High Speed Rail: Phase 2b Preferred Route

# Sustainability Statement including Post Consultation Update

## Appendix B - AoS Process, Alternatives and Supporting Documents

A report by Temple-RSK for HS2 Ltd

TEMPLE

LEADERS IN ENVIRONMENT, PLANNING & SUSTAINABILITY.

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# 1. APPENDIX B-1: THE APPRAISAL OF SUSTAINABILITY METHOD

## 1.1. The role of the AoS

1.1.1. The Appraisal of Sustainability (AoS) process was devised by Temple Group, in conjunction with HS2 Ltd and in consultation with Government departments and statutory agencies, as a way of appraising how HS2 would support or conflict with objectives for sustainable development. The AoS approach was first established in 2009 to assist the appraisal and development of the Phase One proposals. Its use has continued during the evolution of the Phase Two scheme. Throughout this time the AoS formed a key part of the sifting process, helping to:

- Advise engineers and HS2 Ltd during scheme design of particular sustainability constraints and opportunities;
- Inform the engineers in refining scheme proposals to avoid or lessen potential adverse effects;
- Advise HS2 Ltd at key decision stages of the relative sustainability advantages and disadvantages of different options, and the consequence of potential impacts; and
- Formally report the sustainability impacts of the options at each stage.

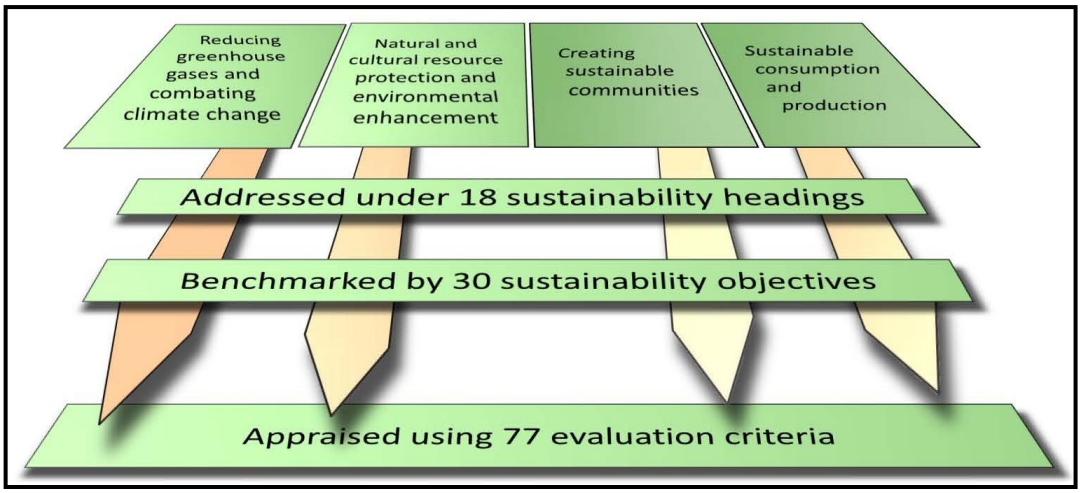
## 1.2. The AoS framework

1.2.1. The factors used by the AoS to appraise the impacts of the scheme options are captured within the AoS framework. Use of the AoS framework has helped to ensure a uniform and consistent approach to appraising each option at each successive sift.

1.2.2. The AoS is founded on four overarching sustainability priorities. These derive from government priorities that were set out within the 2005 UK Sustainable Development Strategy: *Securing the Future*[1]. Beneath these priorities sit the 18 sustainability topics, covering matters such as noise and vibration, flood risk, greenhouse gases and resource use. Each topic is benchmarked by one or more of 30 sustainability objectives. 77 evaluation criteria are then used to determine scheme performance against these objectives. This 'appraisal cascade' is illustrated in **Figure B1-1**.

[1] HM Government (2005). UK Sustainable Development Strategy: Securing the Future, TSO

**Figure B1-1 – The appraisal cascade**

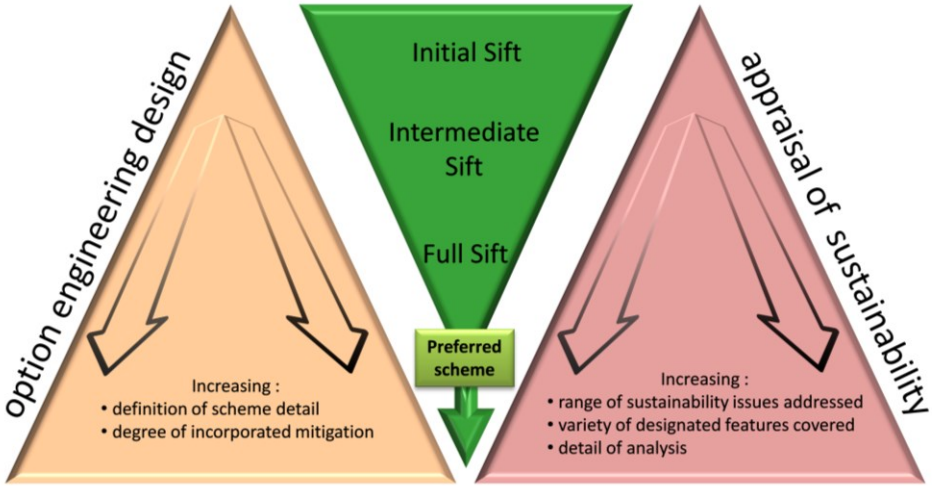



## 1.3. Support to option sifting

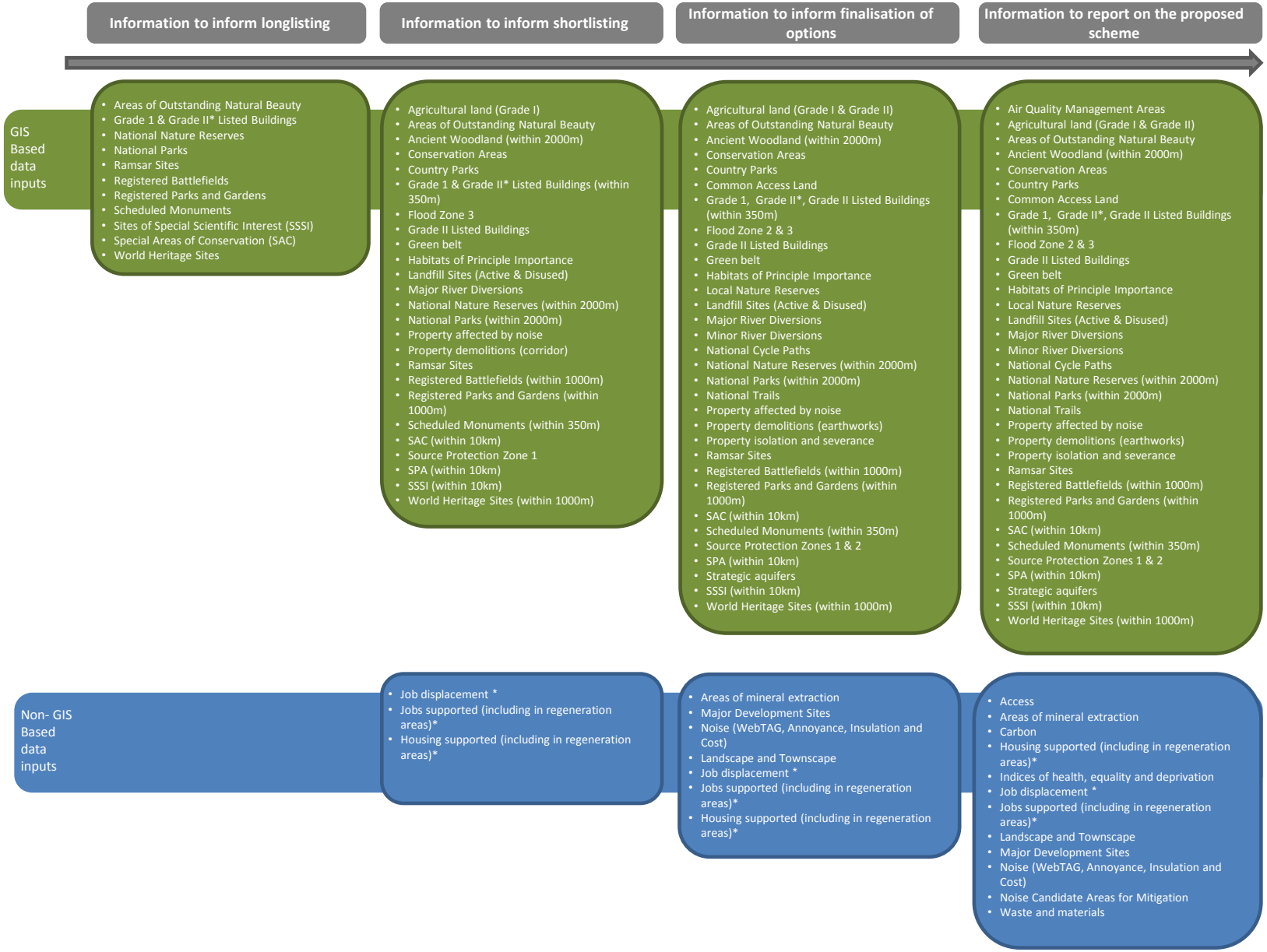
1.3.1. The approach to determining and appraising the many possible routes, stations and depots for Phase Two followed that used for Phase One, where a sequence of sifts reduced the number of options being considered. As illustrated in **Figure B1-2,** this was accompanied by a corresponding increase in both the detail of option design and the depth of appraisal at each stage of sifting. For the AoS this meant a sequential increase in the range of sustainability issues and environmental designations that were considered, and an increase in the depth of analysis.

1.3.2. In general, this three stage process started with consideration of major environmental features (essentially international and national designations) at the initial sift (sift 1), through to more detailed geographical analysis at the intermediate sift (sift 2), and specialist review at the most detailed appraisal during the full sift (sift 3). At this last stage, the options were designed to include earthworks, as well as horizontal and vertical profiles showing approximate rail heights in comparison to ground level. In some cases, where differences between refinement options were minor, a greater level of detail was considered at a comparatively earlier stage in the process to help differentiate between options. This process is illustrated in **Figure B1-2** and **Figure B1-3**.

