

High Speed Rail: Phase 2b Preferred Route

Sustainability Statement including Post Consultation Update

Non-technical summary

A report by Temple-RSK for HS2 Ltd



TEMPLE

LEADERS IN ENVIRONMENT,
PLANNING & SUSTAINABILITY.

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1. INTRODUCTION

1.1.1. This is the non-technical summary (NTS) of the Sustainability Statement including Post Consultation Update (November 2016) which describes how the preferred route for a new high speed railway from Crewe to Manchester and the West Midlands to Leeds would support appraisal objectives for sustainable development. It describes the preferred route at this stage of development, how sustainability issues have been considered and incorporated to assist decision making, and highlights the key sustainability impacts - both beneficial and adverse - that are envisaged at this stage. It also describes how the impacts of the preferred scheme compare with the scheme that was presented at public consultation in 2013/2014¹, known as the consultation scheme. This NTS provides an overview, in non-technical language, of the findings of the Sustainability Statement.

2. HS2 AND SUSTAINABILITY

- 2.1.1. Sustainability has been a fundamental consideration in the way the Phase 2b preferred scheme has been selected and designed. Since the consultation scheme in 2013, the sustainability team has worked closely with the engineers to develop route, station and depot proposals that fit as well as possible with the environment and communities they pass since the consultation scheme in 2013. As a result, the preferred scheme has emerged from several hundred options (comprising well over 10,000 miles of possible railway) as the one considered overall on balance to best meet objectives for sustainability, alongside those of passenger demand, build cost, engineering complexity and journey time.
- 2.1.2. Since consultation in 2013-2014, scheme development has also taken account of a number of strategic considerations, such as the Northern Powerhouse Rail (NPR) project and ongoing strategic review as set out in Sir David Higgins' (HS2 Ltd Chairman) reports.
- 2.1.3. The potential impacts described in this document reflect the design of the scheme at this stage in the process. Ultimately the proposals will be issued for further consultation and refined and developed to a level that will support the hybrid Bill and the close scrutiny entailed in the Bill's passage through Parliament. At the hybrid Bill development stage the project will be informed by a more detailed Environmental Impact Assessment (EIA). This will involve an in-depth assessment of the preferred scheme, taking account of a wider range of environmental information obtained from consultation and a programme of environmental field surveys. The need for specific mitigation, such as noise barriers, landscape planting, habitat creation and compensation, and watercourse protection, will also become clearer at that stage.

3. PHASE 2B PREFERRED SCHEME

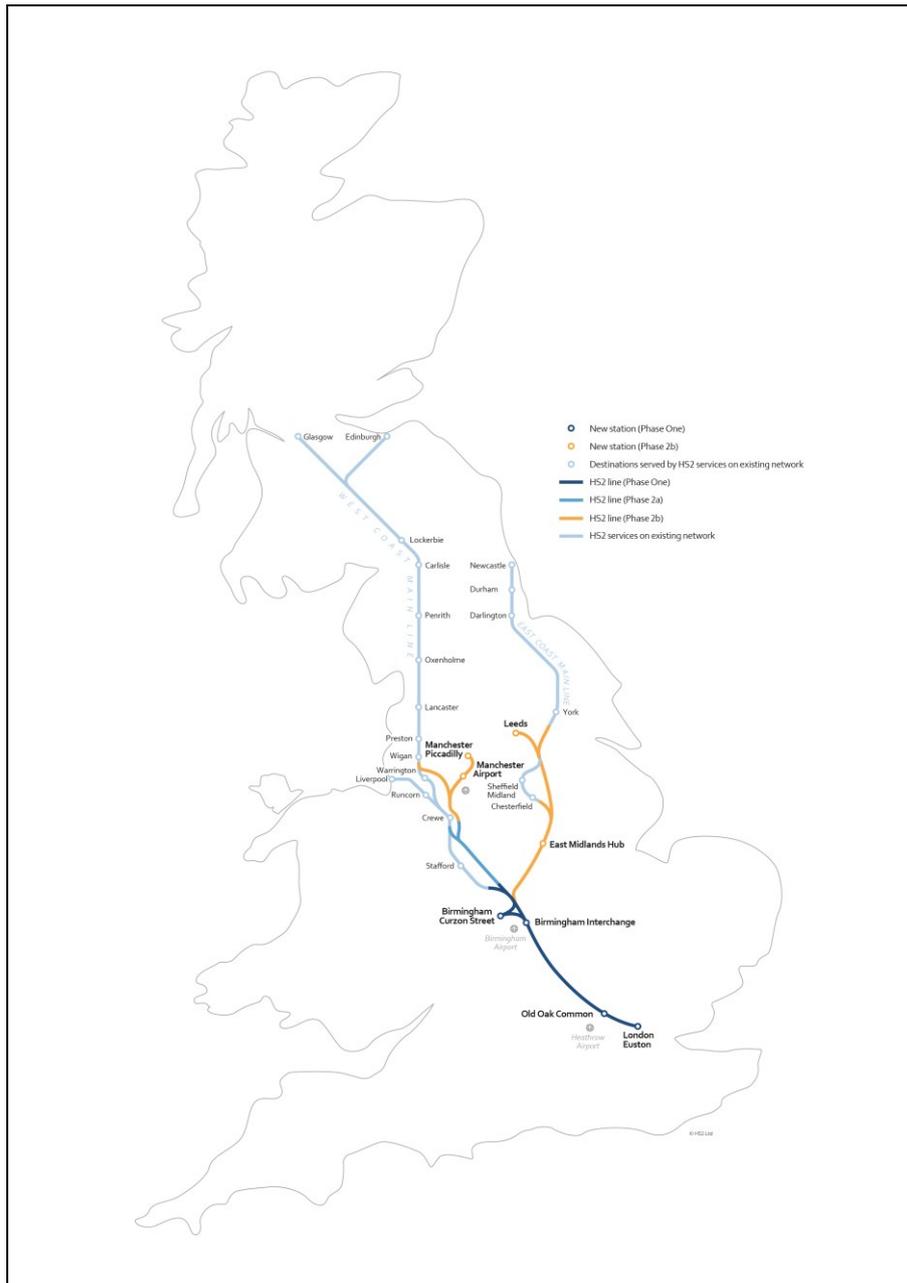
3.1.1. The Phase 2b preferred scheme comprises the western leg which runs from Crewe to Manchester Piccadilly via Manchester Airport and includes a connection to the West Coast Main Line (WCML); and the eastern leg, which runs to Leeds via the East Midlands (including connections to the Midland Main Line and the East Coast Main Line (ECML))².

¹ Temple-ERM (2013) High Speed Rail: Consultation on the route from the West Midlands to Manchester, Leeds and beyond. Sustainability Statement.

² The section of route from the HS2 Phase One connection at Fradley, north of Birmingham, to Crewe is known as Phase 2a. A Sustainability Statement covering this route accompanied the Secretary of State's announcement in November 2015. The development of the hybrid Bill and an EIA of Phase 2a is now underway.

- 3.1.2. A spur to Manchester includes a new high speed station near Manchester Airport and a new terminus station adjacent to the existing Manchester Piccadilly station. A Rolling Stock Depot is proposed north of Crewe for stabling, inspection, cleaning and light maintenance of rolling stock.
- 3.1.3. On the eastern leg, two stations would be included; the East Midlands Hub station at Toton, incorporating Network Rail platforms, and Leeds station which would be integrated with the existing Leeds station. Two depots would also be required; Staveley Infrastructure Maintenance Depot for use in maintaining the railway infrastructure and New Crofton Rolling Stock Depot for stabling, inspection, cleaning and light maintenance of rolling stock.

The HS2 network, Phase One, Phase 2a and Phase 2b³

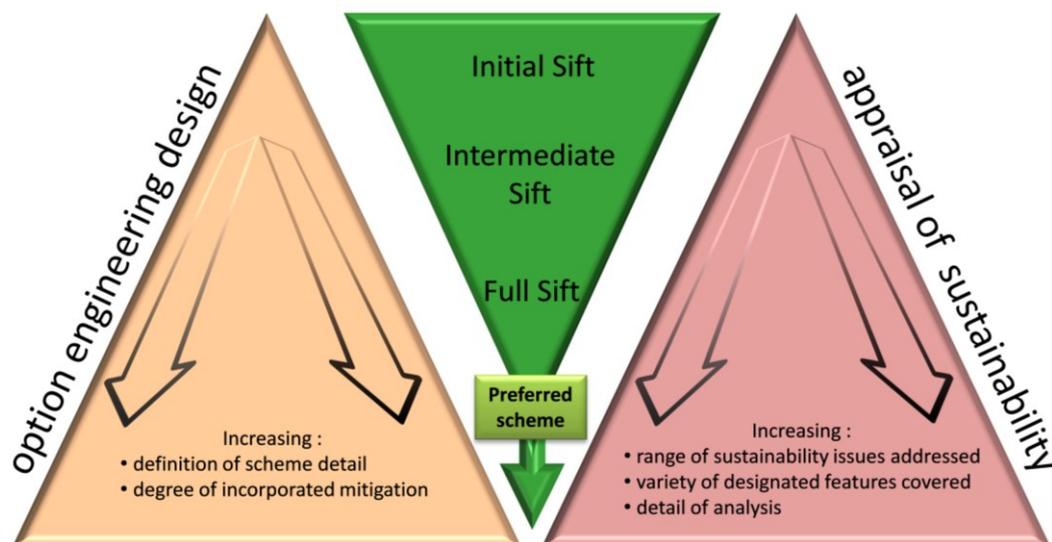


³ The Figure includes the potential northbound connection that could deliver Transport for the North's ambition for a frequent 30 minute journey time between the city centres of Leeds and Sheffield. This proposal is presented as part of the consultation. However, as this does not currently form part of the Phase 2b preferred scheme it is not included in the scope of this report.

4. APPRAISAL OF SUSTAINABILITY PROCESS

- 4.1.1. The Appraisal of Sustainability (AoS) is a process that was devised as a way of independently and consistently appraising how HS2 options would support or conflict with objectives for sustainable development. The AoS informed engineers and HS2 Ltd of particular sustainability constraints and opportunities and how to avoid or lessen potential adverse impacts. It provided information at the decision-making stages by outlining the sustainability advantages and disadvantages of different options, and the consequence of potential impacts. It also enabled the independent reporting of the sustainability impacts of the options at each stage.
- 4.1.2. The AoS approach (**Figure 4-1**) was first established to assist in the appraisal and development of the Phase One proposals and has continued through Phase 2b (and was used on Phase 2a) to form a key part of the overall method used to sift options and designs. It was designed as an adaptive tool that could introduce an increasing depth of appraisal detail, as the number of options reduced, and the detail of their design increased.

