network	Available (via M6 connection)	Available (via M6 connection)	Available (via A500 connection)

Criteria	*Stone (Reference)*	*Aldersey's Rough*	*Crewe (Basford Hall)*
Reduction of site working time below 3 hours	Within acceptable limits	Within acceptable limits	Alternative approach required
Departure headways	No constraint identified	No constraint identified	No constraint identified
Slab-track	Reduced footprint	Reduced footprint	Reduced footprint

Table 3 – Summary Comparison Table

6.3.5 The following criteria may impact on selection of the best site but are outside the scope of this Technical Note:

- Relative environmental impact of each location;
- Impact on construction and logistics of each proposed location;
- Impact on operations of each proposed location (i.e. operational requirements for loops and perturbation crossovers); and
- Relative costs of each facility.

6.3.6 A number of potential operational solutions have been identified (see sub-section 4.3) that will extend the on-site working time, but they will reduce the flexibility to react to future constraints on maintenance delivery due to changes in commercial operations.

7 References

1	Phase 2a C862 Route Diagram	C862-PBR-RT-DSC-000-000001
2	HS2 Phase 2b Route Diagram Manchester Leg	2RS02-WSP-RT-DSC-M000-000001
3	HS2 Asset Management Delivery Strategy (not yet issued)	HS2-PBR-MN-STR-000-000001
4	Route Wide Maintenance Facilities	HS2-PBR-MN-REP-000-000001
5	House of Commons Briefing Paper: High Speed 2 (HS2) Phases 2a, 2b and beyond	CBP07082
6	Aldersey's Rough Railhead and IMB-R Option 4	C862-PBR-CL-DPL-000-000052
7	Crewe Railhead and IMB-R Option 1	C862-PBR-CL-DPL-WS08-000002
8	Stone IMB-R (Infrastructure Maintenance Base – Rail Connected)	C862-PBR-CL-DPL-WS04-000015
9	Phase 2a C862 Design to Cost – Review of Maintenance Facilities	C862-PBR-MN-REP-000-000001
10	Phase 2A C862 Strategic Evaluation of Railhead and IMB-R Locations – Post CP3 Design	C862-PBR-CL-REP-000-000034

Appendix I – Aldersey's Rough Design Iteration Process

Phase 2A C862 Aldersey's Rough Railhead/IMB-R Technical Note

Document no: C862-PBR-CL-REP-000-000034 (Appendix)

MDL Ref: K560

Revision	Date	Author	Checked by	Approved by	Revision Details:
P01	01/09/2017	KP	AS	DC	Initial Preliminary Design – for acceptance

PHASE 2A C862 ALDERSEY'S ROUGH RAILHEAD/IMB-R TECHNICAL NOTE

C862-PBR-CL-XXX-000-0000XX

Revision	Date	Author	Checker	Approver	Description
P01	01/09/2017	Konstantinos Paraskevas	Andrew Spence	David Carter	Initial Preliminary Design – for acceptance

Contents

1 Aldersey's Rough Railhead and IMB-R Design Development

1.1 Design requirements

1.1.1 The Aldersey's Rough Railhead/IMB-R design development followed an iteration process which is detailed below.

1.1.2 The main functional requirements for the Railhead/IMB-R layout are:

- The layout should be located at the southeast quadrant of the WCML/Silverdale Railway crossing
- The layout will make use of the disused Silverdale Railway
- Access to the WCML will be required on both directions and will be provided by using a connection to the Slow lines
- Access to the HS2 mainlines in both directions, directly from IMB-R (without travelling on NR infrastructure)

1.2 Option 1 and Option 2

1.2.1 The first two attempts in developing a layout which would meet the above requirements resulted in sub-standard geometric values at the connection with HS2. These designs were called Option 1 and Option 2 and they were rejected from an engineering point of view.

1.3 Option 3

1.3.1 The next design addressed the sub-standard values issue by introducing a reception siding / headshunt line parallel to the HS2 Up Line. This design is called Option 3 (image 1). The complete drawing title is: Aldersey's Rough Railhead and IMBR Option 3 (C862-PBR-CL-DPL-000-000051).