**Figure B1-2 – As options reduce, engineering and appraisal detail increases**



## Figure B1-3 – Increasing range of sustainability information at each sift



1.3.3. At the smaller individual route option and route refinement scale, the emphasis of the AoS appraisal focus was on those sustainability aspects most helpful in differentiating one option from another – those more concerned with the potential physical impacts of the proposals on, say, ecology or property. The AoS scope expanded to cover the route-wide issues; for example, its carbon footprint and wider economic impact. These route-wide issues were considered once this initial stage of design of the preferred route was completed.

## 1.4. Route appraisal tools

1.4.1. The AoS framework provided the conceptual basis for the appraisal which has been adopted and built upon since inception in 2009. The practical challenge of implementing a consistent and sufficiently detailed appraisal and comparison of many options over a relatively short period necessitated a bespoke approach.

1.4.2. Changes in approach to transport scheme appraisal over the life of AoS (e.g. updates to the Department for Transport's Transport Analysis Guidance, TAG) have required minor refinements to the AoS methodology to ensure the scheme is appraised in line with current guidelines whilst maintaining an overall consistency of approach. Equally, updates to datasets considered in the appraisal of options have needed to be accommodated in the AoS to ensure reliance on the best available data is maintained. Where such changes have been made, these are described in the relevant section of the Sustainability Statement.

1.4.3. Drawing on the evaluation criteria and topics within the AoS framework, a GIS based approach was used to combine data capture with a powerful route comparison function. This data set was provided by HS2 Ltd in 2014 and has been consistently applied since then. This drew on mapped data to collate information on different sustainability features potentially affected by a route or station option within a given area. It then compiled and assimilated this data in a single place, allowing interrogation of key sustainability issues for a specific part or parts of the scheme.

1.4.4. A standardised output then enabled the AoS team to examine sustainability data and provide an overview of the impacts of particular route sections for each of the sustainability topics.

1.4.5. This unique approach provided efficiency and consistency to the AoS by:

- Producing standardised outputs for each route section at each sift;
- Minimising manual processing therefore reducing the margin for human error associated with data input and processing;
- Enabling a tiered approach to appraisal at each sift, with the process and detail of outputs at each stage building on those from the previous one; and
- Providing a transparent and traceable method of informing the decision-making process, clearly documenting the AoS process and outcomes in a way that allows easy comparison of options.

1.4.6. Having captured impact information within the appraisal templates, the AoS team evaluated each relevant criterion of the AoS framework. Key impacts were summarised within the template, allowing a consolidated view on the overall sustainability performance of the option in question. This appraisal information, together with inputs from the engineering and cost teams was then presented to the HS2 Ltd Change Board for evaluation and selection of preferred route options.

## 1.5. Managing adverse impacts

1.5.1. As well as establishing certain design principles and supporting the options sifting process, the AoS has enabled a number of potentially adverse effects to be avoided or reduced through mitigation. In the earliest sifts, this took place through rejection of potentially more adverse options. At the full sift stage with greater detailed design, mitigation focused on making changes to the alignments of the options that remained.

1.5.2. As part of the sifting process and with close collaboration with the engineering design teams, options were reviewed to identify where there were opportunities to incorporate mitigation into route section design. Examples include reducing the width of the rail corridor within sensitive environments to minimise landtake, or lowering it in cutting to reduce visual and noise impacts. The route options that make up the preferred route for both eastern and western legs have therefore incorporated a number of refinements that have evolved through the appraisal process, starting as far back as 2010.

1.5.3. The proposed scheme that was presented for public consultation at a series of events from July 2013 to January 2014 had already incorporated a number of refinements, following the publication of the Engineering Options Report: West Midlands to Manchester (2012)[2] and the Initial Preferred Route in January 2013. The AoS process assisted these refinements by providing a definitive view on their relative sustainability implications.

1.5.4. One particular focus of early mitigation work affecting both the proposed scheme (2013) and the subsequent preferred route was the introduction of preliminary noise mitigation. The noise appraisal team identified locations along the route where additional mitigation could be included to reduce the potential severity and number of noise impacts. These 'candidate areas for mitigation' took account of clusters of dwellings impacted in any one area and determined the likely effectiveness of potential mitigation measures, particularly trackside noise barriers. The noise impacts reported in the Phase 2b Preferred Route Sustainability Statement including Post Consultation Update (2016) Volume 1 assume this mitigation is in place for these candidate areas.

1.5.5. Following consultation, route refinements have built upon feedback received during the consultation process to better understand local and strategic issues and concerns. These were then reviewed by the AoS team (including individual sustainability topic specialists) and engineers and, where practicable alongside engineering and cost considerations, the alignments were revised to avoid or reduce potential adverse effects.

1.5.6. In addition, building on lessons learned from Phase One, a series of small design updates were included which reflected on-going initiatives to improve the technical performance of the design, as well as deliver cost efficiencies. This was particularly applicable to improving how the scheme design interacted with the Water Framework Directive (WFD) and drove a number of improvements in the design of watercourse crossings.

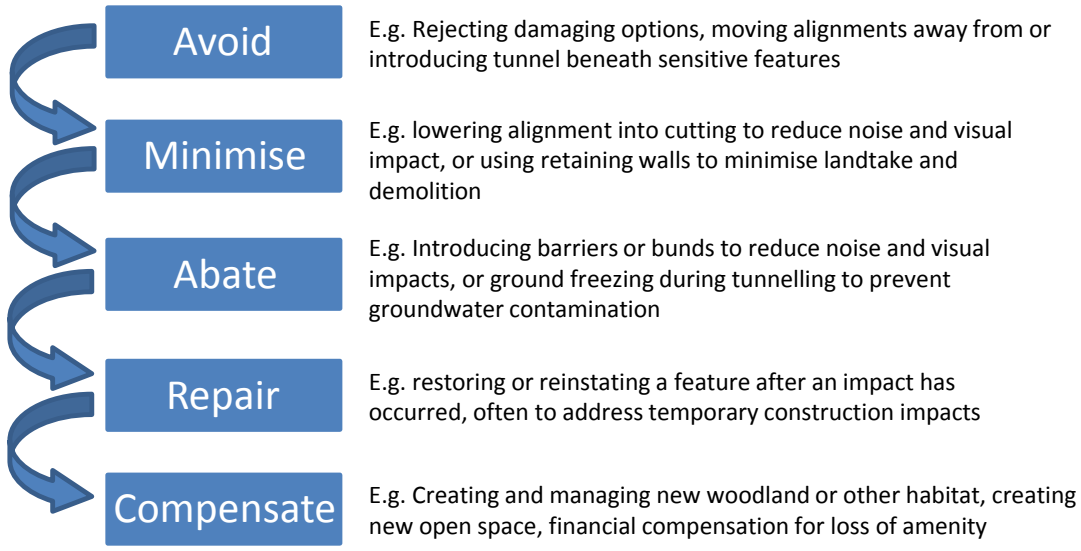
1.5.7. The AoS will continue to support any further investigation of possible scheme variations and mitigation opportunities up to the point that Government confirms its preferred route, which would then be subject to an Environmental Impact Assessment (EIA).

1.5.8. The way that mitigation is introduced therefore follows a hierarchy. As scheme design develops in detail, the opportunity to change the alignment lessens and

[2] Mott Macdonald Scott Wilson Grimshaw (2012). Engineering Options Report: West Midlands to Manchester

alternative mitigation strategies become appropriate. In the future, with a design largely fixed, mitigation might best be achieved by providing compensation for an adverse impact that is otherwise deemed unavoidable. This sequence of mitigation options is illustrated in **Figure B1-4**. In developing potential route alignments to support a route decision, the focus is on the top level of this hierarchy – seeking to avoid, where feasible, direct impacts on communities and key environmental features. The primary aim being to aid the selection of the best possible corridor for the railway given the obvious impacts of delivering new infrastructure.

**Figure B1-4 – The mitigation hierarchy**




1.5.9. HS2 Ltd will also consider opportunities for environmental enhancement. For example, the railway could present opportunities to reinforce and enhance biodiversity, providing a green corridor to be colonised by plants and animals, and linking with and forming connections between existing habitats. It could provide opportunities for urban regeneration and townscape improvement by enhancing or stimulating wider master planning initiatives. There may also be occasions where noise mitigation introduced as part of the railway design could bring about wider benefits by screening other existing sources of noise, such as major roads and motorways.

1.5.10. The kinds of mitigation that could be applied during the EIA can be seen through the EIA work on Phase One and Phase 2a, as directed by HS2's Sustainability Policy. These principles are set out within Section 6 of Volume 1 of the Phase One Environmental Statement and Volume 1 of the Phase 2a Working Draft Environmental Impact Assessment Report. This describes the range of measures and policies that was considered as the Phase One preferred route design developed. These measures are principally of three types:

- mitigation that is provided through the planning and design of the preferred scheme, such as through variation in horizontal and vertical alignment, or use of bridges, tunnels and retained cuttings;
- mitigation that requires physical features, such as noise barriers, landscaped mitigation or balancing ponds; and
- mitigation that comprises further measures or policies to address specific topics, which are set out for each topic in Volume 1 of the Phase One ES.

1.5.11. **Figure B1-5** illustrates how mitigation is considered as scheme design develops in

detail.