Figure 4-1 The AoS Approach



- 4.1.3. The AoS was based on an overarching framework containing almost 80 different evaluation criteria, which were applied at different stages or sifts. The framework was linked with a computerised mapping system that allowed a range of sustainability features to be compared for different options.

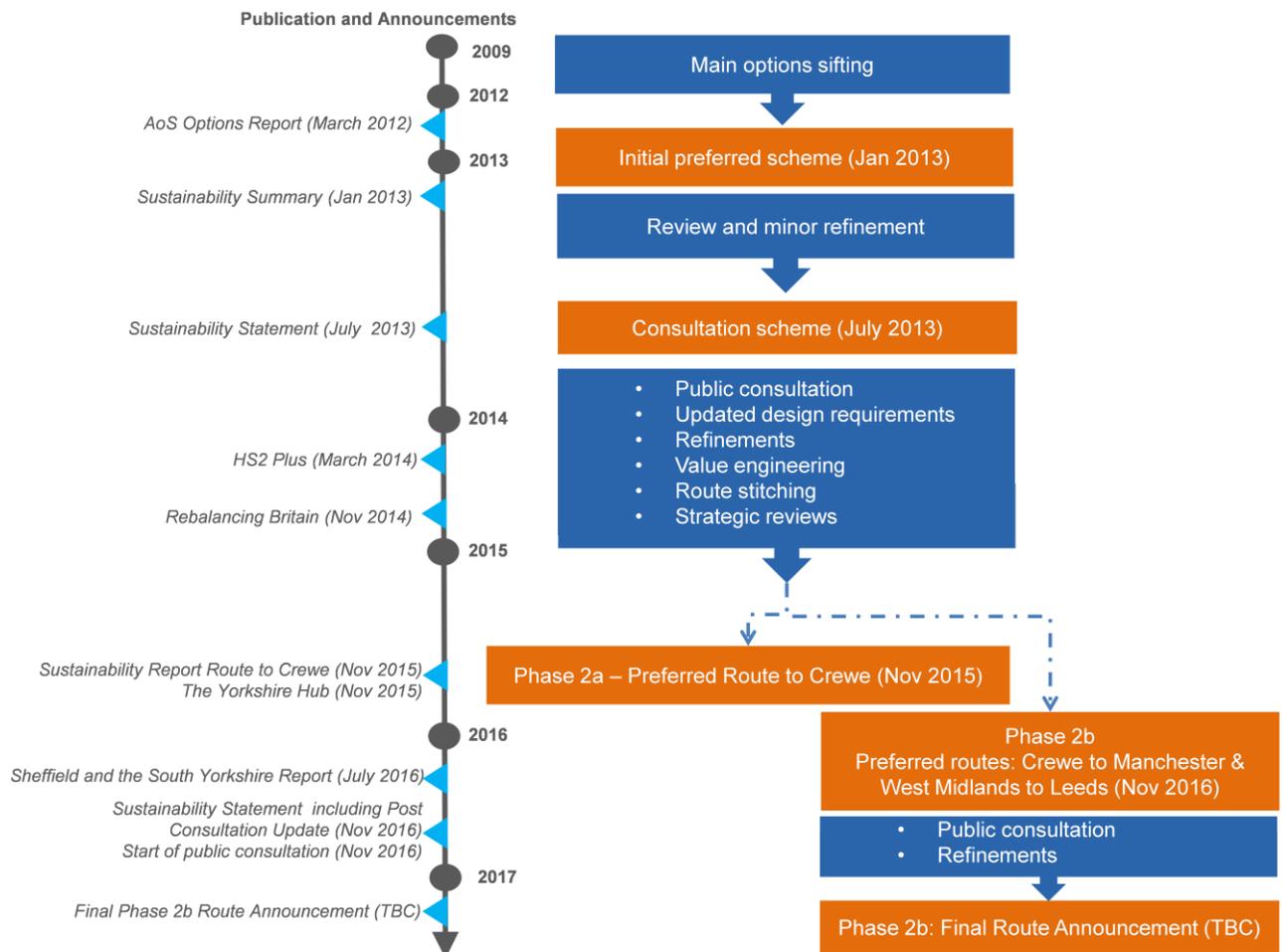
5. EVOLUTION OF THE PHASE 2B PREFERRED SCHEME

- 5.1.1. Following the announcement of the consultation route in July 2013, the Department for Transport (DfT) and HS2 Ltd have been drawing together information, analysis and opinion from a number of sources, namely:
- response to consultation;
 - strategic considerations, such as the NPR project and ongoing strategic review of the Phase 2b proposals, as set out in Sir David Higgins' reports; and

- lessons learned from Phase One and further design development.

5.1.2. These have all prompted a number of changes and **Figure 5-1** provides an overview of the AoS process and the key milestones to date.

Figure 5-1 Evolution of the preferred scheme – AoS



6. MITIGATION AND CONTINUED SCHEME DEVELOPMENT

6.1.1. From the outset of the scheme, mitigation of potential impacts has been a key focus. Potential adverse impacts have been avoided or reduced through the selection of options and particular horizontal or vertical alignments. The way that mitigation is introduced follows a hierarchy. As scheme design develops in detail, the opportunity to change the alignment lessens and alternative mitigation strategies become appropriate. As the scheme progresses, more specific mitigation proposals will be developed. Mitigation principles will include the introduction of physical features, such as noise barriers and landscape screening. More specific measures will be developed for each topic as necessary. 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.

6.1.2. The Phase 2b AoS has concentrated on the potential long term and permanent effects of the preferred scheme, resulting from landtake and operation of the railway and its infrastructure. Certain associated infrastructure, such as road re-alignments, tunnel ventilation shafts and electricity infrastructure, are yet to be determined in detail. Similarly, plans for constructing the preferred scheme are not yet defined. These associated works and the impacts that will occur over the construction period will be addressed in due course

by the Phase 2b EIA. Mitigation of construction impacts would be provided through the application of a Code of Construction Practice (CoCP), used to outline standards and procedures that must be used during construction.

- 6.1.3. A CoCP will be developed for Phase 2b during the more detailed environmental assessment stage. It will contain strategic control measures and standards to be implemented throughout the construction phase

7. WESTERN LEG ROUTE DESCRIPTION

7.1. Overview

7.1.1. For reporting purposes, the western leg has been divided into two areas:

- Crewe to Golborne (mainline); and
- the spur to Manchester.

7.2. Crewe to Golborne

7.2.1. The western mainline route extends from the south of Crewe to Golborne. The route enters a tunnel beneath Crewe and emerges from tunnel at the northern outskirts of Crewe, alongside the WCML.

7.2.2. The route continues alongside the WCML until Walley's Green where the two railways diverge, with the western mainline route bearing north across the expansive river-crossed landscape of the Cheshire Plain. The Rolling Stock Depot north of Crewe will be located where the WCML and the western mainline route diverge.

Aerial view looking north from Crewe including the proposed site of the north Crewe Rolling Stock Depot



7.2.3. The route then passes between Winsford and Middlewich where a junction provides access to the depot from the north. Continuing north past Whatcroft, the mainline requires a series

of embankments and bridges or short viaducts to carry it over rivers, canals, railways and roads.

- 7.2.4. The route passes the eastern edge of Northwich and then between Lostock Gralam and Lostock Green, where the proposed A556 road diversion lies to the west of the route. The route remains on embankment across the farmland east of Higher Wincham and Pickmere before crossing over the M6 and dividing, with the mainline continuing north and the spur line to Manchester bearing east at Hoo Green.
- 7.2.5. The mainline route passes under the M56 and then uses embankments and viaducts as the land dips into the Bollin Valley and crosses the farmed former mosslands around the southern edge of Greater Manchester.
- 7.2.6. The mainline route then begins to bear north-west in shallow cutting before rising onto a viaduct over the Manchester Ship Canal. The route continues on embankment across farmland between Warrington and Irlam. It crosses over the M62 and bears west towards Culcheth. Entering cutting it passes on the south side of Culcheth before turning northwards to cross over the Liverpool to Manchester railway. The route descends into cutting and passes beneath the A580, between Lowton St Mary's and Lowton Common east of Golborne. Bearing west it rises onto embankment along the north side of Golborne and then turns northwards as it converges with the WCML at Bamfurlong. The junction allows onward connection with stations further north including Wigan, Preston, Lancaster, Glasgow and Edinburgh.

Aerial view looking north west across the Manchester Ship Canal



7.3. Western Leg: Spur to Manchester

- 7.3.1. The spur into Manchester bears east at Hoo Green passing to the north of Rostherne Mere, largely in cutting, parallel to and south of the M56. It passes between Ashley and Tatton Park before bearing north beneath the M56. A new HS2 station, providing an interchange at Manchester Airport and serving the surrounding area, is proposed west of the airport at Davenport Green.

- 7.3.2. The route continues north in cutting alongside the M56 before entering tunnel for approximately 13km beneath southern Manchester. Four tunnel shafts to provide ventilation and emergency access are likely to be required. Indicative locations for these are proposed near the junction of the Altrincham Road (A560) and the M56; the northern edge of Withington golf course off the Palatine Road in the Mersey valley; on Wilmslow Road between Ferndene Road and Rathen Road in Didsbury; and off Lytham Road in Rusholme. The route re-surfaces at Ardwick rising onto viaduct into Manchester Piccadilly, where a new HS2 terminus station would be constructed adjacent to and north of the existing station.

8. WESTERN LEG, SUMMARY OF IMPACTS BY TOPIC

8.1. Planning and development

- 8.1.1. The route would pass through or near to several major development sites, which could introduce large new areas of proposed housing or other development projects (including new infrastructure) between now and the time HS2 would be in operation. These developments may be directly affected, although those around stations could well benefit from the proximity of HS2.
- 8.1.2. For each of the development sites potentially affected, HS2 Ltd would work with relevant local authorities and the affected developers or promoters to determine how potential impacts might best be managed and how potential co-location opportunities could be maximised.

8.2. Employment and housing

- 8.2.1. The introduction of an HS2 station could have a positive effect on the surrounding area, as people and businesses realise the opportunities of living and working close to the high speed network. The AoS estimated the likely number of additional jobs and houses potentially supported by HS2 around proposed stations.
- 8.2.2. HS2 could support up to an estimated 43,600 jobs and up to 4,100 homes on the western leg, largely around Manchester Piccadilly station. The employment figure takes account of jobs displaced by demolitions, although it is expected that the majority of these would be able to relocate in the local area or region.

