TRANSPORT AND WORKS ACT 1992

Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006

THE NETWORK RAIL (EAST WEST RAIL WESTERN SECTION PHASE 2) ORDER

DRAFT ENVIRONMENTAL STATEMENT

CHAPTER 3: CONSIDERATION OF ALTERNATIVES

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3. CONSIDERATION OF DESIGN ALTERNATIVES AND DESIGN EVOLUTION

3.1 Introduction

3.1.1 The Application Rules require an Environmental Statement to provide:

"an outline of the main alternatives studied by the Applicant and an indication of the main reasons for his choice, taking into account the environmental effects".

3.1.2 Environmental and wider sustainability issues have been a material consideration in the design development and option selection process. The EIA methodology and a range of tools and processes are being applied throughout the design process, from feasibility to preliminary design, thereby achieving a continuous process of iterative design improvement with respect to the environment. However, there are aspects of EWR2 where more discrete alternatives have been considered, at the project, as opposed to, the strategic level. In addition, there are also some aspects of EWR2 where alternatives could not be considered.

3.1.3 This chapter therefore sets out the following:

- The design process in relation to environmental aspects and the evolution of EWR2, using EIA and sustainability decision support tools;
- Those aspects of EWR2 where more discrete alternatives were considered, the main choices and reasons these have or have not been selected in relation to environmental considerations;
- Consideration of the option to 'do nothing'; and
- Information in relation to those aspects of EWR2 where no alternatives could be considered.

3.2 Background

Drivers for EWR2

3.2.1 The expected growth in demand for housing and employment within the EWR corridor will increase travel demands in an area where the existing transport networks are straining to accommodate current travel needs.

3.2.2 The car is currently the dominant form of travel in the area, particularly for east-west journeys. There is a lack of viable public transport alternatives,

arising from both a lack of infrastructure and suitable services, which further encourages car use in the area. The existing highway networks are already under pressure from congestion and it is not sustainable for increasing travel demand associated with the growth potential for the area to be met solely by increasing car use.

3.2.3 There are also environmental issues associated with high volumes of road traffic such as emissions of harmful air pollutants, noise and restricted travel options for journeys affected by time or mobility constraints. Also, the lack of rail connectivity and east-west rail links, combined with increasing highway congestion currently limits the labour market in terms of employment destination options.

Strategic Considerations

3.2.4 A series of business cases prepared in 2011, 2014 and 2015[16] have shown the benefits that will arise from EWR2 in relation to public spending, employment, contribution to public finances, infrastructure investment, local journeys and local connectivity. The benefits from EWR2 have been further endorsed by the National Infrastructure Commission (NIC) in their 2016 interim report on the Cambridge-Milton Keynes-Oxford corridor[17].

3.2.5 There are also environmental and long term sustainability benefits associated with EWR2:

- It makes use of existing railway land and infrastructure;
- It provides a sustainable transport solution, which also contributes towards a more efficient and modern railway network nationally;
- It will facilitate a modal shift (370,000 car journeys annually, based on preliminary modelling undertaken by the DfT), as a result of EWR2 will reduce highway congestion, improve local air quality and greenhouse gas emissions. The modelling used to provide this provisional figure will be subject of on-going refinement and will be updated for the final ES;

[16] http://www.eastwestrail.org.uk/business-case/

[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/569867/Cambridge-Milton_Keynes-Oxford_interim_report.pdf

- It creates flexibility and more journey options in relation to both transport type and destinations at the local and regional level for all levels of mobility and socio-economic movements (e.g. employment, education, health);
- It provides improved accessibility and inclusivity of station and rail services; and
- Added resilience of the transport network to climate change.

3.3 The 'Do Nothing' Alternative

Introduction

3.3.1 An important part of the EIA process is to consider the 'do-nothing' scenario i.e. what would occur if the proposed development did not go ahead. Under the 'do-nothing' scenario, the environmental baseline would remain unchanged in that there would be no physical changes to the environment arising from the Project, whether positive or negative.