**Figure B1-5 – Consideration of mitigation through the design process**

| | Initial Sift | Intermediate Sift | Full Sift | |
|---|---|---|---|---|
| Design detail used for AoS (routes) | Plans showing simple vertical and horizontal alignments, allowing differentiation of surface or tunnel. | Plans showing vertical and horizontal alignments, allowing differentiation of surface, viaduct, cutting, embankment or tunnel. | Plans showing vertical and horizontal alignments, allowing differentiation of surface, viaduct, tunnel, cutting, embankment, cut and cover tunnel and green tunnel (finalisation stage only).<br>Additional vertical profile information defined the height of the route option relative to ground level. | |
| Design detail used for AoS (stations) | Plans showing footprints for station and station throats for Manchester and Leeds termini and East Midlands and South Yorkshire station options.<br>Manchester interchange station options considered at long listing stage only and shown only as a station box with no throat. | | Plans showing the operational boundary for the station and station throats, but distinguishing platforms, concourse, station carpark and forecourt.<br>Plans showing the extent of four tracking required for through-stations.<br>Plans showing enabling and associated works.<br>Design information on the possible future appearance of the station.<br>A construction boundary was also identified that defined a provisional footprint needed to accommodate worksites and temporary and permanent works. | |
| Sustainability factors considered | See **Figure B1-3** | | | |
| Appraisal team | Core team (including planning and socioeconomic specialists) interpreting available mapped information against AoS framework criteria. | | Core team undertaking initial appraisal, with verification and additional appraisal by sustainability specialists. | |
| On site appraisal | None | Stations only, to validate and refine predicted townscape and cultural heritage impacts and to undertake a land use survey of station footprints. | Stations and environmental 'hot spot locations' visited by relevant sustainability specialists to augment appraisal by GIS.<br>Stations land-use surveys conducted to validate demolition counts. | |
| Mitigation | During the sifting of options, mitigation has only been considered through the advice to HS2 Ltd in the context of the relative advantages and disadvantages of different options, thereby supporting decisions to progress certain options over others.<br>This also resulted in new options being developed to resolve sustainability and engineering challenges. | | | Mitigation incorporated into options that emerged from the option refinement stage, to address specific impacts.<br>Mitigation through adjustment to vertical and/or horizontal alignment, and introduction of tunnels and green tunnels. |

# 2. APPENDIX B-2: HS2 PHASE TWO ALTERNATIVES

## 2.1. Summary

2.1.1. This appendix outlines the alternatives considered in reaching the proposed scheme that was announced in 2013. It reflects on the decisions to promote the Y network, the development of Phase Two options between October 2010 and March 2012, the identification of an initial preferred route in January 2013, and the emergence of the proposed scheme for consultation that was the subject of the Sustainability Statement (2013)[3].

2.1.2. Since the publication of the Sustainability Statement in July 2013 and the period of consultation that followed, the Phase Two route has further evolved. In March 2014, Sir David Higgins (HS2 Ltd Chairman) recommended bringing forward development of the Phase Two route from the West Midlands to Crewe (Phase 2a). Building on this recommendation, an updated Sustainability Report was published documenting the post-consultation changes to this section of route in November 2015. Changes made to the rest of Phase Two (Phase 2b), which comprises the section from Crewe to Manchester, and the West Midlands to Leeds, are the subject of the Phase 2b Sustainability Statement including Post Consultation Update.

2.1.3. Strategic alternatives to high speed rail have been considered and included existing rail enhancement options and improving highways. Overall, Government considered that a new high speed railway line would provide the greatest capacity increase and connectivity benefits and that a Y-shaped network extending to Manchester and Leeds was preferred based on the economic and business case.

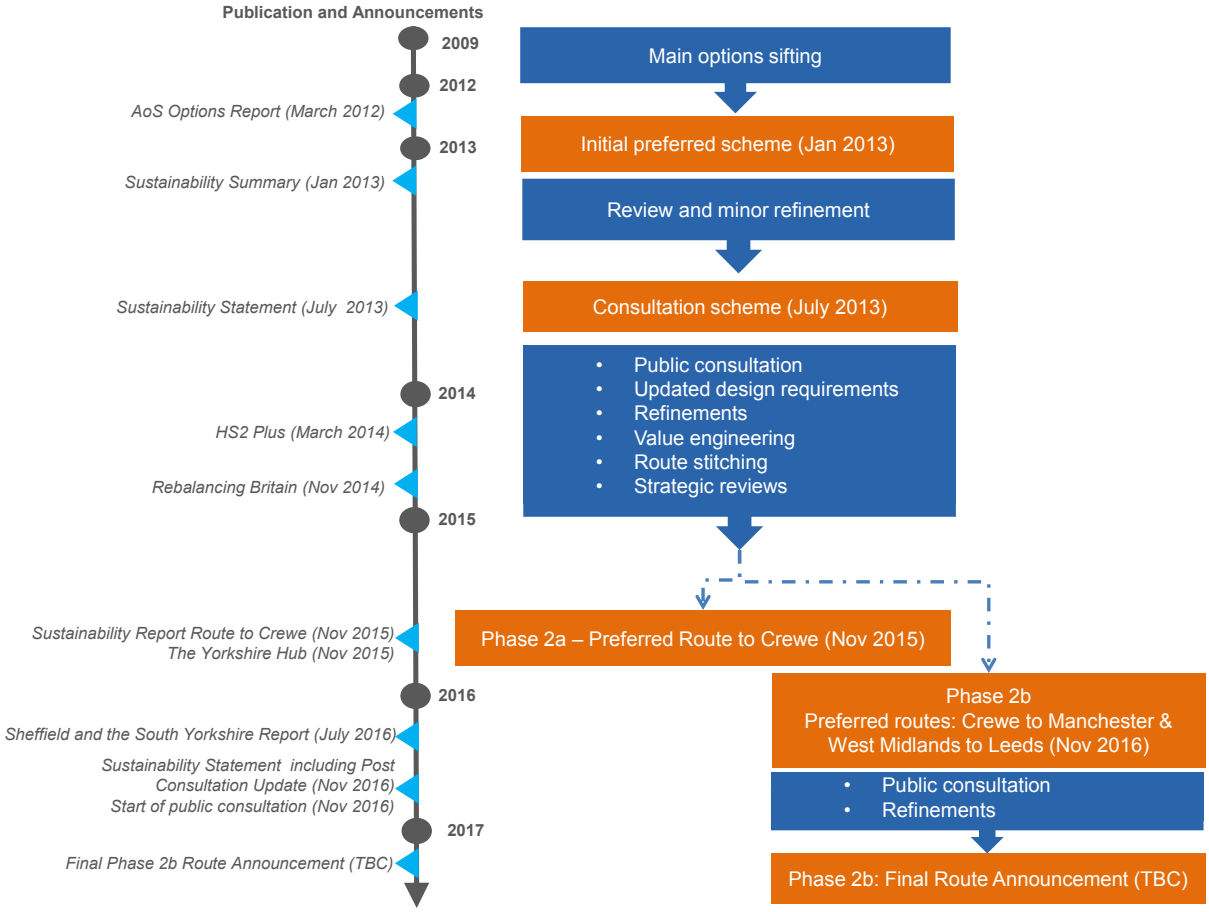
2.1.4. At the time of publication of the Sustainability Statement in 2013, in excess of 1,000 route sections (over 16,000 km of route) had been sifted, and over 250 potential station and depot locations reviewed. Since then, further route sections have been appraised as part of the post consultation refinements process, covering an additional 9,000 km of possible options and several depot and station alternatives.

2.1.5. The approach to determining and appraising the many possible routes for Phase Two followed that used for Phase One, where a sequence of sifts reduced the number of options being considered. As a result of this process, and of additional scheme refinements, proposed single routes to Manchester and Leeds, connections to the existing rail network, and the selected stations and depots along each route lead to the identification of an initial preferred route, and later a proposed scheme for consultation in 2013.

2.1.6. The following diagram summarises the process to date in the evolution of the Phase Two route to that presented as part of the Phase 2b Sustainability Statement including Post Consultation Update (2016), along with the key outputs and announcements along the way.

[3] Temple-ERM (2013). High Speed Rail: Consultation on the route from the West Midlands to Manchester, Leeds and beyond. Sustainability Statement

**Figure B2-1 Phase Two Route Development Timeline**




## 2.2. HS2 Strategic Alternatives

2.2.1. The following section provides an overview of strategic alternatives to HS2. The *HS2 Phase 2a: West Midlands to Crewe, working draft environment impact assessment report, volume 1 appendix: alternatives report*[4] provides further detail on the alternatives, as well as the *Strategic Alternatives to HS2 Phase 2b* report produced by Atkins that will be released as part of the Phase 2b announcement. The *Strategic Alternatives to HS2 Phase 2b* summarises that there is no alternative that could deliver the same level of benefit for the country, stand the test of time and provide the same level of capacity, connectivity and service that Phase 2b does in pursuit of strategic objectives.

### Do Nothing

2.2.2. The Government has summed up its position in the 2013 Strategic Case for HS2, "*… not providing for growing demand would not fit with the Government's objectives for economic growth and could significantly constrain the UK's economic potential. Nor is it consistent with the 2011 National Infrastructure Plan's aim 'to improve connectivity and capacity between main urban areas and between them and international gateways, to deal with longer term capacity constraints..'. We do not believe it is tenable to do nothing. In addition to the negative economic effects, there would be severe individual impacts either crowding people off the*

[4] HS2 Ltd (2016) HS2 Phase 2a (West Midlands to Crew) Working Draft Environmental Impact Assessment Report Volume 1 appendix: Alternatives Report

*network, or allowing the experience to become so unpleasant that people choose not to travel*."[5]

2.2.3. The Government also ruled out using fares to constrain demand, *"to suppress demand across the network would therefore involve very significant and highly undesirable price rises. It would also not improve connectivity, our other key objective. It would have serious consequences for economic productivity and growth."*

2.2.4. Key developments since the publication of the 2013 Strategic Case for HS2 include continuing growth in rail demand, as indicated in the Supplement to the Strategic Case[6], "*since the Strategic Case was published, demand for rail travel has continued to grow at a rate that is well above the long term forecast that underpins DfT's Economic Case for HS2. From 2013 to 2015 (years ending 31 March), the number of rail journeys in Great Britain grew by 10.2 per cent from 1,501 million to 1,654 million. This is an annual growth rate of 5 per cent – more than double the growth of around 2 per cent assumed in the Economic Case for HS2*."

2.2.5. There has also been increased focus, since publication of the October 2013 Strategic Case, on the role of high quality transport infrastructure in improving productivity and therefore the potential of HS2 to help rebalance the economy. A 2014 study for the DfT[7] found that transport investments can deliver economic benefits over and above conventionally measured benefits to transport users because, "*(a) Transport fosters intense economic interaction that raises productivity; this can occur in clusters within narrowly defined areas or more widely by linking areas. (b) Transport shapes the level and location of private investment, potentially leading to higher levels of economic activity in some areas."*

2.2.6. The Supplement to the 2013 Strategic Case for HS2 concludes that, *"…HS2 is critical for Britain's future. It gives the capacity that is needed urgently to keep pace with demand on our most strategically important rail corridors, and it provides the high quality connectivity that will allow the economies of our major cities, particularly those outside of London, to thrive. In doing so, HS2 can contribute to the rebalancing of the national economy and the emergence of a new Northern Powerhouse."*

### Alternative modes – air of road travel

2.2.7. Having decided to focus on the congested networks, inter-city travel and access to international gateways, the 2005-2010 Government considered how best to plan to serve the growing demand. In Britain the most populous and economically significant corridors are from London to the West Midlands and the North West, and to the cities in the East Midlands and South and West Yorkshire. At its southern end, central London, Heathrow and HS1 are key destinations, but there is a wider choice of cities to serve in the Midlands and the North.