8.3. Property and community integrity

- 8.3.1. The western leg could result in the demolition of an estimated 111 dwellings. The majority of these would be associated with the spur into Manchester and into Manchester Piccadilly station. An estimated 48 dwellings would be demolished at Manchester Piccadilly station.
- 8.3.2. The proposals would also require the demolition of two community facilities, 91 commercial properties and two industrial properties. The route could also result in the isolation of an estimated three properties.

8.4. Access issues

- 8.4.1. Both Manchester stations would provide an important interchange hub with other transport systems, including roads, railways, airports, cycleways and footpaths. The HS2 terminus would be alongside the existing Manchester Piccadilly station. This already offers good rail connections with various destinations across the city and region and Network Rail's Northern Hub proposals at the station will further enhance this connectivity. The HS2

station would be served by Manchester's Metrolink light rail system as well as by good bus services.

- 8.4.2. The HS2 Manchester Airport station would have a direct connection with Manchester Airport and its existing railway station that links the airport with numerous towns and cities locally and regionally. The HS2 station would also provide access to the M56 and the A538 Wilmslow Road.
- 8.4.3. The western leg would cross four long distance footpaths and three national cycle routes. Access across the preferred route is likely to be maintained 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 achieving this where feasible. A detailed appraisal of all access crossings will be undertaken as part of the EIA.

8.5. Health, well-being and equality

- 8.5.1. The AoS included separate appraisals on health and well-being, and on equalities. These studies each considered how impacts of the preferred scheme might affect certain groups of people more acutely than it would the population as a whole. The health appraisal matched general impacts from the scheme with areas of higher health deprivation. This revealed general areas around Manchester, Salford and Wigan areas with populations relatively more vulnerable both to potential negative health effects (for example due to displacement of jobs, noise and demolition of housing and community facilities); and potential positive health effects (for example due to improved access to employment, new housing and access to transport).
- 8.5.2. Separate equality analysis was undertaken to indicate the extent to which groups vulnerable to discrimination and social exclusion may be affected by the preferred scheme to a greater degree than the population in general. Different priority equality groups have been identified along the route.
- 8.5.3. Potential beneficial equality impacts were identified around Manchester Piccadilly station as a result of new local jobs and housing. Potential adverse impacts were also identified around Manchester Piccadilly station and the Manchester Airport station, as a result of potential demolitions of housing and other properties.

8.6. Noise and vibration

- 8.6.1. The noise specialists have worked closely with the scheme engineers to determine (at this stage of design) the feasibility of introducing noise barriers at the 'preliminary candidate areas for mitigation'. This should substantially reduce the number and extent of noise impacts reported at this early stage. With the additional indicative mitigation, the number of dwellings predicted to have noise impacts from HS2 along the western leg is estimated at 1,100.
- 8.6.2. Later assessment as part of the EIA will provide a more in-depth understanding of noise impacts along the route, including generation of sound contour maps. This will allow for more specific mitigation measures to be developed and incorporated into the design.

8.7. Air quality

- 8.7.1. The Manchester Airport station and Manchester Piccadilly station would overlap areas currently identified as having poor air quality. Any additional road traffic to these places, either during construction or operation of HS2, could exacerbate local pollution levels if no air quality improvements have been implemented by local authorities by that time. In

developing scheme proposals, it would be necessary to comply with EU law on ambient air quality. This will be considered further as part of the EIA.

- 8.7.2. On a larger scale, HS2 could result in air quality improvements as people switch from cars to rail, although this has not been determined at this stage.

8.8. Landscape and visual impacts

- 8.8.1. The western leg would have no direct or indirect impacts on nationally designated landscapes. Considerable parts of the route would have only slight landscape or visual impacts, successfully avoiding important landscape and visual amenity resources, including the sections of bored tunnel under Crewe and approaching Manchester Piccadilly.
- 8.8.2. Key landscape and visual impacts are likely to affect:
- residents on the northern outskirts of Crewe and Wimboldsley, due to the relocation of the Rolling Stock Depot to the north of Crewe;
 - the landscape and views between Winsford and Middlewich and for residents at the hamlets of Clive and Stanthorne;
 - recreational users of the Shropshire Union Canal, the River Dane and Trent and Mersey Canal and for residents at Wimboldsley;
 - views at Broken Cross and Lostock Green and the landscape character near Lostock Gralam in part due to visual impacts on Winnington Wood and Leonard's & Smoker Wood;
 - views north of Peover Eye and Smoker Brook affecting users of Heyrose Golf Course; and
 - the landscape of the Mersey Valley between Warrington and Irlam, as well as views for local residents due to the new viaduct over the Manchester Ship Canal.
- 8.8.3. The proposed Manchester terminus station would be on the site of existing development adjacent to the existing Manchester Piccadilly station, and would fit well with the existing townscape.
- 8.8.4. These conclusions are based on a level of scheme design that does not yet include specific mitigation. As the design progresses, these and other potential impacts may be reduced through the incorporation of a range of potential landscape mitigation measures.

8.9. Cultural heritage

- 8.9.1. The western leg has been selected and aligned so that it would have few impacts on known designated heritage assets. It would avoid physical impacts on all of the most significant designated features, including Scheduled Monuments, Registered Battlefields and Grade I and II* listed structures. The route has been aligned so that it avoids direct physical impacts on Registered Parks and Gardens, and effects on their settings would also be low. The majority of effects are expected to be minor at most.
- 8.9.2. Potentially greater impacts would include:
- potential demolition of two Grade II listed buildings; and
 - direct impact on the Trent and Mersey Canal Conservation Area, which is crossed at three locations.

8.10. Biodiversity and wildlife

- 8.10.1. The route would pass in close proximity to a number of habitats of international significance, including Midland Meres and Mosses (the Mere), Rostherne Mere and Manchester Mosses (Holcroft Moss).
- 8.10.2. HS2 Ltd will continue to work closely with Natural England and the Environment Agency to ensure the moss would be unaffected by the scheme. This will include agreement over measures such as suitable foundation works, track construction techniques and a design which does not affect the drainage characteristics around the site.
- 8.10.3. No designated habitats of national importance would be directly affected. Although there is the potential for indirect impacts at a small number of Sites of Special Scientific Interest (SSSIs); these are likely to be mitigated through scheme design and best practice management of construction activities, using measures that will be set out in the CoCP.
- 8.10.4. The scheme would have direct impacts on an estimated 4.2km of key habitat, including four woods listed on the Ancient Woodlands Inventory.
- 8.10.5. As part of the later EIA work, a package of mitigation and enhancement measures will be developed to address the impacts on habitats and species. Such measures would seek to address both the direct impacts on designated sites, and to reflect the wider strategic ecological priorities of affected areas.

8.11. Water resources and flood risk

- 8.11.1. The preferred scheme would cross a network of watercourses of varying size. In a small number of cases this may necessitate a diversion or modification to the river channel. In total, the route would cross 11 major rivers, 59 minor rivers and five navigable waterways. Further design will seek to avoid the need for diversions and to explore opportunities for environmental enhancement.
- 8.11.2. The preferred scheme could exacerbate flood risk where it crosses designated flood zones. In these cases, it has been assumed that viaducts would be used. However, at a later stage, each crossing will be examined in more detail to determine the most appropriate form of alignment.

8.12. Land use resources

- 8.12.1. High level agricultural land classification maps show that some 900m of Grade 1 agricultural land would be crossed by the route. In addition, approximately 20km of the route would be through land shown as Grade 2. More in-depth assessment of the impact on farm holdings will take place in due course, as part of the EIA.
- 8.12.2. Of the various active (operational) and disused (non-operational) landfill sites that would be close to the preferred route, higher risks were identified for two operational sites and three of the disused sites, based on the type and length of crossing, the size of the landfill and its recorded contents. The design of the route through these areas would need to ensure that potential impacts from possibly contaminated materials are fully mitigated.

8.13. Excavated materials and material resource

- 8.13.1. The current estimate for excavated material arising on the western leg is 2.4 million cubic metres, although this does not take account of the probable high proportions of materials

likely to be incorporated within the scheme for the creation of embankments, landscaping and bunding.

8.13.2. The estimated quantities of bulk building material required for the scheme would comprise about 187,000 tonnes of steel and about 2,046,100 tonnes of concrete.

9. EASTERN LEG ROUTE DESCRIPTION

9.1. Overview

9.1.1. For the purposes of reporting, the eastern leg has been divided into the following areas:

- Marston to Kegworth;
- Kegworth to Heath;
- Heath to Barnburgh; and
- Barnburgh to Leeds and Church Fenton.

9.2. Marston to Kegworth

9.2.1. The eastern leg would diverge from Phase One near Marston. The route would continue alongside the M42 and A42 past Kingsbury, Tamworth, Austrey, Measham, Ashby-de-la-Zouch, Worthington and Kegworth. The route diverges from the motorway near Measham and rejoins near Packington. Viaducts or bridges carry the route over the valleys of the rivers Tame, Anker and Mease, but much of this section of the route is otherwise within cutting.

9.3. Kegworth to Heath

- 9.3.1. South of Kegworth the route is briefly aligned within the corridor of the M1 before diverging eastwards and rising onto viaduct over 3km long, crossing the A6, A453 and Soar floodplain. Emerging north of Red Hill, the route passes over the River Trent and its floodplain on a second longer viaduct, bringing the route into the Erewash Valley through Long Eaton and Toton. The East Midlands Hub station, incorporating Network Rail platforms, is proposed at Toton alongside an existing rail freight yard. Indicative locations for maintenance loops are proposed next to the East Midlands Hub Station. Maintenance loops are likely to comprise an additional section of track, each about 1.4km long.
- 9.3.2. The route then passes through the gap between Stapleford and Sandiacre where it bears north-east alongside the M1. The route runs close to the motorway for much of the next 40km as it leaves Toton and passes the settlements of Strelley, Nuthall, Hucknall, Selston, and Pinxton.
- 9.3.3. North of Pinxton, a spur would depart from the mainline and head west to enable HS2 services to access Sheffield Midlands station using the existing railway through Chesterfield. The spur would pass between the villages of Blackwell and Newton, before connecting to the existing rail corridor near Clay Cross.

Aerial view looking towards the proposed location of the Sheffield Spur Junction



- 9.3.4. Heading north from Pinxton, the preferred route would pass to the east of Sutton-in-Ashfield, before going under the M1 in a cut and cover tunnel. It would closely follow the M1 on the motorway's west side, passing Hardwick Hall, Stainsby and Heath. Modification to the M1 and some of its junctions may be required at certain locations.