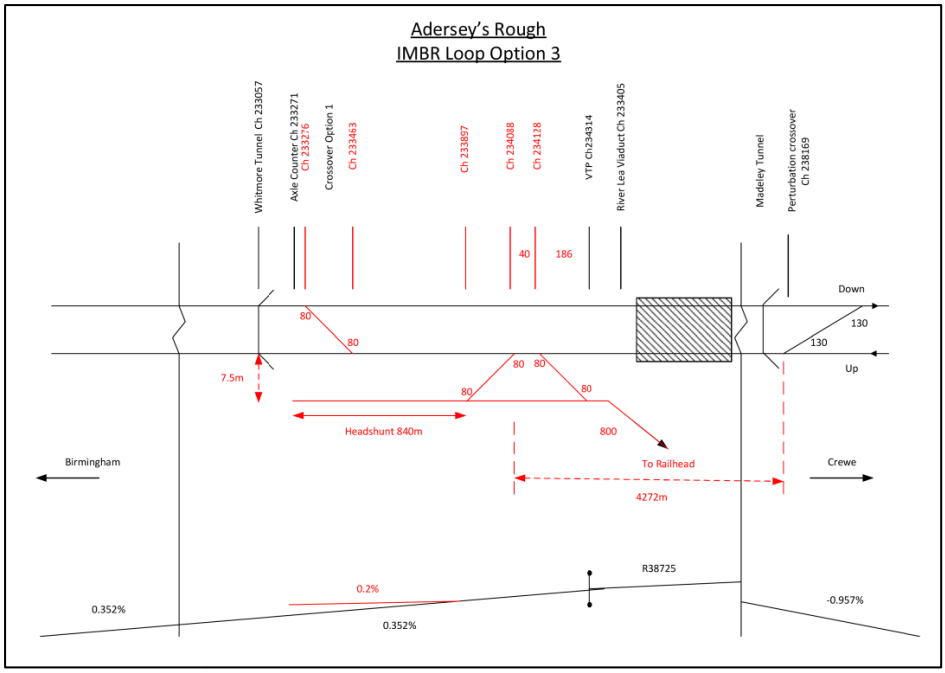

Image 1: Aldersey's Rough Option 3 high level schematic

1.3.2 This reception siding / headshunt connects to the HS2 Up Line with two 80kph crossovers. These crossovers allow trains to enter and exit the Railhead/IMB-R from the HS2 Up Line from both directions.

1.3.3 Trains travelling northwards on the HS2 Down Line can use the new 80kph crossover located just north of the Whitmore Heath Tunnel to cross over to the HS2 Up Line and then into the reception siding.

1.3.4 Trains leaving the headshunt heading North, can cross over to the HS2 Up Line using the 80kph crossover and then cross over to the HS2 Down Line using a 130kph crossover just north of the Madeley Tunnel. (The HS2 mainline geometry inhibits the crossover being closer to the headshunt connection. Passive provision for a crossover in this area is included in the hB design.)

1.3.5 The headshunt line needs to be 840m long clear of the last crossover toes to accommodate a 800m train heading to the north. Sidings where trains may be parked must be <0.2% gradient. The 840m length combined with the 0.2% gradient results in the headshunt track being approximately 1.2m higher than the adjacent HS2 Up Line.

1.3.6 This level difference requires the installation of a retaining wall between the two tracks. However in that case the track interval (between the centrelines) should be increased from 7.5m to 13.5m. This increase would impact the length of the crossovers from the HS2 Up Line to the headshunt, thus reducing the available length before the Whitmore Heath tunnel portal.

1.3.7 Therefore, the headshunt gradient increased from 0.2% to 0.352% (parallel to the HS2 alignment) which removes the need for the retaining wall,

meaning the tracks can remain at 7.5m apart. However, this gradient increase means that trains would not be able to park here according to the TSI/TAD (a departure would be needed for trains to park here).