2.2.8. Rail is the obvious mode to serve the long distance market between city centres because it can provide fast and reliable journeys between cities and high capacity access into the centres without requiring wide roads or extensive car parking close to final destinations. However, before drawing any definite conclusions, the Government considered all the generic options for different modes and for new routes and upgrades to existing networks:

[5] The Strategic Case for HS2 (2013) p.66 paras 3.2.2-3.2.3

[6] Supplement to the October 2013 Strategic Case for HS2, DfT, November 2015, p.11 para 2.1

[7] Venables, Anthony J; Laird, James; and Overman, Henry 2014, Transport Investment and Economic Performance, Paper commissioned by UK Department for Transport.

- first, how to make best use of the existing key networks; and
- second, on longer term solutions for the strategic corridors.

### Air Travel

2.2.9. In 2012 the then Government stated its desire to maintain the UK's status as an international aviation hub, but to see modal shift away from domestic air services where possible[8], not only because of the significantly lower carbon emissions per passenger kilometre, but also in order to release airport capacity at Heathrow for international services[9].

2.2.10. In March 2013 the then Government published its Aviation Policy Framework, reiterating this policy. It summarised the approach to the relationship between aviation and high speed rail, "*an important part of our approach is to enable more people to take the train, instead of air transport, for domestic and short-haul European journeys, both in order to achieve environmental benefits and to release capacity at airports. However, we recognise that there will always be a need for domestic aviation; for example, for connections to Northern Ireland and the Scottish islands and other parts of the UK not served by rail, for cross-country routes, and for express freight onward journeys.*"[10]

### New Motorways

2.2.11. In 2010, the then Government concluded that "*a viable case could not be made for major new motorways as a sustainable solution to the UK's long term inter urban transport needs*." At the time a key issue was the increase in carbon emissions attributable to the growth in car travel enabled by an entirely new motorway. However, the Government was also concerned by other aspects of sustainability including local impacts, such as landscape, air quality, noise and land take.

2.2.12. High speed rail is preferable in terms both of capacity and connectivity, especially in urban areas. It also tends to have less adverse effect on the environment and produces significantly lower carbon emissions per passenger kilometre than cars. In addition, a new motorway would incur a similar range of local impacts as a high speed line but would require more land. For all of these reasons the Government decided not to give further consideration to new motorways as an alternative to HS2. However, it did not discount the possibility that decarbonisation of road transport might alter the case for road infrastructure in the very long term, though not for city centre markets[11].

### Selective enhancement of the road network

2.2.13. The Government's current view of strategic road capacity as an alternative to HS2 is, "*the strategic road network is of vital importance and we have a policy to increase capacity. However, we do not believe that increasing road capacity alone is the solution to meeting our strategic objectives.*

[8] High Speed Rail: Investing in Britain's Future – Decisions and Next Steps (Cm.8247), DfT, January 2012, p.18 para 24

[9] High Speed Rail: Investing in Britain's Future – Decisions and Next Steps (Cm.8247), DfT, January 2012, p.80 para.4.38

[10] Aviation Policy Framework, DfT March 2013 p.38 para. 1.101

[11] High Speed Rail: Investing in Britain's Future – Decisions and Next Steps (Cm.8247), DfT, January 2012, p.45 para. 2.19

*… By 2021, spending on road enhancements will have tripled. This will counter the effects of past underinvestment, maintain the network and add some extra capacity where it is needed to ease congestion on existing motorways.*

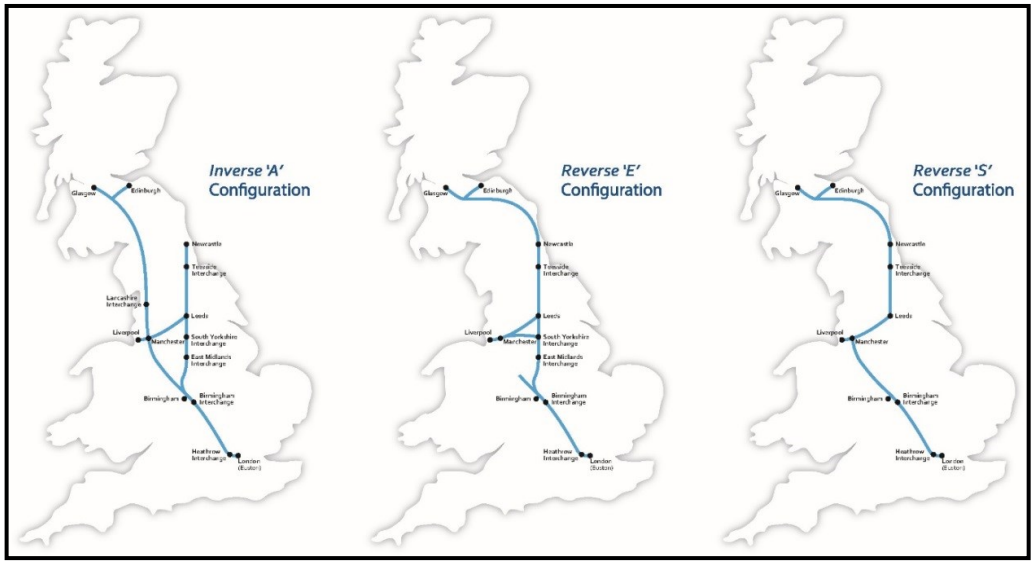
*But, these enhancements do not provide the additional capacity needed to allow roads alone to soak up the predicted increase in passenger demand. Significant as they are, they are only part of the wider transport response. To put into context the scale of road building that would be required, HS2 will deliver capacity roughly equivalent to two new dual three-lane motorways. We also know that roads are not well suited to improving connectivity between city centres, because traffic speeds are limited, or for providing additional commuter capacity into major cities, because of the traffic constraints that exist there.*"[12]

## 2.3. Route-wide Rail Alternatives

### High Speed Rail Configurations

2.3.1. Strategic alternatives to a new high speed railway included various enhancement options to the existing railway network and improvements to highways. Overall it was considered that a new railway line would provide the greatest capacity increase and connectivity benefits. The development of the core high speed network was considered in a number of configurations. As shown in Figure **B2-2**, this included options for the 'Inverse A', 'Reverse S' and 'Reverse E' shaped networks.

**Figure B2-2 – Alternative Configurations**




2.3.2. In comparison to other strategic options, a variation of the inverse A (called the Y network) was considered to offer shorter journey times to the north from most key conurbations, strong interregional connectivity and enhanced access to key international gateways from across the country. It was concluded that the Y network would provide better value for money than the alternative options considered.

2.3.3. On that basis, Government announced in 2010 its decision to proceed with the Y shaped network and this initiated a programme of work, commencing in October 2010, to identify the best route, station and depot options for this Y-formation.

[12] The Strategic Case for HS2 2013 p.67 paras 3.2.9-3.2.11

### Design Speeds

2.3.4. The following varying design speeds were considered; conventional rail speed (200kph), a higher design speed, reducing design speed locally to mitigate adverse environmental effects and alternative routes at 300kph.

2.3.5. In January 2012 the Government concluded that *"the additional benefits generated by designing a new line to accommodate high speed services, compared to the only real long term alternative of a new conventional speed line would outweigh the additional costs by a factor of more than four to one*".[13]

### Upgrading existing rail lines

2.3.6. In parallel with the evolution of the proposal for a new high speed line the Government has explored the options for upgrading the existing rail network to test whether the additional capacity and connectivity to serve long term demand could more effectively be provided through a package of enhancements to existing lines. Options for upgrading the West Coast Main Line (WCML) and the Chiltern Main Line (CML) were considered as well as scenarios for enhancement of all the main lines.

2.3.7. Following a number of studies, over a number of years the government concluded that "*the alternatives to Phase One and the full HS2 scheme would each offer ways of providing some additional capacity on the network. Some of the upgrade schemes are likely to be taken forward as part of Network Rail's normal forward planning process to modernise the network. However, they do not deliver satisfactorily against the objectives set for HS2. In particular, they:*

- *do not provide sufficient additional capacity to meet the long term needs for the north-south railway;*
- *do not provide significant additional released capacity for commuters and freight on the WCML;*
- *fail to offer a robust solution to the problem of resilience and performance, particularly on the WCML, which suffers from unacceptably high levels of unreliability;*
- *would significantly disrupt services on existing lines as construction work is carried out over a period of many years. In the case of the full 'Y' alternative, there would be large scale disruptive work on the three main north-south lines. Network Rail has estimated that this could result in up to 14 years of service disruption which the Government considers is not acceptable; and*
- *fail to provide the scale of connectivity benefits for the major cities of the Midlands and north and this, together with limited capacity gains in the longer term for commuters, freight and long distance travel, means that they would not achieve the overarching economic aim set for HS2."*[14]

## 2.4. Establishment of the Preferred Route

### AoS Options Report (March 2012)

2.4.1. Following the announcement of the Government's preference for a Y-shaped high speed network configuration, further work was undertaken to investigate various route, station and depot options that could deliver the western and eastern legs of

[13] High Speed Rail: Investing in Britain's Future – Decisions and Next Steps (Cm.8247), DfT, January 2012 p.72 para. 3.96

[14] The Strategic Case for HS2, DfT, October 2013 p.135 para. 6.4.2

the network. A process of sifting was utilised to refine a long list of options and route combinations, as shown in **Figures B2-3 and B2-4**.