9.4. Heath to Barnburgh

- 9.4.1. North of Heath the route continues alongside the M1 before passing over it and bearing east near Bolsover. The M1 and HS2 diverge briefly before converging again, HS2 passing over the motorway once more and then following the motorway on its west side past Barlborough. Just north of the M1 crossing, near Mastin Moor, a grade separated junction links the main HS2 line with Staveley Infrastructure Maintenance Depot.
- 9.4.2. North of Barlborough, the route would follow the west side of the M1 running directly adjacent to the motorway passing the town of Wales, diverging briefly near Woodall and Aston, before crossing the junction of the M1 and M18 on viaduct near Thurcroft. Staying to the western side of the M18, the preferred route would pass between Bramley and Hellaby before diverging north from the M18 through Conisbrough Parks. The route would pass between Mexborough and Conisbrough over the A6023 and to the east of Barnburgh.

9.5. Barnburgh to Leeds and Church Fenton

- 9.5.1. Passing to the east of Hickleton, the route would head west near Clayton, Frickley, South Kirby, Brierley and Hemsworth. To the south of New Crofton is the New Crofton Rolling Stock Depot.
- 9.5.2. The route enters the edge of the Calder Valley west of Normanton and Altofts, passing on viaduct over the River Calder. It then rises on a long viaduct over the River Aire, the Aire and Calder Navigation and the M62 motorway. The spur into Leeds diverges at this point.
- 9.5.3. The mainline passes Swillington before bearing east to join the corridor of the M1 north of Garforth. It passes beneath the A1(M) just south of its junction with the M1, and then predominantly uses cutting and embankment through undulating and wooded farmland before bearing northwards once again to the north of Sherburn-in-Elmet. It rises onto a

long viaduct and connects into the Normanton to York railway between Church Fenton and Ulleskelf, which joins the ECML, allowing onward connection with stations further north including York, Newcastle and Edinburgh.

- 9.5.4. The spur into Leeds diverges from the mainline along the Aire Valley before entering tunnel beneath Woodlesford. Emerging north-west of this settlement it continues along the valley before dropping into cutting and passing beneath the M1. It continues alongside the existing Normanton to Leeds railway through the industrial areas of Stourton and Hunslet, just north of the M621. The spur rises onto viaduct past Pottery Field into an elevated station over the River Aire, which will be integrated with the existing Leeds station.

Aerial view of Leeds City Centre



10. EASTERN LEG, SUMMARY OF IMPACTS BY TOPIC

10.1. Planning and development

- 10.1.1. The route would pass through or near to several major development sites, which could introduce large new areas of proposed housing or other development projects (including new infrastructure) between now and the time HS2 is operating. These developments may be directly affected, although those around stations could well benefit from the proximity of HS2.
- 10.1.2. For each of the development sites potentially affected, HS2 Ltd would work with relevant local authorities and the affected developers or promoters to determine how potential impacts might best be managed and how potential co-location opportunities could be maximised.

10.2. Employment and housing

- 10.2.1. The introduction of HS2 stations could have a positive effect on the surrounding areas, as people and businesses realise the opportunities of living and working close to the high

speed network. The AoS estimated the likely number of additional jobs and houses potentially supported by HS2 around proposed stations.

- 10.2.2. HS2 could support up to an estimated 29,700 jobs and 4,950 homes around the two stations on the eastern leg. The employment figure takes account of jobs displaced by demolitions, although it is expected that the majority of these would be able to relocate in the local area or region.

10.3. Property and community integrity

- 10.3.1. The eastern leg could result in the demolition of an estimated 144 dwellings, most of which are either at or approaching East Midlands Hub station where there are 76 residential demolitions. It is estimated the route could also result in the additional demolition of approximately 16 dwellings at the Shimmer housing development in Mexborough, which is partially occupied and under construction. This is based on site plans provided by the Developer and based on the operational footprint of the railway at this stage of design.
- 10.3.2. The proposals would also require the demolition of an estimated two community facilities (including a bingo hall in Leeds), 108 commercial properties and eight industrial properties. The route could also result in the isolation of an estimated 210 residential properties.

10.4. Access issues

- 10.4.1. The HS2 stations would provide an important interchange hub with other transport systems, including railways, trams, roads, airports, cycleways and footpaths. The East Midlands Hub would include platforms for conventional rail services allowing direct transfer of passengers for connections with Nottingham, Derby and Leicester, and other stations in the East Midlands. The HS2 station in central Leeds would be adjacent to the existing station which would allow connections with the existing rail network. The station would be serviced by two concourses on either side of the River Aire. Pedestrian access would be via both concourses.
- 10.4.2. The eastern leg would cross 11 long distance footpaths, some of which would be crossed at more than one location, and six national cycle routes. Access along all public rights of way is likely to be maintained 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 achieving this where feasible. A detailed appraisal of all access crossings will be undertaken as part of the EIA.

10.5. Health, well-being and equality

- 10.5.1. The AoS included separate appraisals on health and well-being, and on equalities. These studies each considered how impacts of the scheme might affect certain groups of people more acutely than it would the population as a whole. The health appraisal matched general impacts from the scheme with areas of higher health deprivation. This revealed general areas in and around Rotherham, Doncaster, Barnsley, Wakefield and Leeds with populations relatively more vulnerable both to potential negative health effects (for example due to displacement of jobs, noise and demolition of housing and community facilities); and potential positive health effects (for example due to improved access to employment, new housing and access to transport).
- 10.5.2. Separate equality analysis was undertaken to indicate the extent to which groups vulnerable to discrimination and social exclusion may be affected by the preferred scheme to a greater degree than the population in general. Different priority equality groups were identified along the route.

- 10.5.3. Potential adverse effects were identified at Long Eaton and Broxtowe as a result of potential demolitions to commercial property leading to job loss.
- 10.5.4. Potential beneficial equality impacts were identified around Leeds station as a result of new local jobs and housing. Potential adverse impacts may occur due to the demolition of housing and commercial, retail and industrial property.

10.6. Noise and vibration

- 10.6.1. The noise specialists have worked closely with the scheme engineers to determine (at this stage of design) the feasibility of introducing noise barriers. This should substantially reduce the number and extent of noise impacts reported at this early stage. With the additional mitigation, the number of dwellings predicted to have noise impacts from HS2 along the eastern leg is estimated at 4,500.
- 10.6.2. Later assessment as part of the EIA will provide a more in-depth understanding of noise impacts along the route, including generation of noise contour maps. This will allow for more specific mitigation measures to be developed and incorporated into the design.

10.7. Air quality

- 10.7.1. The East Midlands Hub would be located within or near to areas currently identified as having poor air quality. Other areas of poor air quality are located in the vicinity of the M1. Any additional road traffic to these places, either during construction or operation of HS2, could exacerbate local pollution levels if no air quality improvements have been implemented by local authorities by that time. In developing scheme proposals, it would be necessary to comply with EU law on ambient air quality. This would be considered further as part of the EIA.
- 10.7.2. On a larger scale, HS2 could result in air quality improvements as people switch from cars to rail, although this has not been determined at this stage.

10.8. Landscape and visual impacts

- 10.8.1. The eastern leg would have no direct or indirect impacts on nationally designated landscapes. Considerable parts of the route would have only slight landscape or visual impacts, successfully avoiding important landscape and visual amenity resources. Examples include many parts of the route between Marston and Tonge; much of the alignment from Nuthall to south of Tibshelf; Swillington to Micklefield; and the approach into Leeds station between the M1 and Hunslet.
- 10.8.2. Key landscape and visual impacts are likely to affect:
- the landscape at the northern edge of Kingsbury Water Park affecting visitors to Alder and Sandy Pool areas;
 - residents of Kingsbury and Holt Hall Farm and residents at Whateley village;
 - views from Pooley Country Park, the Coventry Canal and the River Anker;
 - views from Appleby Parva and Appleby Magna;
 - residents on the western outskirts of Long Whatton;
 - views from the outskirts of Kegworth and users of the River Soar and Midshires Path;
 - the landscape of the Trent Valley south of Long Eaton and views near Trentlock affecting recreational users in the Erewash Valley and residents in Toton;

- views near Sandiacre affecting users of the Erewash Canal;
- landscape character and views where route is in deep cutting at Tibshelf;
- the landscape at Barrow Hill, associated with the footprint of Staveley Depot;
- views from the Dearne Way towards the viaduct and embankments over the River Dearne affecting recreational users and residents;
- landscape setting of the Hickleton village and parkland;
- landscape setting at Barnburgh;
- landscape setting at Nor Wood and Aston;
- landscape character where route passes between New Crofton and Nostell Priory;
- views from the Aire and Calder Navigation, the Trans Pennine Trail and Leeds Country Way where route crosses the Calder and the Aire valleys; and
- the historic townscape and views where the new Leeds station spans the River Aire.

10.8.3. These conclusions are based on a level of scheme design that does not yet include specific mitigation. As the design progresses, these and other potential impacts are likely to be reduced through the incorporation of a range of landscape mitigation measures.

10.9. Cultural heritage

10.9.1. The eastern leg has been selected and aligned so that it would have few impacts on designated heritage assets. It would avoid physical impacts on most of the more significant designated features, including Registered Battlefields and Grade I and II* listed structures. The route has been aligned so that it avoids all physical impacts to Registered Parks and Gardens, and effects on the settings of those it passes would be generally low.

10.9.2. The majority of effects are expected to be negligible or minor at most. Potentially greater impacts would include:

- direct impacts on the below ground remains of the Scheduled Roman site at Ratcliffe on Soar, and impacts on the settings of three other Scheduled sites;
- potential demolition of four Grade II listed structures; and
- direct impacts on four Conservation Areas.

10.9.3. Many of these potential impacts would occur over several kilometres north of Tibshelf. Given the historic sensitivity of this area, the route has been closely aligned with the M1, and this would be instrumental in helping to limit the potential impacts of the scheme, although further focus will need to be applied to the design through this area.

10.10. Biodiversity and wildlife

10.10.1. The route would pass over the River Mease, a European protected Special Area of Conservation and a SSSI. HS2 Ltd has worked closely with Natural England and the Environment Agency to determine the alignment and provisional design here, which will continue to be developed at the next stage of design to ensure that there would be no adverse impacts on these areas.

10.10.2. The route would pass through the south-western extremity of Park Forest, which is part of Sherwood Forest in Nottinghamshire. Park Forest has been identified by Natural England

as an area that could support nightjar and woodlark. Ongoing liaison with Natural England will be required as the project progresses to better understand impacts in this area.