3.3.2 Descriptions of the existing environmental baseline are included in the technical chapters 6 to 14. In addition, Chapters 9 (Ecology), 10 (Noise and Vibration) and 12 (Landscape and Visual Impacts) consider the 'future baseline' which sets out the likely baseline environmental conditions that would be present without the Project but at the time the Project would be constructed and operational.

3.3.3 In general terms, however, the following paragraphs summarise the broader future baseline context that would be expected were the Project not to go ahead.

Future Conditions

3.3.4 As set out in the previous section, the existing transport network around the Project Area suffers from high traffic demand and a lack of alternative modes of off-highway transport[18]. Without the strategic alternative provided by a railway development, the existing highway network would be required to support all transport requirements for the area. Given the expected population and economic growth in the area, traffic levels in the 'do-nothing' scenario are likely to increase pressure on the existing

[18] http://www.eastwestrail.org.uk/business-case/

highway network. This would lead to a worsening of environmental impacts associated with air quality, noise, traffic, access to employment and public services, and climate change. Further road network capacity expansion would be the only other alternative to manage these effects, which is environmentally less preferable. Under the 'do nothing' scenario, the benefits of the proposed Project would not be realised; among them, the improved public transport connectivity manifesting through increased capacity, reduced journey times, a higher frequency and greater reliability of services. In addition, an important opportunity to help stimulate the economy and facilitate the development of sustainable communities in the area would be lost.

3.4 No Alternatives Considered

3.4.1 Whilst environmental considerations are being taken into account at the project level throughout the design development process (as set out in Section 3.5), in some instances, at a project level, it has not been possible to consider a series of alternatives and their environmental effects, whether because optioneering has been constrained by outside factors, or due to other criteria being the leading determinant between different options. Section 3.6 sets out where alternatives could and could not be considered in relation to specific elements of the Project.

3.5 Consideration of Alternatives

Location

3.5.1 Identifying practical alternative locations for a linear project, such as the Project, which is part of a wider programme of network improvements, is subject to constraints. The limits to these alternatives received Government recognition in the December 2014 National Policy Statement for National Networks (NPS)[19]. The NPS acknowledges linear infrastructure, such as rail developments, differ from other types of infrastructure for several reasons:

[19] https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

- "These networks are designed to link together separate points. Consequently, benefits are heavily dependent on both the location of the network and the improvement to it.
- Linear infrastructure is connected to a wider network, and any impacts from the development will have an effect on pre-existing sections of the network.
- Improvements to infrastructure are often connected to pre-existing sections of a network. Where relevant, this may minimise the total impact of development, but may place some limits on the opportunity for alternatives."

3.5.2 The NPS urges decision-makers to bear in mind these conditions when evaluating such developments. These conditions not-withstanding, the Project is still required to comply with the EIA Directive with regards to the consideration of alternatives, as addressed in this chapter.

3.5.3 Once the strategic decision was taken to progress with a programme of rail improvements within the east-west growth corridor and that these improvements were to incorporate EWR Phase 1, a clear requirement was set out to restore services along and improve the capacity of the existing railway between Bicester, Bedford, Milton Keynes and Princes Risborough.

3.5.4 Any alternatives to this would constitute almost entirely green field development and would therefore be likely to have greater environmental effects.

Scale

3.5.5 The outer limits of the Project are also pre-determined. In order to realise the benefits of the proposals, physical improvements would be required, to some extent, along the existing railway between Bicester, Bedford, Milton Keynes and Princes Risborough.

3.5.6 Within these physical requirements, a series of options have been developed for consideration by the DfT as part of NR's management and project control process, known as Governance for Railway Investment

Projects (GRIP[20]) stages. This feasibility stage for the Project, GRIP 2, developed different service or timetable options that the Project could deliver i.e. the number and frequency of services.

3.5.7 These options can generally be described as:

- Do nothing (the implications of which are set out in Section 3.3);
- Do something (in which a certain level of service provision could be achieved); and
- Do more (in which the maximum possible service provision could be achieved).