**Figure B2-3 – Evolution of the Western Leg Options**

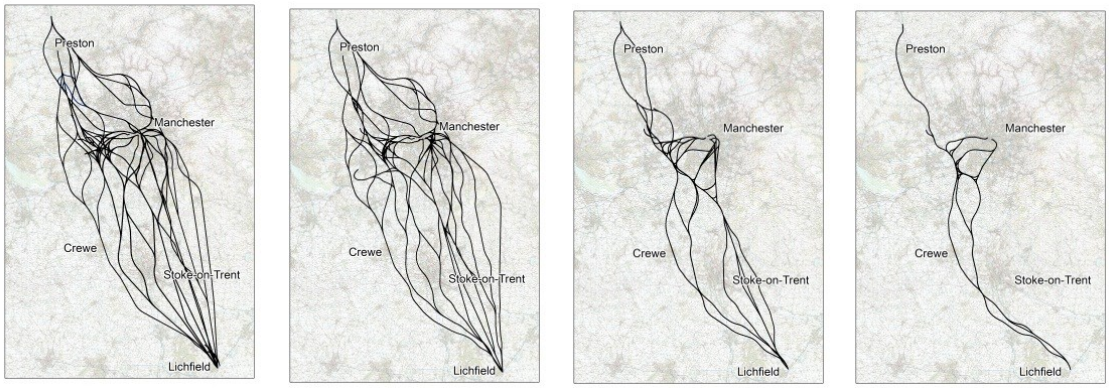
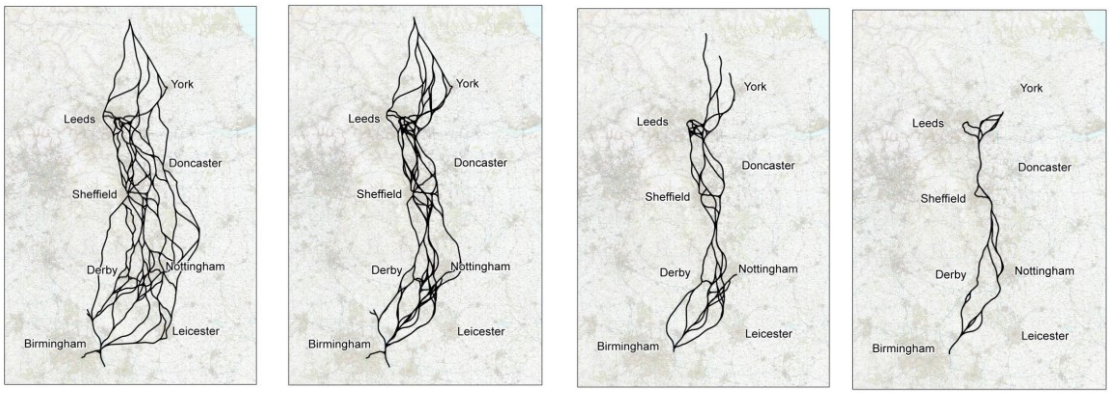



**Figure B2.4 – Evolution of the Eastern Leg Options**




2.4.2. Between October 2010 and December 2011 hundreds of line of route, station and depot options were considered. The route options were reduced through a number of 'sifts'.

2.4.3. By December 2011, HS2 Ltd had identified a number of options that were considered to best meet the HS2 Phase Two remit. A number of refinements were made to these in order to achieve engineering improvements or to mitigate particular potential impacts.

2.4.4. HS2 Ltd advice to Government, Options for Phase 2 of the high speed network: Appraisal of Sustainability (AoS)[15] describes the output from the initial sifting process and, in particular, describes the performance of those options that were considered to best meet the remit. The report focused on 42 separate route sections for the western leg and 32 for the eastern, which could be used to create up to 144 and 112 possible route combinations for Manchester and Leeds respectively. The 74 sections presented in the report had been sifted down from several hundred through the earlier route optioneering process. These options are grouped as shown in **Table B2-1**.

[15] High Speed 2 Ltd. (2012). Options for Phase Two of the high speed rail network. A report to Government by HS2 Ltd

**Table B2-1 – AoS Options Report Groupings**

| Manchester corridor | Leeds corridor |
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| • West Midlands to Manchester outskirts | • West Midlands to Leeds outskirts |
| • Manchester approaches and terminus | • Leeds approaches and terminus |
| • Interchange stations | • East Midland intermediate stations |
| • Intermediate stations | • South Yorkshire intermediate stations |
| • West Coast Main Line connection | • East Coast Main Line connection |
| • Depots | • Depots |
| **Heathrow options** | |
| • Connections to mainline and station option | |

2.4.5. The route options identified could be combined in various ways, with certain sections interchangeable between common points (nodes) in order to create different whole route combinations. Each option was considered by HS2 Ltd in terms of passenger demand, cost, engineering complexity, journey time and sustainability.

## Sustainability Summary (January 2013)

2.4.6. During summer 2012, the Government held a series of meetings with political and economic leaders from the cities and regions that could be served by Phase Two to gauge their opinions of the proposals. Focussing on the station options rather than route options and undertaken in confidence to prevent the risk of widespread blight for residents and communities, these events helped the Government obtain an initial view on how HS2 could support development and regeneration aspirations.

2.4.7. In addition, the Secretary of State for Transport visited areas potentially affected by the proposals in order to both better understand the options and, where necessary, to request further work from HS2 Ltd to reconsider aspects of the route. From these design reviews, alternatives to route sections emerged and were subject to a further level of appraisal. This work culminated in the Government selecting its initial preferred route which was published through the Sustainability Summary[16] in January 2013.

2.4.8. The Sustainability Summary described the potential impacts of the initial preferred route as a single route for each of the western and eastern legs on people and the environment.

2.4.9. The western leg of the initial preferred route would connect with the WCML at two locations (Crewe and Golborne). It would include a terminus station in Manchester city centre as well as a further station at Manchester Airport. An Infrastructure Maintenance Depot at Crewe and Rolling Stock Depot near Golborne were also identified as being required.

2.4.10. The eastern leg of the initial preferred route would connect with the East Coast Main Line (ECML) north-east of Church Fenton; as well as a terminus station in Leeds City Centre at Leeds New Lane, south of the existing Leeds Station, it would include intermediate stations at Toton near Nottingham (referred to as the East Midlands Hub) and at Meadowhall, Sheffield. An Infrastructure Maintenance Depot at Staveley and Rolling Stock Depot near Crofton were also proposed.

[16] Temple-ERM (2013). HS2 Phase Two Initial Preferred Scheme Sustainability Summary

2.4.11. Another key decision taken by Government at this time was to pause work on the spur to Heathrow.

### Sustainability Statement (July 2013)

2.4.12. A period of 'informal engagement' was launched following the announcement of the initial preferred route. Ministers met with Members of Parliament affected by the Phase Two scheme, to reflect on any local priorities. In parallel, HS2 Ltd engaged with numerous stakeholders such as local authorities affected by the line of route, station city partners and key environment and heritage organisations.

2.4.13. Certain changes were made to the initial preferred route partly as a result of this informal engagement. These changes formed part of the proposed scheme for consultation that was the subject of the 2013 Sustainability Statement.

2.4.14. The Sustainability Statement was prepared to assist with public consultation by explaining the potential sustainability benefits and adverse impacts of the proposals and alternatives considered, as well as to explain how sustainability has helped support the scheme selection and design process.

2.4.15. The public consultation ran from July 2013 to January 2014, with a series of consultation events providing an opportunity for engagement with local communities, stakeholders and statutory bodies running between October 2013 and January 2014.

### Post Consultation Refinements (2014 – 2016)

2.4.16. In response to the feedback received during consultation and as a result of the experience gained from Phase One, HS2 Ltd investigated a number of areas for possible modifications to the scheme. Further scheme revisions were driven by an initiative to improve the technical performance of the design and to consider cost efficiencies. Refinements took account of strategic considerations which emerged during scheme development, such as Northern Powerhouse Rail, and ongoing strategic review of the Phase 2b proposals by Sir David Higgins. These are detailed in the Phase 2b Sustainability Statement including Post Consultation Update (2016).

2.4.17. In support of the emerging Phase One scheme proposals, HS2 Ltd prepared a series of updated standards that the design of both Phase One and Two were required to meet. The requirements, which reflect developing industry best practice, aim to ensure that HS2 is designed and built for optimal passenger comfort, as well as long-term operational considerations such as maintainability, safety and durability. The requirements are principally concerned with the camber and gradient of the track alignment, reducing tunnel diameter and adjusting the track alignment to improve drainage as well as the structural clearance over or under roads, other railways, watercourses and floodplains.

2.4.18. A report[17] of the consultation process and a summary of the issues raised were published alongside the decision document[18]. Options were developed to address the issues that were raised during consultation. These were then reappraised and those that were feasible when considered alongside other scheme requirements were progressed. Other scheme requirements included journey time, demand, constructability and comparative cost as well as sustainability and the environment. Options ranged from smaller scale changes to the horizontal and vertical profile of the route, to a larger scale review of route corridors.

[17] Response to HS2 Phase Two Consultation: Appraisal of Sustainability (Question 7)

[18] HS2 Ltd (2015). High Speed Two: East and West – The next steps to Crewe and beyond

2.4.19. In addition other minor scheme revisions arose from route 'stitching' changes from consultation and design requirements which focused on different geographical areas. This meant that other small changes were necessary to re-join these areas into adjacent route sections to form a coherent whole scheme.

2.4.20. Rebalancing Britain, a report by Sir David Higgins published in October 2014, highlighted the need for greater consideration of transport connectivity across the north of England. The role Phase Two played within those wider aspirations was also a consideration within the post consultation refinement route optioneering, through on-going engagement within Transport for the North (TfN) and other key stakeholders.

### Sustainability Report Post Consultation Update: West Midlands to Crewe (November 2015)

2.4.21. In March 2014, Sir David Higgins recommended bringing forward development of the Phase Two route from the West Midlands to Crewe by 2027. This recommendation was made through the publication of the HS2 Plus Report.

2.4.22. In November 2015, the Government, having considered a number of options for accelerating part of the route, announced its intention to bring forward the construction of the section of route connecting the West Midlands to Crewe, known as the preferred route to Crewe. An updated Sustainability Report[19] was published documenting the post-consultation changes to the Phase Two section of route from the West Midlands to Crewe - the preferred route to Crewe.

### Sustainability Statement including Post Consultation Update (November 2016)

2.4.23. Whilst the design and refinement for the section of route between the West Midlands and Crewe was accelerated, further refinement and stakeholder engagement continued for the rest of Phase Two. The Sustainability Statement (2016) details the preferred route for both the rest of Phase Two (Phase 2b) and how impacts have changed following the post consultation refinements.

2.4.24. Changes to the consultation routes have been adopted on both the western and eastern leg, and include both vertical and horizontal realignments, together with proposed changes in depot locations. In November 2015, Sir David Higgins set out his recommendation for the redevelopment of Leeds station in the Yorkshire Hub[20] report. This report followed continued engagement with Leeds City Council, local authorities and local enterprise partnerships across Yorkshire, and Network Rail, where a clear consensus around a single preferred option emerged.