- 10.10.3. The route would pass through the narrowest part of Bogs Farm Quarry SSSI, east of the M1 at Selston. Design work will continue to seek effective mitigation by minimising landtake and hydrological impacts at this site. The preferred scheme would also pass near several other SSSIs, although it is most probable that careful design and construction would effectively mitigate potential impacts.
- 10.10.4. The scheme would have direct impacts on an estimated 18.5km of key habitat, including six woods listed on the Ancient Woodlands Inventory. Two Local Nature Reserves would be directly affected.
- 10.10.5. As part of the later EIA work, a package of mitigation and enhancement measures will be developed to address the impacts on habitats and species. Such measures would seek to address both the direct impacts on designated sites, and to reflect the wider strategic ecological priorities of affected areas.

10.11. Water resources and flood risk

- 10.11.1. The preferred scheme would cross a network of watercourses of varying size. In a small number of cases this may necessitate a diversion or modification to the river channel. In total, the eastern leg would cross major rivers at 19 locations, including multiple crossings of the River Erewash and River Calder. The eastern leg would also involve 253 crossings of minor rivers and 11 of navigable waterways. Further design will seek to avoid the need for diversion and to explore opportunities for environmental enhancement.
- 10.11.2. The preferred scheme could exacerbate flood risk where it crosses designated flood zones. Across the route, 27 floodplains are crossed for more than 100m. Generally it has been assumed that viaducts or a clear-span bridge would be used. However, at a later stage, each crossing will be examined in more detail to determine the most appropriate form of alignment. In addition, there would be flood risks associated with the East Midlands Hub station and Leeds station.

10.12. Land use resources

- 10.12.1. High level agricultural land classification maps show that no Grade 1 agricultural land would be directly affected by the eastern leg. An estimated 28km of the route would be through Grade 2 agricultural land. More in-depth assessment of the impact on farm holdings will take place in due course, as part of the EIA.
- 10.12.2. Of the seven active (operational) and 46 disused (non-operational) landfill sites that would be close to the preferred route, higher risks were identified for four operational sites and 15 of the disused sites, based on the type and length of crossing, the size of the landfill and its recorded contents. The design of the route through these areas would need to ensure that potential impacts from possibly contaminated materials are fully mitigated.

10.13. Excavated materials and material resource

- 10.13.1. The current estimate for excavated material arising on the western leg is 13.6 million cubic metres, although this does not take account of the probable high proportions of materials likely to be incorporated within the scheme for the creation of embankments, landscaping and bunding.

10.13.2. The estimated quantities of bulk building material required for the scheme would comprise about 327,000 tonnes of steel and about 2,601,000 tonnes of concrete.

11. ROUTE WIDE ISSUES

11.1. Carbon emissions

11.1.1. Over the construction and the first 60 years of operation of HS2, it is likely that carbon savings would come about as people switch from other transport modes with higher carbon emissions, and as released capacity on existing railways is taken up by new passenger and freight services instead of road vehicles. These changes would be less than the carbon emissions resulting from mainly the construction phase. This will depend on the final design for the scheme which for Phase 2b is currently at a preliminary level of detail.

11.1.2. Over the full lifetime of the scheme, assumed to be 120 years, HS2 would continue to give rise to net carbon reductions from its operations, as well as to carbon increases due to ongoing maintenance, repair and replacement of infrastructure. As a result, the overall carbon trend for HS2 could be a net carbon reduction over its design life, even if a higher value of construction emissions is assumed.

11.2. Climate resilience

11.2.1. Consideration of the resilience of the preferred scheme to the wider effects of climate change will be addressed in due course as part of the EIA. However, HS2 Ltd is committed to ensuring this resilience is considered within the design: one of the seven themes of its Sustainability Policy is to: "Build a network which is resilient for the long term and seek to minimise the combined effect of the project and climate change on the environment".

11.3. Safety

11.3.1. The introduction of HS2 would increase the choices that people make to travel between locations. Different modes of transport have varying degrees of risk levels associated with them due to the different hazards associated with each mode. Statistical evidence on injury and fatality rates shows that travel via rail or air is generally several times safer than travelling by road.

11.3.2. The introduction of HS2 would offer an alternative mode of rail transport, which some people are expected to choose for certain journeys. If there are more people choosing to travel by rail than by air or by road, this would produce an overall shift in the risk levels to which these people are exposed and thus result in a change in overall safety. Therefore HS2 could have a positive impact on safety.

11.4. Wider economic issues

11.4.1. HS2 would represent a major transformation in the UK rail network and capacity, and a significant public investment in national infrastructure. Such projects have the capacity to transform areas, driving longer-term shifts in economic performance and potentially altering the shape of economic geography.

11.4.2. The potential benefits from HS2 would result from:

- Improved access to markets, with businesses having better access to a wider range of potential customers, suppliers and labour.
- Increased trade and competition, with new opportunities for increased trade and competition between local and regional markets, as well as for wider export.

- Change in business behaviour leading to potential efficiency gains.
- Improved employment opportunities, by giving more people access to a wider range of jobs.

12. SUMMARY OF IMPACTS

12.1.1. To provide an understanding of the overall sustainability performance of the Phase 2b preferred scheme, the *Sustainability Statement including Post Consultation Update*, includes a summary of the potential combined impacts for the eastern and western legs, focusing on the appraisal categories that can be more easily quantified based on current design. Some of the details will change as further refinements and mitigation are introduced. **Table 12-1** presents a selection of the appraisal categories; other topics are covered in the full cumulative impact table, and the full summary table contained in the Sustainability Statement. The Sustainability Statement also considers HS2 combined impacts, that is, combined impacts from Phase One, Phase 2a and Phase 2b.

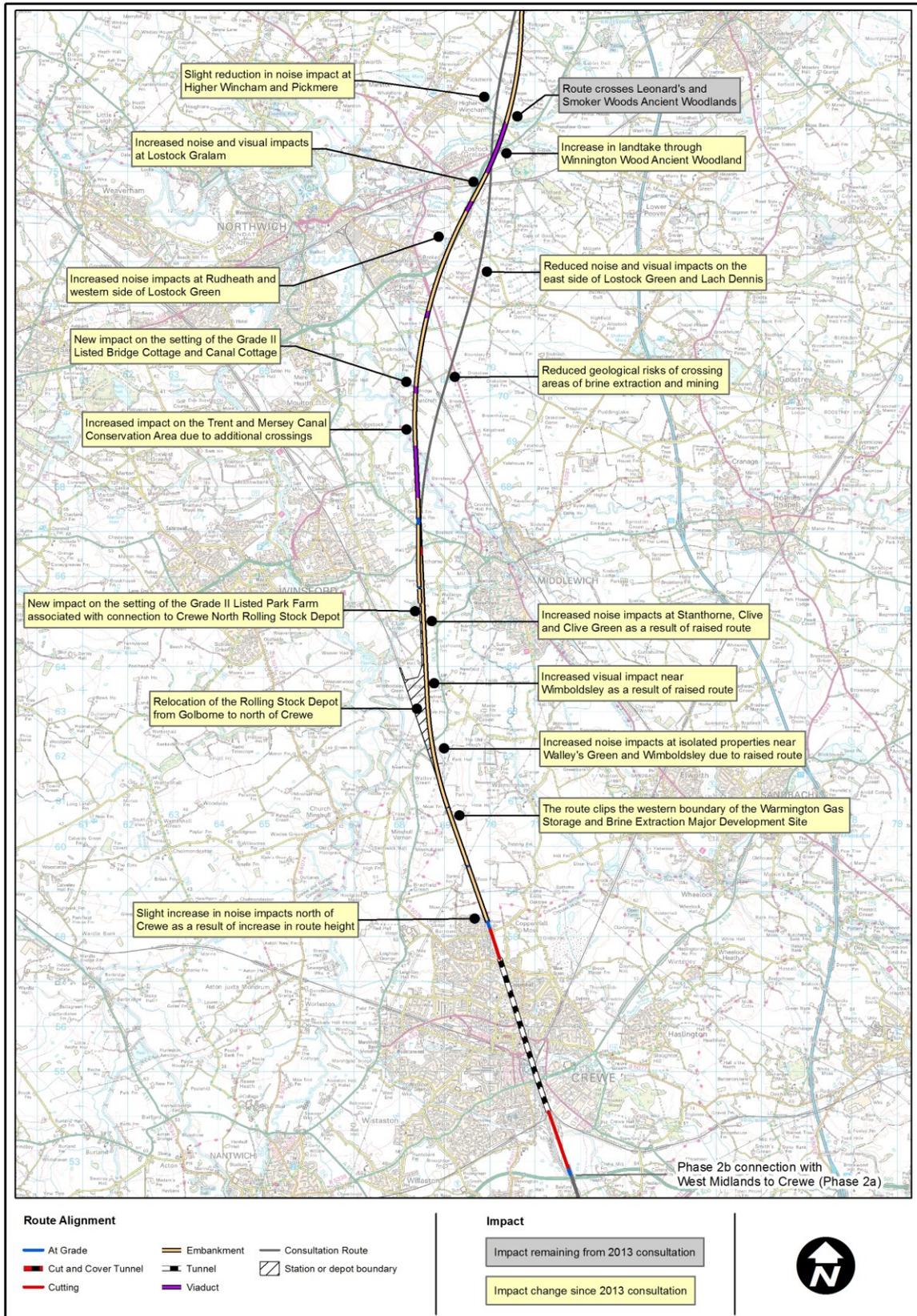
12.1.2. As summarised in this document, the Phase 2b scheme would have no direct impacts on Areas of Outstanding Natural Beauty (AONBs), Registered Battlefields, Grade I and Grade II* structures, Registered Parks and Gardens and Natura 2000 sites.