1.3.8 This solution requires the existing retaining wall at the Whitmore Heath tunnel portal to move to the east by 12 metres which impacts the adjacent ancient woodland.

1.3.9 Moving on to the layout of the Railhead and IMB-R, a run-around loop was introduced in order to minimise the amount of required works on the disused Silverdale railway and at the same time simplifying the operability of the Railhead/IMB-R.

1.3.10 There has been a number of iterations to the design in order to avoid the Aldersey's Rough woodland and avoid farm demolitions. Although the majority of the Aldersey's Rough woodland was avoided, the Bromley Green Farm needs to be demolished in this option.

1.3.11 Finally, the Railhead/IMB-R is connected to the reception siding / headshunt by a raised track which runs parallel to the disused Silverdale railway at an elevation approximately 10m higher than the disused Silverdale railway. The higher elevation is required due to the elevation of the HS2 main lines in this area. This track needs to be rising in order to meet the HS2 main lines alignment. Also, this track will be located on an embankment which affects the Hey Sprink Ancient Woodland.

1.3.12 A high level earthworks assessment of this option estimated the required amount of cut to be 3.5milliom m^3. This amount of earthworks would create serious construction programme challenges and transport logistics issues, which would very likely delay the completion of the HS2 earthworks and therefore delay the delivery of HS2 Phase 2A.

1.3.13 For all the reasons detailed above, different options were explored which tried to minimise the issues identified with Option 3.

1.4 Option 4

1.4.1 The next option was developed in order to minimise the impact of the Railhead/IMB-R on the Aldersey's Rough woodland and avoid the demolition of Bromley Green Farm. The complete drawing title is: Aldersey's Rough Railhead and IMBR Option 4 (C862-PBR-CL-DPL-000-000052).

1.4.2 This design has the same functionality as with the Option 3 layout. It comprises the same connections to the WCML and HS2 mainline using the same headshunt and reception lines.

1.4.3 However, Option 4 has a different layout orientation which avoids both the Aldersey's Rough woodland and the Bromley Green Farm. However, it occupies more agricultural land and it crosses more watercourses.

1.4.4 Option 4 reduces the amount of required earthworks by approximately 0.5million m^3. However, the remaining earthworks would still create construction programme challenges –especially with the mass haul strategy– and which would likely delay the completion of the earthworks and therefore delay the delivery of HS2 Phase 2A.

1.4.5 The issues identified with Option 4 were considered to be significant, and a further option was explored in order to minimise the required earthworks.

1.5 Option 5

1.5.1 Further to the challenges above, a new design was developed with the main targets of minimising the negative environmental impacts and earthwork quantities.

1.5.2 The complete drawing title is: Aldersey's Rough Railhead and IMBR Option 5 (C862-PBR-CL-DPL-000-000054).

1.5.3 The functionality of this layout is different from the previous two Options with the main differences being:

- The introduction of a third reception siding on the western section of the Silverdale Railway (west of the WCML)
- The introduction of headshunt lines parallel to the Silverdale Railway between Hey Sprink ancient woodland and Aldersey's Rough woodland
- The removal of the loop at the Railhead/IMB-R

1.5.4 These changes increase the operational complexity of the Railhead/IMB-R, since the layout introduces more shunting train movements. These movements are minimised by the introduction of fixed diamond crossings at key areas. However these crossings are a non-preferred S&C layout. The construction risk is negated by the fact that the layout is compact and comprises many parallel lines which improves the construction sequence.

1.5.5 The earthworks for this layout are minimised since the material required is approximately 0.2million m^3 of fill. This reduces the environmental impacts, transport logistics and cost.

1.5.6 The new layout crosses less watercourses than Option 3 and Option 4, which simplifies the drainage design.

1.5.7 The impacts on the ancient woodland areas are similar to Option 3. However, the required land is less than Option 3 and Option 4 and it does not require any farm demolition.

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