2.4.25. The changes on the eastern leg have also involved a review of how best to serve the South Yorkshire area which has led to an alternative proposal for accessing Sheffield City Centre and significant change in the proposed HS2 route corridor for this region. The HS2 Sheffield and South Yorkshire Report 2016 published in July 2016 provided a strategic overview of the proposals, which are detailed in the Sustainability Statement (2016) for the preferred route for Phase 2b. At the next stage of design, the EIA is required to detail scheme alternatives in light of a more comprehensive environmental assessment and a greater level of design detail.

[19] Temple-RSK (2015). Sustainability Report Phase Two Post-Consultation Update: West Midlands to Crewe A report produced by Temple-RSK for HS2 Ltd

[20] DfT (November 2015). The Yorkshire Hub: An interim report on the redevelopment of Leeds station

# 3. APPENDIX B-3: GLOSSARY OF TERMS

This section defines all designations and sustainability features referred to in the Sustainability Statement, along with any other technical terms that might be encountered. Where appropriate, supporting methodological information outlining how impacts were appraised is also provided.

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| Agricultural land (Grade 1 and 2) | The quality of agricultural land in England and Wales is assessed according to a system devised by MAFF/DEFRA, revised and published in 1989 and known as the Agricultural Land Classification (ALC). This is the nationally applicable system used for land use planning and development control. The two top grades are as follows:<br>• Grade 1: excellent quality agricultural land - land with no or very minor limitations to agricultural use;<br>• Grade 2: very good agricultural land - land with minor limitations which affect crop yield, cultivations or harvesting.<br>Local authorities should take account of Agricultural Land Classification in order to make informed choices about future land use within the planning system. |
| AQMA – Air quality management area | AQMAs are areas defined by local authorities that have levels of certain pollutants that area expected to exceed National Air Quality Objectives. These areas could be just one or two streets, or could be much larger. The local relevant local authority is required to set a plan to improve air quality in the AQMA, detailed in a Local Air Quality Action Plan. |
| Ancient Woodlands | Ancient Woodland is land continuously wooded since AD1600 in England and Wales and which has never been cleared or replanted. Many Ancient Woodlands are designated for their scientific and conservation importance. The Ancient Woodland inventory records such woods over two hectares in England. Ancient Woodlands do not enjoy their own statutory protection, although many are protected through designations such as SSSIs or other designations. See also *Habitats of Principal Importance*. |

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| AONB - Area of Outstanding Natural Beauty | AONBs have equivalent status to National Parks and are designated under the National Parks and Access to the Countryside Act 1949. The Countryside and Rights of Way Act 2000 added further regulation and protection.<br><br>The single purpose of AONB designation is to conserve and enhance the natural beauty of the area. Where there is a Conservation Board, the Board has an additional purpose of increasing the understanding and enjoyment by the public of the special qualities of the area. A Board must also seek to foster the economic and social well-being of their local communities. If it appears to a Board that there is ever a conflict between these two purposes, it must give greater weight to the conservation and enhancement purpose. |
| Aquifer | An aquifer is a wet underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, or silt) from which groundwater can be usefully extracted. Areas underlain by aquifers are represented in plan by information obtained from the Environment Agency, the British Geological Society or mapping of the chemical and quantitative status of groundwater carried out in accordance with the Water Framework Directive. Possible impacts on aquifers have been assessed where they are traversed by cut or tunnel.<br><br>It is an Environment Agency and Water Framework Directive requirement to mitigate by design the impacts of any works which may influence the groundwater resource to the point where they are insignificant. All aquifer crossings will be subject to detailed ground investigation, geo-hydraulic modelling, groundwater flow and quality monitoring before, during and after construction, and bespoke design incorporating groundwater barriers and bypass routes where required. All monitoring, works and design will be carried out in close collaboration with the Environment Agency in order to ensure that the groundwater resource is not polluted or impeded in any way. (See also *SPZ*). |

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| Bulk building materials | The Sustainability Statement Volume 1 records tonnages of bulk building materials, namely steel and concrete, by way of indicating the potential principal material resource requirements of the project. This information was also the basis for embedded carbon figures which were used during sifting stages. The calculations do not take account of the high speed lines structural form and are purely a representation of potential bulk building materials.<br><br>The tonnages have been calculated based on conversion factors taken from the Network Rail 2009 document, *Comparing environmental impact of conventional and high speed rail*. Calculations for concrete at stations have used a generic platform dimension (and assumed platform number), together with specific concourse dimensions. A concrete tonnage conversion has used the Bath University 2009 *Inventory of Carbon and Energy*. No steel volumes are determined for stations. No bulk materials have been calculated for depots. |
| Conservation Area | An area of special architectural or historic interest, designated under the Planning (Listed Buildings & Conservation Areas) Act 1990, whose character and appearance it is desirable to preserve and enhance. They do not have statutory protection, but local authorities will set rules on certain development in conservation areas. |
| Code of Construction Practice (CoCP) | A CoCP will be developed for Phase Two during the more detailed environmental assessment stage. It will contain strategic control measures and standards to be implements throughout the construction phase. |
| Country Parks | There are about 250 recognised Country Parks in England and Wales. Most were designated in the 1970s, under the Countryside Act 1968 with the support of the former Countryside Commission. In more recent times there has been no specific financial support for Country Parks directly, and fewer have been designated. Most are managed by local authorities, although other organisations and private individuals can also run them. There is nothing to stop anyone opening a site and calling it a Country Park, although they might not receive recognition from Natural England. |
| Demolitions | Using plans showing the preferred route footprint, counts have been made of the number of residential properties, community facilities, industrial properties and commercial properties that would potentially be demolished by the preferred route. |
| Depot | Two types of depots would be required for HS2. Rolling stock maintenance depots for used for stabling, inspection, repair, cleaning and light maintenance of trains. Infrastructure maintenance depots for stabling, preparing and maintaining the rolling stock. They would provide a central store and supply point for engineering material, as well as facilities for rail plant maintenance and rescue and recovery locomotives. |

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| Disturbance | The AoS Options Report refers to dwellings being “at greater risk of disturbance from construction activity” in relation to health and wellbeing. This simple measure of dwellings within 100m of the route corridor is intended to indicate in very broad terms the number of people living close to the route who could be at greater risk of temporary impacts from noise, dust and light spillage during construction. These potential impacts would be determined far more accurately at later stages and as part of the EIA. In practice, strict control measures would be put in place to ensure that construction impacts are kept as low as possible. |
| ECML | East Coast Main Line. The main railway currently linking London and Scotland via Leeds, York and Newcastle. |
| Enterprise zones | A geographical area (agreed between the local enterprise partnership and Government) that has been designated for specific economic advantages. The aim is to attract investment, drive economic growth and employ local residents. |
| Environmental Impact Assessment (EIA) | An EIA seeks to ensure that the environmental effects of major projects and development proposals are fully investigated, understood and taken into account before decisions are made on whether they should proceed. The framework for this is provided by the amended EIA Directive (2014/52/EU). A new approach to the EIA Directive pays greater attention to threats and challenges that have emerged since the original rules came into force some 25 years ago. Member states must apply these rules from 16 May 2017.<br><br>The Sustainability Statement documents how sustainability has been integral to the development of the preferred route. Following public consultation and further route development a preferred route will be identified. This preferred route will be subject to an EIA, this is likely to take place during 2017-2010 for Phase 2b. |

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| Excavated material | Excavated material refers to the earth and other materials that are produced during ground excavations. Excavated material would be produced principally from tunnelling and construction of cuttings. New embankments would require the *addition* of material. For each route section estimated excavated material volumes are reported as either a *surplus* or a *deficit* volume, depending respectively on whether more or less material would be produced than would be used within the scheme.<br><br>Excavated material volumes have been provided by HS2 Ltd. They derive from calculations of the volumes of assumed structures (embankments, cuttings and tunnel) at this stage of design. They do not take account of bulking factors (the increase in volume following excavation). Nor do they take account of any mitigation earthworks, such as noise bunds or landscaping, which would be introduced into later designs. It would be a general intention of HS2 Ltd to balance excavated material surplus and deficit volumes as far as possible to reduce the need for offsite disposal. |
| Flood risk areas | The Environment Agency maps highlight areas of flood risk alongside watercourses with a catchment size of 4km$^2$ or more and for smaller catchments with a history of flooding. These maps indicate areas which are high, medium or low risk of flooding. High to medium risk zones are as follows:<br><br>• Zone 3b. Functional flood plain, which are areas subject to frequent flooding and play an important part in flow routes and storage.<br><br>• Zone 3a. High risk of flooding; area designated as having a 1 in 100 or greater chance of river flooding (>1%).<br><br>• Zone 2. Medium risk of flooding; area designated as having between 1 in 100 and 1 in 1000 chance of river flooding (1% - 0.1%).<br><br>The Sustainability Statement identifies all occasions of floodplain crossings over 100m in length. A more detailed examination of flood risk will be undertaken in due course. |
| Green belt | Green belt is designated in the UK for controlling urban growth and preventing the coalescence of main urban areas. A railway through green belt may create pockets of land that are susceptible to development infill and may conflict with the open and contiguous character for which a green belt is designated. |
| Green tunnel | A green tunnel provides an enclosure of the railway, where otherwise it would be in partial cutting or on the surface, with a box structure and a green (grassed or other vegetation) roof. Such an enclosure would normally be provided as mitigation for potential noise, visual or access impacts. |

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| Habitats of Principal Importance | The Natural Environment and Rural Communities (NERC) Act came into force on 1st October 2006. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with Natural England, as required by the Act.<br><br>There are 56 habitats of principal importance on the S.41 list. These are all the habitats in England that were identified as requiring action in the UK Biodiversity Action Plan (UK BAP) and continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework. They include terrestrial habitats such as upland hay meadows to lowland mixed deciduous woodland, and freshwater and marine habitats such as ponds and subtidal sands and gravels. |
| Hazardous waste | The full definition of hazardous waste is set out in the revised Waste Framework Directive (rWFD) (2008/98/EC). This provides a European-wide definition of hazardous waste and requires the correct management and regulation of such waste. Hazardous waste is defined as a waste possessing one or more of the 15 hazardous properties set out in Annex III of the rWFD, but which include being explosive, oxidizing, highly flammable, an irritant, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic, or ecotoxic. Further regulations are in place that set our how hazardous waste is to be managed in order to mitigate the potential risks it presents to human health and the environment.<br><br>At this stage of the AoS it has not been feasible to determine the classification of the landfill facility (inert, non-hazardous or hazardous) or the nature of the constituent waste materials within the landfill site. More detailed design would seek to avoid or minimise the impacts on these sites. |
| High noise levels | A high noise level exposure is defined as a free field noise level from HS2 operational noise greater than or equal to 73 dB $L_{Aeq,18hr}$. |