Table 12-1 Summary of the Phase 2b Preferred Route Impacts

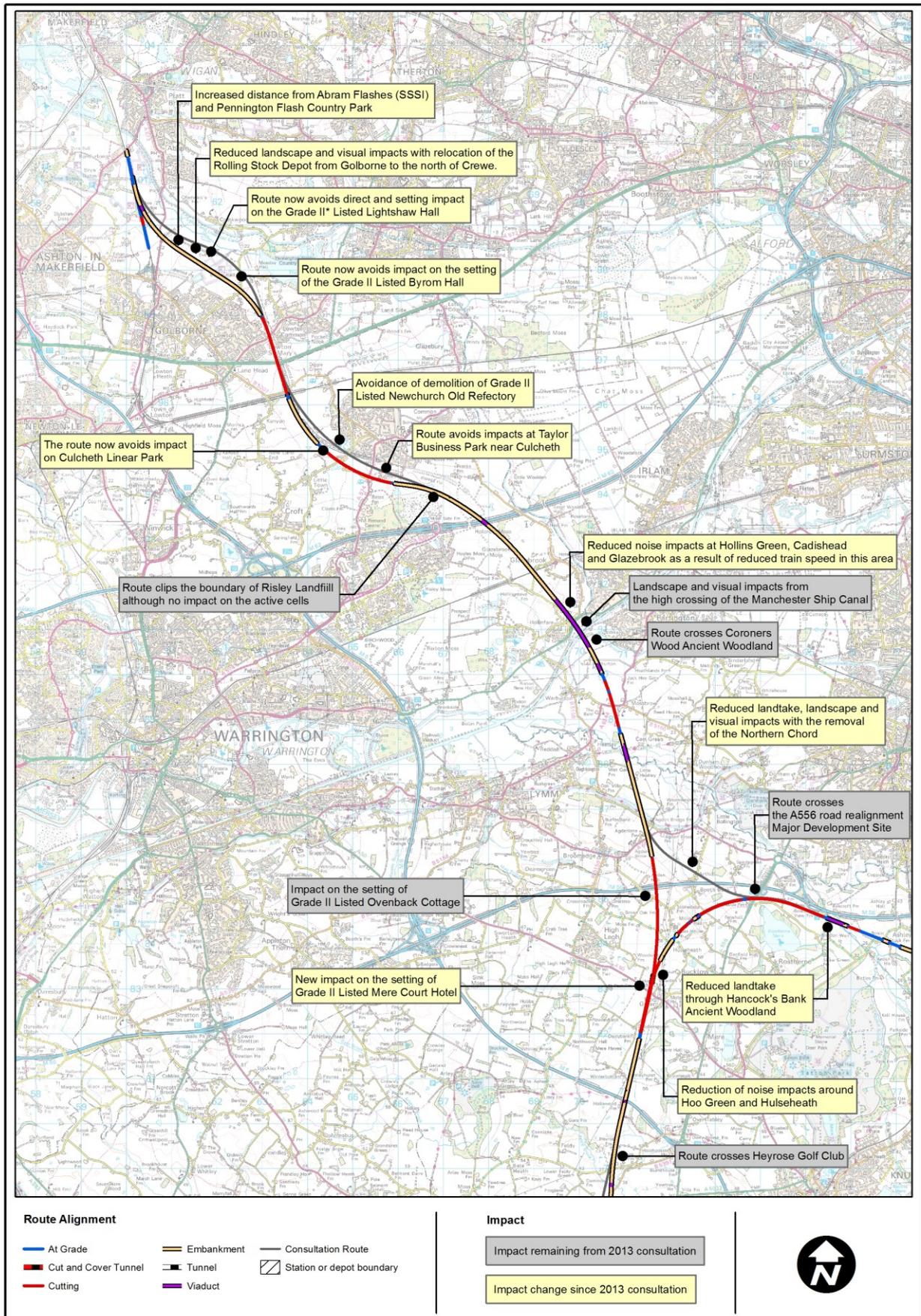
	Phase Two: Western Leg Consultation Route	Phase 2b: Western Leg Preferred Route	Phase Two: Eastern Leg Consultation Route	Phase 2b: Eastern Leg Preferred Route	Phase 2b: Preferred Route Total
Route length (km)	87.9	81.5	184.8	197.8	279.3
Total demolitions	221	206	279	262	468
Demolitions (residential)	121	111	139	144	255
Dwellings within 100m	600	600	3,300	1,900	2,500
Jobs supported	30,000 - 43,600	30,000 - 43,600	18,700 – 26,700	21,200 - 29,700	51,200 - 73,300
Potential dwellings subject to noticeable noise increase with additional mitigation	600	1,100	7,800	4,500	5,600
AONB crossed at surface (km)	0	0	0	0	0
Scheduled Monuments directly affected	0	0	1	1	1
Listed structures directly affected	3	2	5	4	6
SSSIs directly affected	0	0	1	1	1
Ancient Woodlands directly affected	4	4	9	6	10
Major rivers diverted	0	3	5	1	4
Excavated material (million cubic metres)	8.0	2.4	12.4	13.6	16.0
Concrete (thousand tonnes)	2,284	2,046	3,662	2,601	4,647
Steel (thousand tonnes)	221	187	410	327	514

13. SUMMARY OF CHANGES FROM CONSULTATION SCHEME 2013

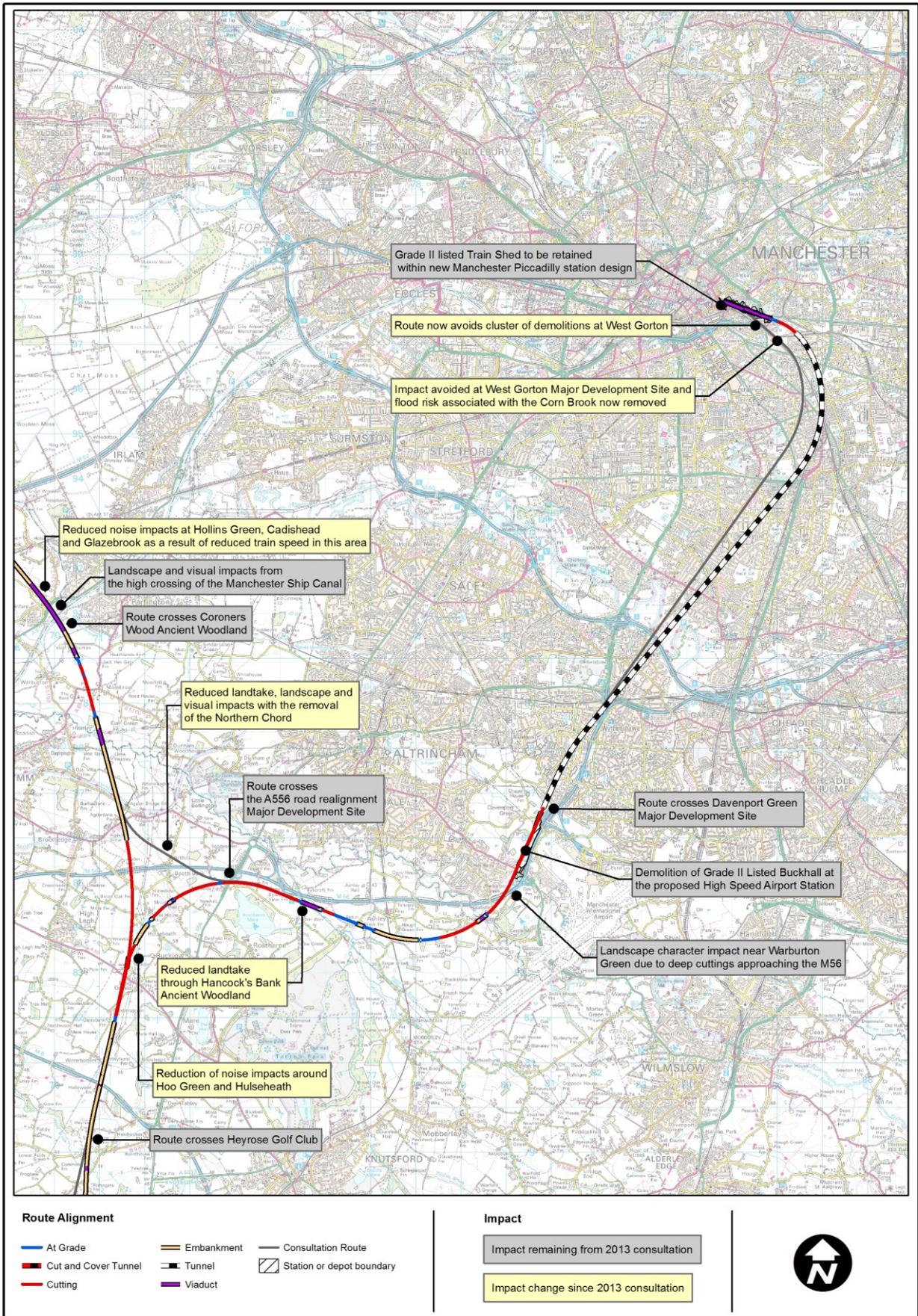
Western Leg Summary Map (1 of 3 Crewe to Winterbottom)



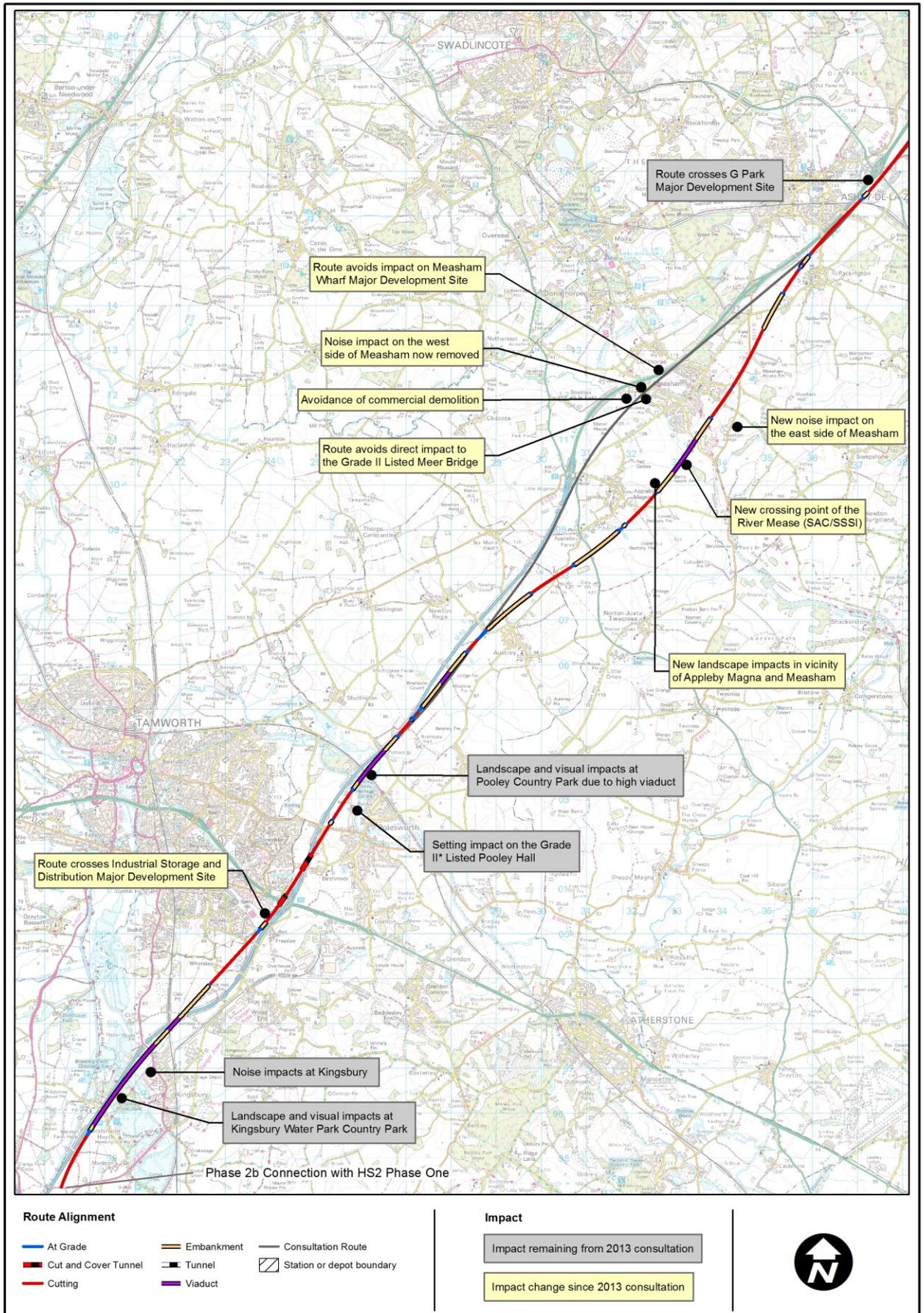
Western Leg Summary Map (2 of 3 Winterbottom to Golborne)