3.5.8 It should be noted that the condition of the existing railway and services required between these locations are not universal across the Project. The level of engineering works that would be required to deliver the Project would therefore also vary according to these existing conditions and service requirements.

3.5.9 In general terms, the greater the number and frequency of services to be provided, and therefore the greater the benefit afforded by the Project, the greater the infrastructure requirements (i.e. the scale or size). Several considerations have been taken into account by the DfT when considering which option to proceed with, including the benefits that could be achieved; this includes environment and sustainability factors as well as cost, safety, and engineering complexity.

3.5.10 Though environmental considerations are not the only determining factor between the options, the development of the options at this feasibility stage takes into account high level baseline information and risks/opportunities in relation to the environment.

3.5.11 The option selected is the 'do something' option. In terms of scale, and in accordance with the varying existing conditions and requirements across the Project, this means:

- Between Bicester and Bletchley, the existing railway is either life expired and redundant or, in some places, no longer in place. This

[20] The eight GRIP stages are: GRIP 1 – Output definition; GRIP 2 – Feasibility; GRIP 3 – Option Selection; GRIP 4 – Single Option Development; GRIP 5 – Detailed Design; GRIP 6 – Construction, test and commission; GRIP 7 – Scheme hand back and GRIP 8 – Project close out.

requires a greater level of intervention to reach the required standard through this stretch of the Project;

- Between Bletchley and Bedford, the existing railway is established and running passenger services. A lesser level of intermittent improvements would achieve the required standard;
- Between Claydon Junction and Aylesbury, the existing railway runs passenger services only to the south of Aylesbury Vale Parkway, whilst to the north of Aylesbury Vale Parkway the railway is maintained to the lowest serviceable condition for low speed freight trains; and
- Between Aylesbury and Princes Risborough, the existing railway is established and running passenger services, therefore requiring limited improvements.

Layout

3.5.12 With the location and the scale of the Project now determined, the next level of alternatives to be considered relates to the internal layout, for example in relation to the arrangement of bridges, footpaths, the new station at Winslow and environmental mitigation required to deliver the Project.

3.5.13 Even in this instance, there are some elements of the Project where layout is predetermined, such as in relation to works at existing stations (e.g. Aylesbury Vale Parkway and Bletchley).

3.5.14 The following sections set out the main alternatives considered.

Track

3.5.15 The track design is required to provide a layout sufficient to accommodate the required services as well as a vertical and horizontal alignment able to meet railway industry standards for safe railway operation.

3.5.16 The feasibility stage of the design explored the viability of different combinations of track layouts to meet the service requirements, given the relationship between alignment, line speed and journey time. The process consisted of an iterative period of design, taking account of a number of criteria, as opposed to the development and consideration of discrete layout options. The factors taken into account as part of this process included:

- Compliance with the need to deliver the required pattern of train services and journey times;
- Environmental constraints and design principles;
- Key stakeholder issues;
- Construction methodology and access;
- Capital cost; and
- Consents and land required.

3.5.17 The iterative design process considers a number of combinations of track layouts including, but not limited to:

- Whether to provide new single or double track railway in specific locations;
- Whether to retain existing track or replace with new components;
- The requirement for, and the optimum location for railway loops;
- The need to facilitate bi-directional travel;
- Development of new chords to provide additional connections between existing sections of track; and
- The implications of accommodating the desired line speed along specific sections of the track.

3.5.18 As mentioned in the 'Location' section of this chapter, the requirements at different locations within the Project differ depending on the condition of the existing railway and services required at these locations.

3.5.19 Table 3.1 briefly summarises the proposed track layout approach for each section of the Project, as well as setting out what alternative layouts have not been progressed with an explanation of the environmental aspects of the choice.