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| HRA and HRA screening | The Habitats Directive (enacted in the UK through the Conservation of Species and Habitats Regulations 2010) requires the 'competent authority' to assess the effects of development on Natura 2000 sites (see below). It requires an initial screening of impacts to determine if there would be a *likely significant adverse effect*, either alone or in-combination with other projects and plans. Where a likely significant effect is concluded, the competent authority must then undertake an Appropriate Assessment (AA) to determine whether the impacts will adversely affect the site.<br><br>The process of screening and, if necessary AA, is termed Habitats Regulations Assessment (HRA). Although it is the responsibility of the competent authority to undertake the HRA, it is expected that the proponent of any development will provide sufficient information to enable such an assessment to be undertaken. HRA screening has been undertaken by Temple-RSK as a parallel and supportive process to the AoS and its conclusions are reported within the Sustainability Statement. |
| Interchange station | Interchange stations are located to provide interchange between HS2 and other modes of transport, including national rail, tram, highway and air. They provide onward access to distributed municipal centres, thereby serving a potentially larger catchment. |
| Intermediate station | Intermediate stations are stations located along the line of route intended to serve one or more major populations centres. They tend to be in or near to municipal centres, or at least are served by direct access from these municipal centres. |
| Isolation | Areas of isolation have been defined as areas which may be enclosed by the preferred route and existing major infrastructure, such as motorways or existing railway. The properties identified within these areas do not consider those likely to be demolished. |
| Jobs (displacement of) | Jobs displaced at stations were calculated by assigning a ratio of jobs per square metre of floor space to commercial demolitions. The affected premises were identified through an onsite comprehensive land use survey to identify the nature and size of each property. The method used at this stage has only considered potential job displacement as a result of commercial demolitions due to the station footprint, and has not yet considered impacts of the four-track sections. |

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| Jobs and houses (support for) | The amount of development that could be stimulated by HS2 with the introduction of a new station is based on the anticipated net additional floorspace of commercial development and residential development within a catchment of the preferred station over the subsequent 25 years, estimated for scenarios both with and without HS2 to determine the difference.<br><br>For this assessment, a 1km catchment area has been considered for high population and employment density areas (Manchester Piccadilly and Leeds) while a 2km catchment area has been analysed for areas with lower density (Manchester Airport and East Midlands Hub) to take into account that in a lower density area the station serves a wider catchment partially taking on a park and ride function. The catchment areas have been adjusted to correspond to the nearest ward or output area boundary for which socio-economic statistics are published by the Office for National Statistics (ONS).<br><br>Information on the property market and potential future development has drawn on a variety of source material including published policy and guidance; relevant strategic planning documents; local planning information and assumptions; and existing property, retail and employment data and studies. In addition, the appraisal included discussions with local authorities and used the appraisal team's knowledge of local areas. |
| Listed buildings (listed structures) | A listed building is one that is 'of special architectural or historic interest' and has been included on a list kept by the Secretary of State. A listed building may not be demolished, extended or altered without special permission (listed building consent) from the local planning authority (who would typically consult Historic England).<br><br>Listed buildings are classified according to their importance and are given a grade depending on how important they are:<br>• Grade I: of outstanding architectural or historic interest.<br>• Grade II*: particularly significant of more than local interest.<br>• Grade II: of special architectural or historic interest. |
| Local Nature Reserves | Places with wildlife or geological features that are of special interest locally. They offer people special opportunities to study or learn about nature or simply to enjoy it. |

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| Major, medium and minor river classifications (specific to the AoS) | Each watercourse has been assigned a value based on the size of the receiving catchment and level of flood risk, as follows:<br>• Major Watercourses: Major watercourses are defined as those watercourses that have a catchment area of 50km$^2$ or greater.<br>• Medium Watercourses: Medium watercourses are defined as those watercourses that have a catchment area of less than 50km$^2$, but are either identified as Environment Agency Main Rivers or are associated with an area of flood risk as shown on the Flood Zone Maps (usually any watercourse with a catchment area of 4km$^2$ or greater).<br>• Minor Watercourses and Cross Drainage: All remaining watercourses are defined as minor watercourses. |
| Major Development Sites | The study has reviewed major proposals for all types of development, including residential development of 100 or more dwellings or a site area of one five hectares or more; other developments with floor space of 5,000m$^2$ or more or a site area of one five hectares or more; major infrastructure schemes, including highways schemes; and major minerals and waste management sites (including both new and extended sites).<br>The review considered local planning policy allocations within adopted and emerging development plan documents. It considered commercial proposals within masterplan documents, development briefs and consultation documents. It considered live (but as yet undetermined) planning applications registered by the local planning authority or Planning Inspectorate. And it considered extant planning consents, where the consent is granted but development is yet to have commenced or be completed.<br>The sites were identified from publically available documents that were current at the time of appraisal.<br>The Sustainability Statement has identified only where there would be a potential conflict with these sites, and has not determined any specific potential impacts, on them and the planned preferred land uses within them. |

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| National Parks | The national parks of England and Wales are areas of relatively undeveloped and scenic landscape that are designated under the National Parks and Access to the Countryside Act 1949. The two purposes of the National Park designation are to conserve and enhance the natural beauty, wildlife and cultural heritage of the area; and to promote public understanding and enjoyment of the areas special qualities by the public. In pursuing these purposes, a National Park authority shall seek to foster the economic and social well-being of their local communities. If there arises a conflict between the two purposes, relevant authorities shall give greater weight to the conservation and enhancement purpose. The Peak District is a national park. |
| National Trust land | The National Trust is the largest private society devoted to heritage preservation in the UK. The Trust's land holdings account for nearly 1.5% of the total land mass of England, Wales and Northern Ireland. A large proportion of this consists of the parks and agricultural estates attached to country houses, but there are also many countryside properties which were acquired specifically for their scenic or scientific value. This land is either owned or held in covenant by the Trust.<br><br>The National Trust Acts grant the Trust the statutory power to declare land *inalienable*. This prevents the land from being sold or mortgaged against the Trust's wishes without special parliamentary procedure. |
| Natura 2000 sites | Natura 2000 site is the collective terms for special areas of conservation (both actual and candidate), special protection areas (both actual and potential), Ramsar sites and sites of community importance (not relevant here). See also *HRA and HRA screening*. |
| NNR - National Nature Reserves | NNRs contain examples of some of the most important natural and semi-natural terrestrial and coastal ecosystems in Great Britain. They are managed to conserve their habitats or to provide special opportunities for scientific study of the habitats communities and species represented within them. NNRs are declared by the statutory national conservation agencies (NE, SNH, CCW) under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981. |
| Noticeable Noise Increase | A Noticeable Noise Increase for HS2 AoS purposes is defined as having a total rail noise level of greater than or equal to 50 dB $L_{Aeq\ 06:00 – 24:00}$ with an increase in rail noise of at least 3 dB $L_{Aeq\ 06:00 – 24:00}$.<br><br>In terms of a railway noise change, 3 dB $L_{Aeq}$ or more is generally considered as a noticeable change. The World Health Organisation, in its 1999 Noise Guidelines report in 2000 on community noise states “to protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB $L_{Aeq}$”. |

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| Noise Insulation Regulations | The Noise Insulation (Railways and Other Guided Transport) Regulations 1996 (NIRR) apply to works on new, altered or additional railway systems in England and Wales. They address changes in levels of railway noise only. The regulations set the daytime criteria where there is a duty on the relevant authority to carry out insulation work on residential buildings as follows:<br>• The total rail noise level is greater than or equal to 68 dB $L_{Aeq,18hr}$ one metre from the building façade;<br>• Noise from the [new] railway makes a contribution of at least 1 dB $L_{Aeq,18hr}$ to the total railway noise;<br>• Noise from the [new] railway results in at least a 1dB $L_{Aeq,18hr}$ increase in total railway noise level; and<br>• Only relevant to dwellings within 300m of the railway. |
| Open access land | Under the Countryside and Rights of Way Act 2000 (CROW), the public can walk freely on mapped areas of mountain, moor, heath, downland and registered common land without having to stick to paths. The new rights came into effect across all of England on 31 October 2005. |
| Promoted recreational routes | Certain rights of way are given additional status, albeit informally so, by their designation as long distance paths or national trails. Long distance paths link individual footpath sections into a continuous recreational walking trail. They may not necessarily be very long, but they are actively publicised or promoted. For example, they may be 'themed routes' where they take inspiration from an historical or literary figure, or they may follow a feature of the landscape. There are in addition, 15 national trails in England and Wales, although none would be affected by the route sections.<br>The Sustainability Statement records impacts only on these routes, rather than on all rights of way. However, HS2 Ltd would seek to maintain *all* existing rights of way (not just promoted recreational routes) through the on-going design of the scheme. This would involve working with local people, local authorities and relevant organisations to determine the best way of maintaining rights of way. |
| Preliminary candidate area for mitigation | These are areas where additional mitigation, such as noise barriers or earth bunds, would potentially have the greatest benefit to reducing the overall number of noise impacts. For the purposes of modelling the scheme 'including additional indicative mitigation' it has been assumed that mitigation at these locations would achieve a noise reduction equivalent to that achieved by use of 3m high noise barriers (or bund) or, at viaducts, by 2m high barriers with noise-absorbent materials used throughout. |