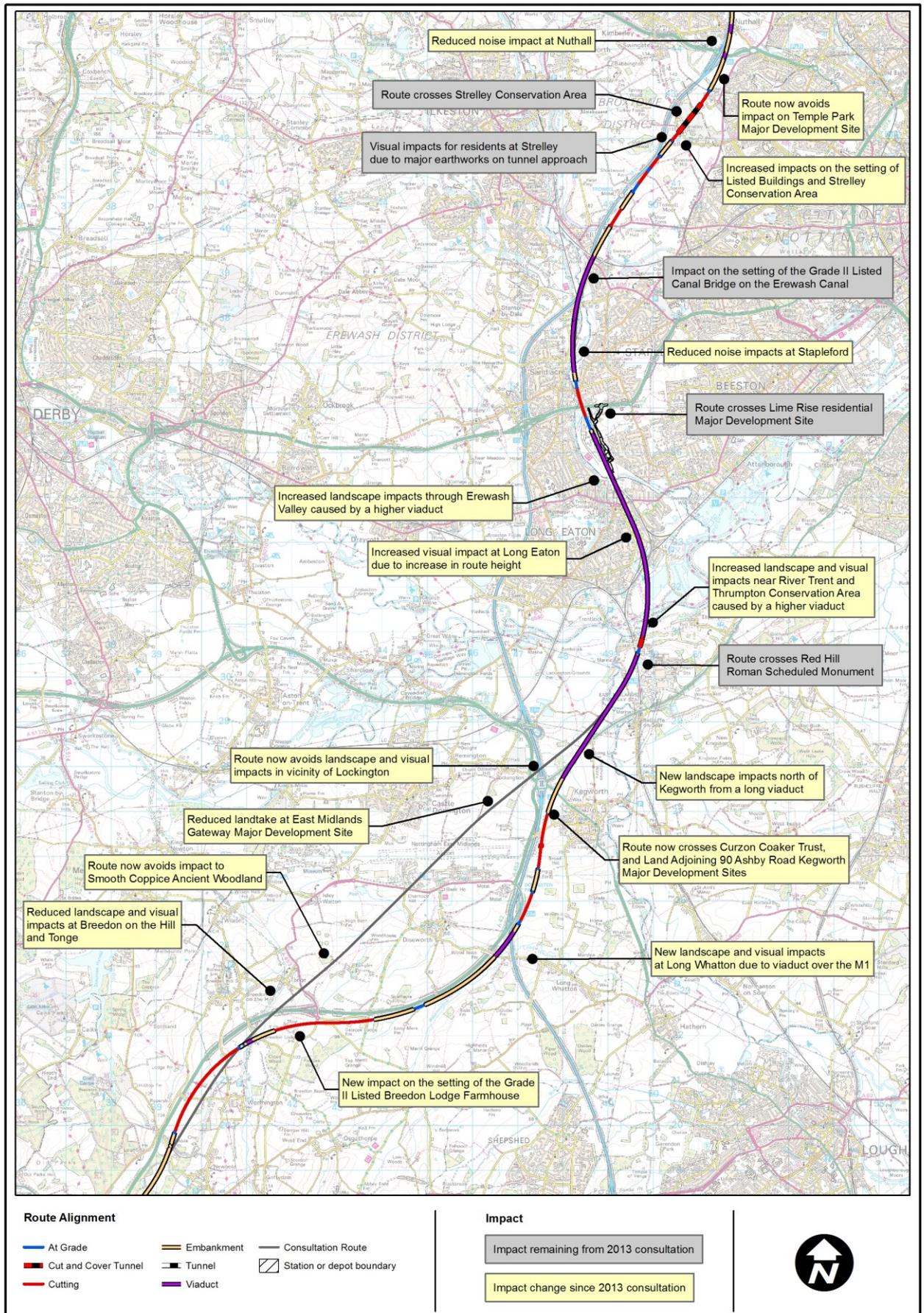
Western Leg Summary Map (3 of 3 Winterbottom to Manchester Piccadilly)



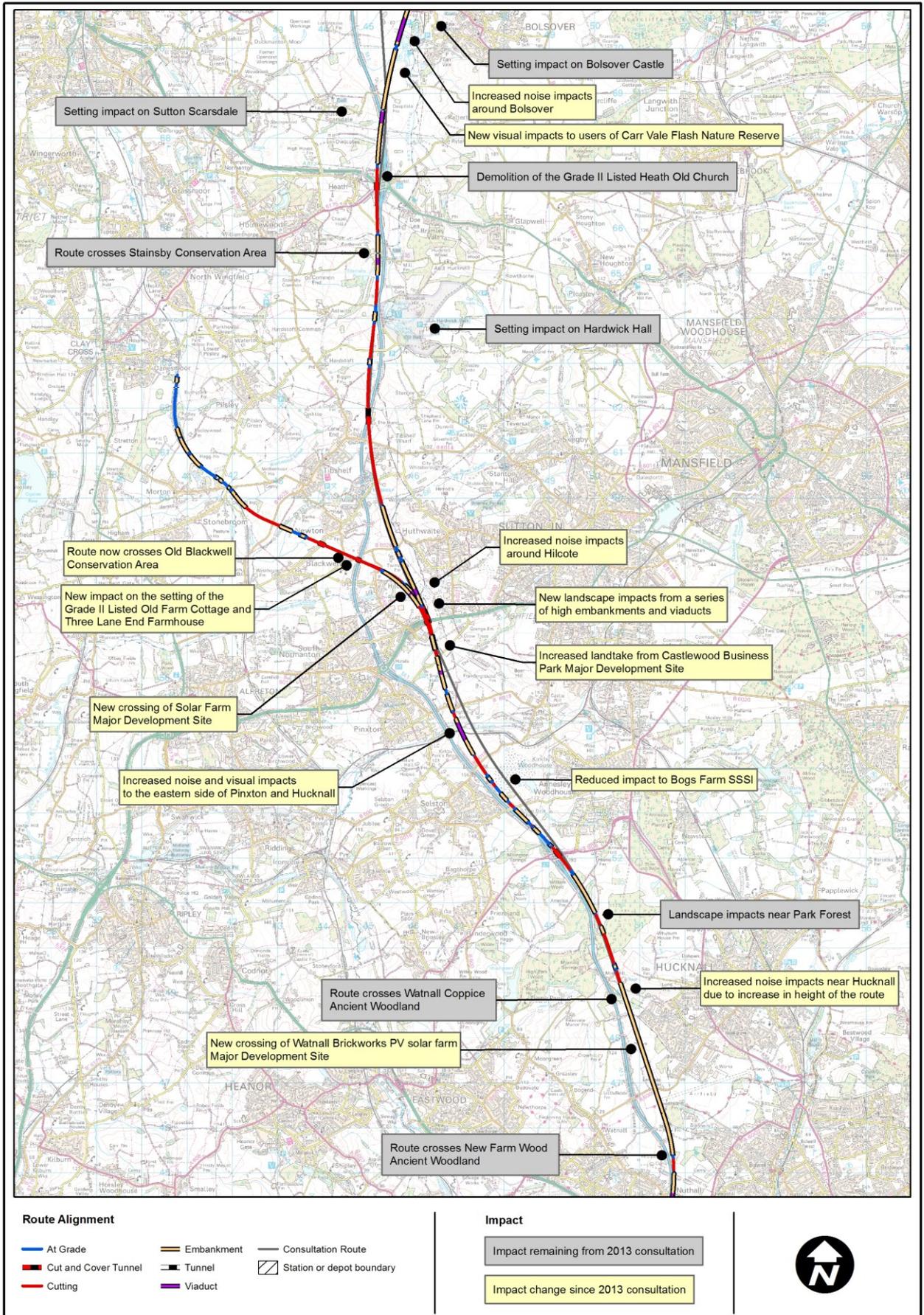
Eastern Leg Summary Map (1 of 6 Marston to Ashby-de-la-Zouch)



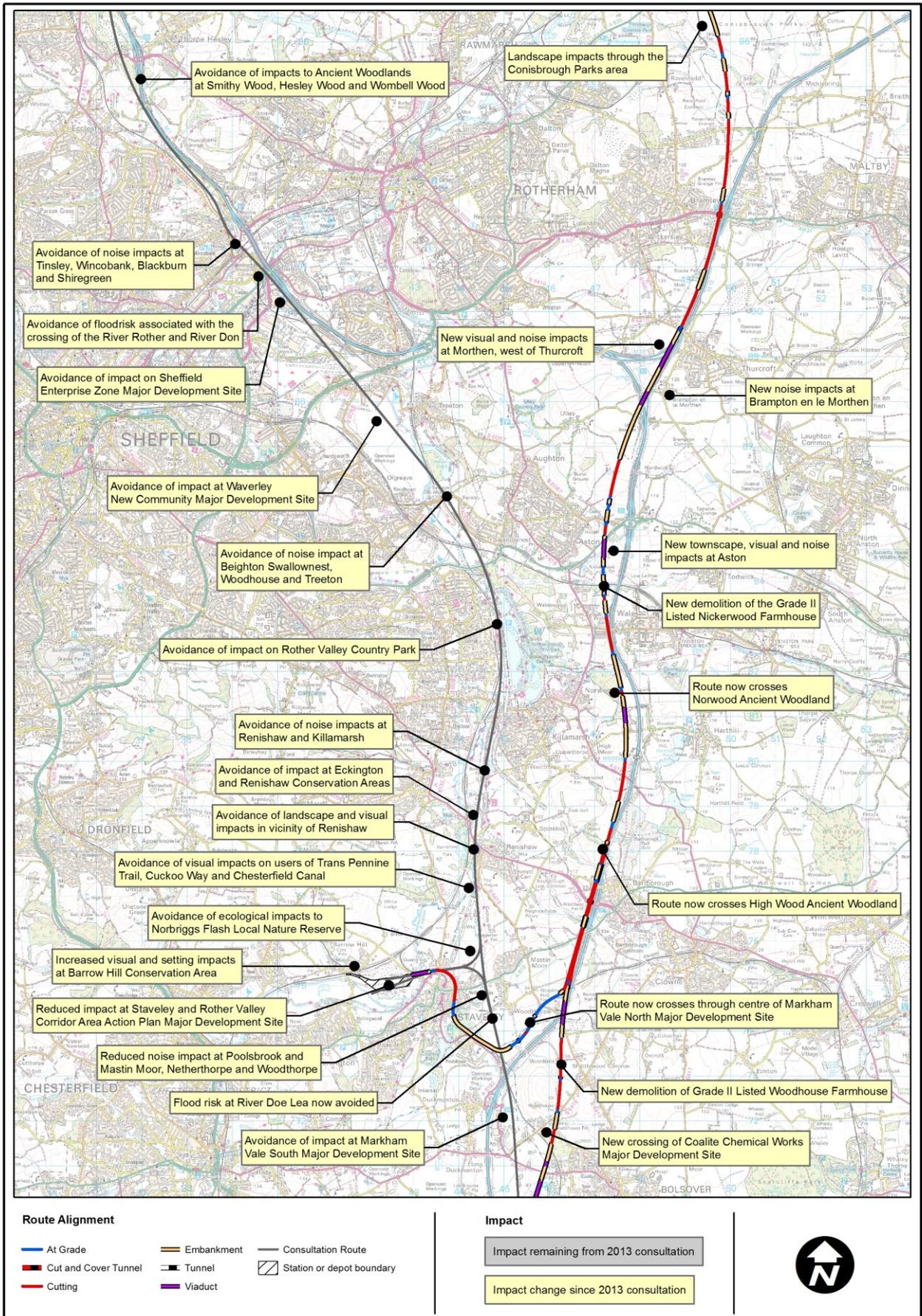
Eastern Leg Summary Map (2 of 6 Ashby-de-la-Zouch to Nuthall)



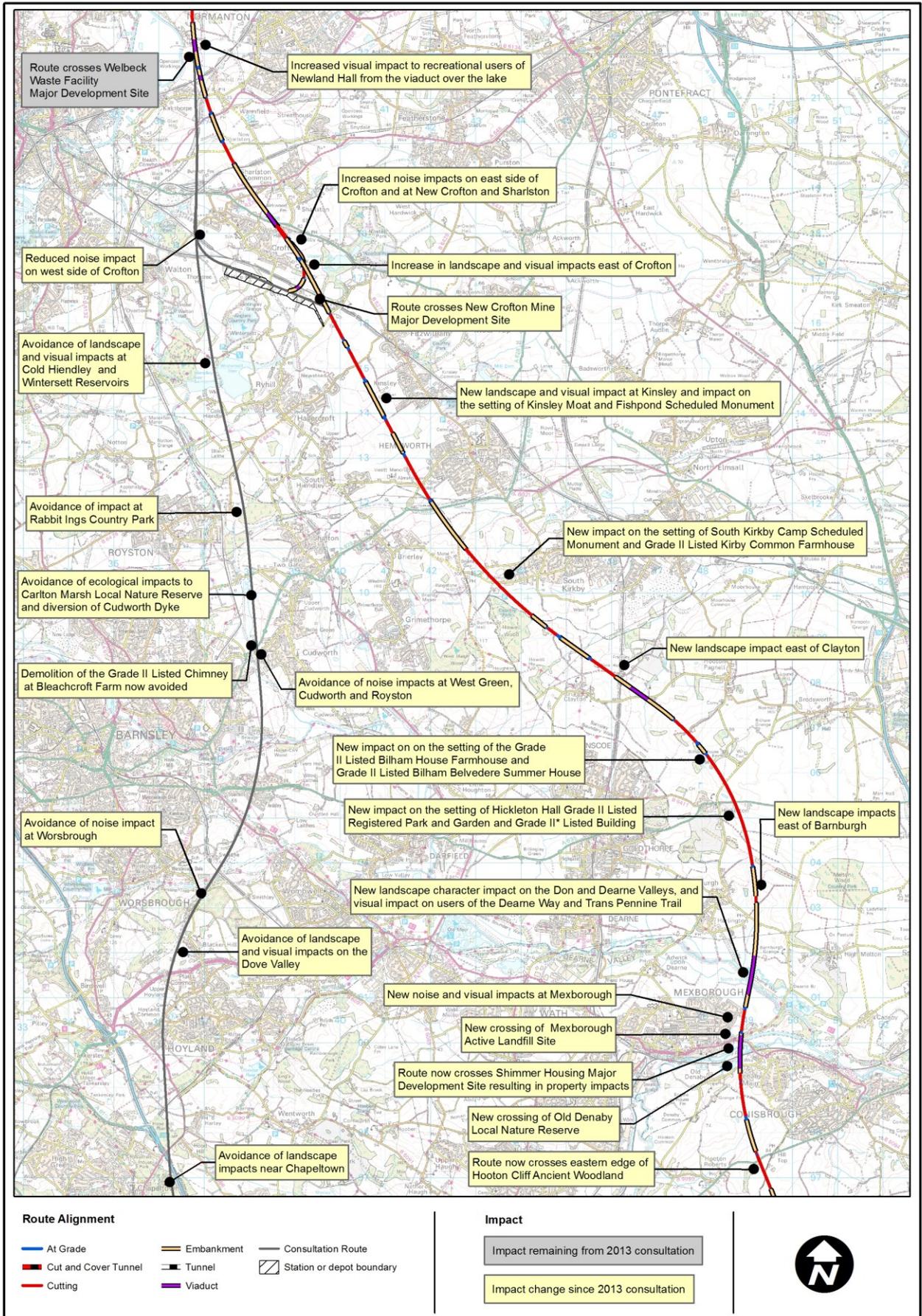
Eastern Leg Summary Map (3 of 6 Nuthall to Bolsover)



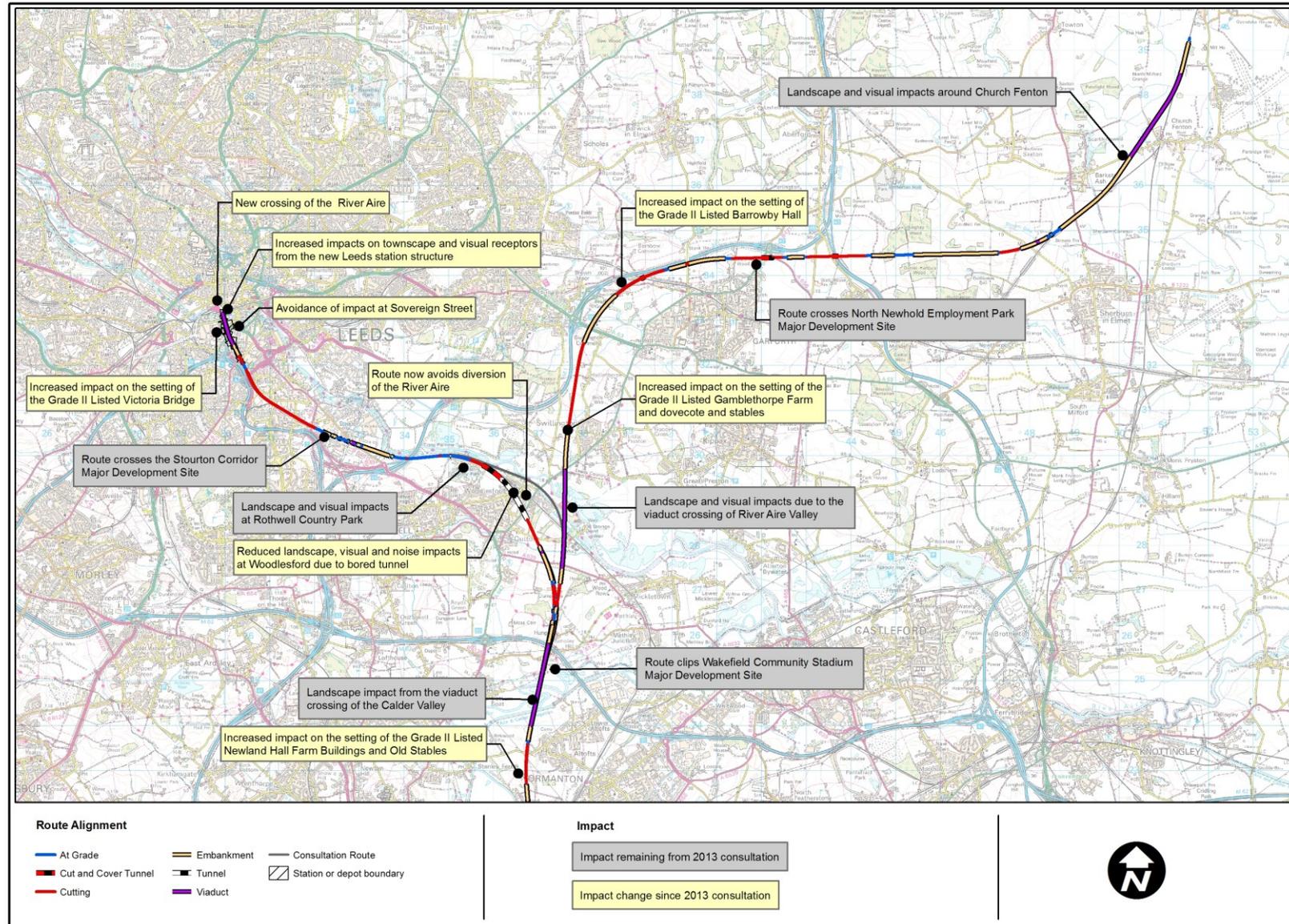
Eastern Leg Summary Map (4 of 6 Bolsover to Conisbrough)



Eastern Leg Summary Map (5 of 6 Conisbrough to Normanton)



Eastern Leg Summary Map (6 of 6 Normanton to Leeds and Church Fenton)





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