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| Protected characteristic groups | Protected characteristic groups are groups of people listed under the Equality Act 2010 according to their having defined “protected characteristics”. Those being considered at this stage within the Sustainability Statement are determined by, age (younger and older population), disability, race, faith, gender, sexual orientation and lone parent families. |
| Ramsar site | Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. The Convention covers all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities. |
| Registered Battlefields | The Historic England Register of Historic Battlefields offers protection for 43 English battlefields and promotes a better understanding of their significance. The inclusion of a site on the register does not give any statutory protection but it is a material consideration when a local planning authority determines a planning application. |
| Registered parks and gardens | Parks and gardens are listed within the Register of Parks and Gardens of special historic interest in England, which was established and is maintained by Historic England. There are currently close to 1,450 sites on the register split into three bands according to their significance. Inclusion on the Register brings no additional statutory protection, but local authorities are required by central government to make provision for the protection of the historic environment in their policies and their allocation of resources. Registration is a material consideration in planning terms so, following an application for development which would affect a registered park or garden, local planning authorities must, when determining whether or not to grant permission, take into account the historic interest of the site.<br>• Grade I: of outstanding landscape and historic interest.<br>• Grade II*: particularly significant landscape and historic interest.<br>• Grade II: of special landscape and historic interest. |
| Scheduled monuments | Defined in the Ancient Monuments and Archaeological Areas Act 1979 and (in England only) through the National Heritage Act 1983 as a protected archaeological site or historic building of national importance. The Department of Culture, Media and Sport are responsible for identifying and scheduling (registering) new sites, as well as ensuring that scheduled sites are protected. Scheduled Monument Consent is required from the Secretary of State prior to any work affecting a monument taking place. Historic England would advise in these matters. |

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| SAC - Special Area of Conservation | SACs are designated under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the EU “Habitats Directive”) as areas identified as best representing the range and variety of habitats and (non-bird) species listed in Annexes I and II to the Directive within the European Union. SACs in terrestrial areas and marine waters within British Fishery limits (up to 200 nautical miles) are designated under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). With SPAs (see below) they form the Natura 2000 network. |
| Severance | Severance could occur when settlements are divided by the route, leaving some people separated from certain community facilities. The methodology for appraising severance in the Sustainability Statement involved looking for communities that will be severed such that one part of a town or settlement would be cut off from another. The counts of residential and community properties within the identified areas were derived from the latest available address point data. |
| SPA - Special Protection Area | SPAs are classified by the UK Government under Directive 79/409/EEC on the conservation of wild birds (the EU “Birds Directive”). SPAs are areas of the most important habitat for rare (listed on Annex I in the Directive) and migratory birds within the European Union. SPAs in terrestrial areas and marine waters within British Fishery limits (up to 200 nautical miles) are designated under the Wildlife and Countryside Act 1981 but governed by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). With SACs (see above) they form the Natura 2000 network. |
| Spur | A track or tracks that diverge from the main line at one location, without onward reconnection, to provide access to other railway facilities at the end of the spur, often at some distance from the point of divergence. |

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| SPZ - Source Protection Zones | Groundwater sources (or abstractions) such as wells, boreholes and springs used for public drinking water supply, are protected through mapping of groundwater Source Protection Zones (SPZ). These zones show the plan area of the underlying aquifer (see *aquifers*) which contributes to the supply of groundwater for drinking water. The zones help to identify the risk of contamination from any activities that might cause pollution in the area and the risk of affecting the supply from any activities which might impede or obstruct the flow of groundwater. The closer the activity to the point of abstraction, the greater the risk. For large public groundwater supplies, the areas of land from which water flows is also mapped, and activities that might cause pollution are carefully controlled. The EA has defined SPZs for 2,000 groundwater sources. SPZs are mapped showing different zones which indicate the increasing vulnerability of the groundwater source to contamination.<br>• SPZ1 – inner zone, which defines an area with less than a 50-day travel time to the point of abstraction (minimum of 50m).<br>• SPZ2 – outer zone, which defines an area with less than a 400-day travel time to the point of abstraction (minimum of 250m or 500m depending on the size of the abstraction).<br>• SPZ3 – total catchment, which is defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge is > 0.75.<br>• SPZ4 – surface water catchment which drains into the aquifer feeding the groundwater supply. |
| SSSI - Sites of Special Scientific Interest | Identified by Natural England under section 28 of the Wildlife & Countryside Act 1981 as requiring protection from damaging development on account of its flora, fauna, geological and/or physiological features. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000.<br>The SSSI series has developed since 1949 as the national suite of sites providing statutory protection for the best examples of the UK's flora, fauna, geological or physiographical features. These sites are also used to underpin other national and international nature conservation designations (see below). Most SSSIs are privately-owned or managed; others are owned or managed by public bodies or non-government organisations. |

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| Super output areas and indices of multiple deprivation | The English Indices of Deprivation 2015 (ID 2015) are the Government's official measure of multiple deprivation at small area level. The Index of Multiple Deprivation 2015 (IMD 2015), which forms part of the ID 2015, is based on the small area geography known as Lower Super Output Areas (LSOAs). LSOAs are small areas of relatively even size (around 1,500 people). In most cases, these are smaller than wards, thus allowing the identification of small pockets of deprivation.<br><br>There are 32,844 LSOAs in England. The LSOA ranked 1 by the IMD 2015 is the most deprived and that ranked 32,844 is the least deprived. The IMD brings together seven domains of deprivation to produce the overall Index of Multiple Deprivation: income, employment, health, education, barriers to housing and services, crime and living environment. These are weighted and combined to create the overall IMD 2015.<br><br>Identification of areas of high deprivation is a proxy for those areas considered relatively more sensitive to further adverse impacts associated with HS2. Equally, there are potential benefits where HS2 offers regeneration opportunity from which people in deprived areas might benefit. |
| UDP | Unitary development plans are development plan prepared by a metropolitan district and some unitary local authorities that contain policies equivalent to those in both a structure plan and a local plan. By virtue of specific transitional provisions, these plans will continue to operate for a time after the commencement of the new development plan system. |
| Vibration (and ground-borne noise) | The appraisal records the number of dwellings located over tunnel sections as an indication of numbers at risk of vibration impacts. These are not recorded in the AoS Options report as experience from HS1 and other high speed railways shows that potentially significant effects from vibration and ground-borne noise in properties over tunnels can be avoided. HS2 Ltd is committed to ensuring that no significant effects occur over tunnels.<br><br>Further information on the noise appraisal is given in **Appendix C5 Noise and Vibration**. |
| Water Framework Directive | The Water Framework Directive is a European Union directive to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. It will ensure that all aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands meet 'good status'. |
| WCML | West Coast Main Line. The main railway currently linking London and Scotland via Birmingham, Manchester, Liverpool and Crewe. |

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| World Heritage Sites | World Heritage Sites are designated to meet the UK's commitments under the 1972 World Heritage Convention concerning the Protection of the World Cultural and Natural Heritage. These sites are designated for their globally important cultural or natural interest and require appropriate management and protection measures. Sites are nominated and confirmed for inclusion on the list maintained by the international World Heritage Programme administered by the UNESCO World Heritage Committee, composed of 21 State Parties (countries) which are elected by the General Assembly of States Parties for a fixed term. |

# 4. APPENDIX B-4: HS2 LTD SUSTAINABILITY POLICY

hs2 engine for growth

## Sustainability Policy

**Hs2's purpose is to create a world class high speed rail network to support sustainable growth in the UK. It is a major opportunity to provide greater choice in the way we travel to help deliver a sustainable transport system for the UK.**

Our vision is of a high speed railway network which changes the mode of choice for inter-city journeys, reinvigorates the rail network, supports economy, creates jobs, reduces carbon emissions and provides reliable travel in a changing climate throughout the 21st century and beyond.

This policy sets out HS2 Ltd's commitment to be an exemplar project. Building this network will inevitably cause some local effects on communities, the natural and the built environment. We will strive to limit the negative impacts through design, mitigation and by challenging industry standards and we will look for environmental enhancements and benefits.
Through this policy we aim to support the following Government goals:

- Create a step change improvement in transport link between regional centres and from them to London.
- Enable more equal distribution of opportunity, connect communities and encourage regeneration.
- Stimulate sustainable economic growth through increased capacity and shorter journey times between key cities.
- Support British engineering, create job opportunities and develop skills in the UK.
- Deliver lower carbon long distance travel.
- Maximise integration of HS2 with existing UK and international transport networks.
- Encourage wellbeing and protect the environment.

### What we will do

We will promote high speed rail and balance community, environmental and economy issues. We have identified key themes as a focus for our work to:

**Growth and regeneration** - Support sustainable economic development and the localism agenda for regeneration.

**Environmental change** – Commit to protection of the environment through seeking to avoid significant adverse effects on communities, businesses and the natural, historic and built environment, including the prevention of pollution. Minimise impacts where they occur and deliver enhancements as far as practicable to attain no net loss to the natural environment.

**Skills and employment** - Improve skills, jobs, education and the economy through our investment along the length of the route. Act as a driver for improvements in the sustainability of the engineering and construction sector by ensuring that the right workforce is available at the right time with the right skills and behaviours.

**Climate change** - Minimise the carbon footprint of HS2 as far as practicable and deliver low carbon long distance journeys that are supported by low carbon energy.

**Resilience** - Build network which is resilient for the long term and seek to minimise the combined effect of the project and climate change on the environment.

**Resources and waste** - Source and make efficient use of sustainable materials, maximise the proportion of material diverted from landfill and reduce waste.

**Integrated transport** - Engage with stakeholders to create seamless transport links with other modes and allow accessibility for all.

**Equality Diversity and Inclusion (EDI)** - Promote EDI in line with the HS2 EDI Policy, to ensure that it is integrated into all business processes.

### How we will deliver this

To deliver our vision we will embed sustainability in our business at each phase of the project through:

**A clear plan** - Setting goals relevant to the stage of the project for design, through development, construction, operation, maintenance and renewal which stimulate innovation and enable long term enhancements. Our plan and this policy will be reviewed biennially.

**Robust processes** - Ensuring sustainability is integrated into our culture, procedures and processes. This will be managed through the implementation and continual improvement of an Environmental Management System to enhance environmental and sustainability performance. This will include development of Sustainable Design and Delivery Principles as part of a process to enable us to balance the sometimes competing elements of sustainability and to understand whole life cost. We will comply with legal and other obligations.

**Procurement** - Ensuring sustainability is integral in our procurement processes and is applied to our entire supply chain.

**Innovation** - Promoting sustainable construction practices, continually focusing ideas and technologies for improving sustainability.

**Engagement and reporting** - Engaging in dialogue about the project and working with local communities, key stakeholders and our supply chain. Openly reporting our progress in delivering the commitments we make on sustainability regularly and sharing what we learn.

HS2 is determined to embed sustainability in the DNA of this project and integrate it into all of our work

Chief Executive Officer HS2
Approved on: 15 September, 2015

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