Table 3.1 Track Layout Alternatives

Section of Track	Proposed Layout	Layouts not taken forward	Environmental Aspects
Bicester to Bletchley	Provision of new double track	No change	The existing track, where it exists, is in poor condition and not suitable for use as a modern railway. In some parts of this section, there is no track at all. With these layouts, the environmental benefits from the Project
		Upgrade of existing layout	

Section of Track	Proposed Layout	Layouts not taken forward	Environmental Aspects
			could not be realised e.g. modal shift, sustainable transport.
		Provision of new single track	Whilst this layout could have fewer direct environmental impacts, the benefits of the Project would only be partially realised and would not provide a realistic sustainable transport option for the region.
Bletchley Flyover	Upgrade of existing layout	No change	Current infrastructure is insufficient to support required services and provide stops at Bletchley and Milton Keynes Central, continuing through to Bedford. The benefits of the Project would not be realised.
		Provision of new single track and chord connecting to West Coast Main Line at Denbigh Hall South Junction	Whilst this would theoretically provide more capacity, the timetable restrictions on the rest of the network would prevent this from being utilised. There would also be greater direct environmental impacts arising from land take requirements and the provision of additional infrastructure in an urban setting.
		Provision of new double track with two chords connecting at Denbigh Hall South Junction	
		Provision of new length of track from Bletchley Station to Wolverton Station	
Bletchley to Bedford	No change	Upgrade of existing layout	The existing infrastructure is sufficient to support the required services. Retaining the existing layout avoids direct environmental impacts associated with construction and land take, but may miss the opportunity to enhance certain aspects that could provide environmental benefits e.g. use of latest technology in railway systems could reduce noise emissions near residential
		Provision of new single track	

Section of Track	Proposed Layout	Layouts not taken forward	Environmental Aspects
			areas.
Bletchley to Bedford		Provision of new double track	Whilst this could theoretically provide more service capacity, the timetable restrictions on the rest of the network would prevent this from being utilised. There could also be greater direct environmental impacts arising from land take requirements and the provision of additional infrastructure.
Claydon Junction to Aylesbury	Provision of double track	No change	Current infrastructure and layout is insufficient to support required services. Whilst lesser works could avoid some environmental effects associated with construction and operation, this would prevent the environmental benefits associated with the Project being realised.
		Upgrade of existing layout	
		Provision of single track	Whilst this layout could have fewer direct environmental impacts, the benefits of the Project would only be partially realised and would not provide a realistic sustainable transport option for the region.
Aylesbury to Princes Risborough	No change	Upgrade existing layout	The existing infrastructure is sufficient to support the required services, which are not proposed to change from their existing pattern. Retaining the existing layout avoids direct environmental impacts associated with construction and land take, but may miss the opportunity to enhance certain aspects that could provide environmental benefits e.g. use of latest technology in railway systems could reduce noise emissions near residential areas.
		Provision of new single track	

Section of Track	Proposed Layout	Layouts not taken forward	Environmental Aspects
Aylesbury to Princes Risborough		Provision of new single track with passing places	This would require land take through urban centres and the compulsory purchase of residential and commercial properties and could lead to more direct environmental impacts. In addition, due to restrictions within the existing network, the service capacity delivered by such an intervention would not be fully utilised, as it is not proposed to increase services along this stretch of the Project.
		Provision of new double track	

3.5.20 In railway design, the track layout to some extent determines and limits the options for most other aspects of railway infrastructure, such as earthworks, drainage and signalling. For example, the vertical alignment of a section of track, which may be needed to achieve a desired line speed, will determine whether the railway is accommodated at ground level, in a cutting or on an embankment.

New station at Winslow

3.5.21 At Winslow, a new station is proposed and sustainability has been, among other considerations, material in the selection of the preferred location of the station site.

3.5.22 A number of sites were the subject of assessment. The options considered included those near existing roads, as locations remote from existing roads would entail considerable land take and cost for provision of new access. Each site also had to be adjacent to the existing railway. Figure 3.1 illustrates the sites that have been considered which are, from west to east:

- Site 1. Adjacent to Verney Road;
- Site 2. Adjacent to Furze Lane;
- Site 3. Adjacent to Buckingham Road;
- Site 4. Adjacent to Station Road; and
- Site 5. Adjacent to Little Horwood Road.

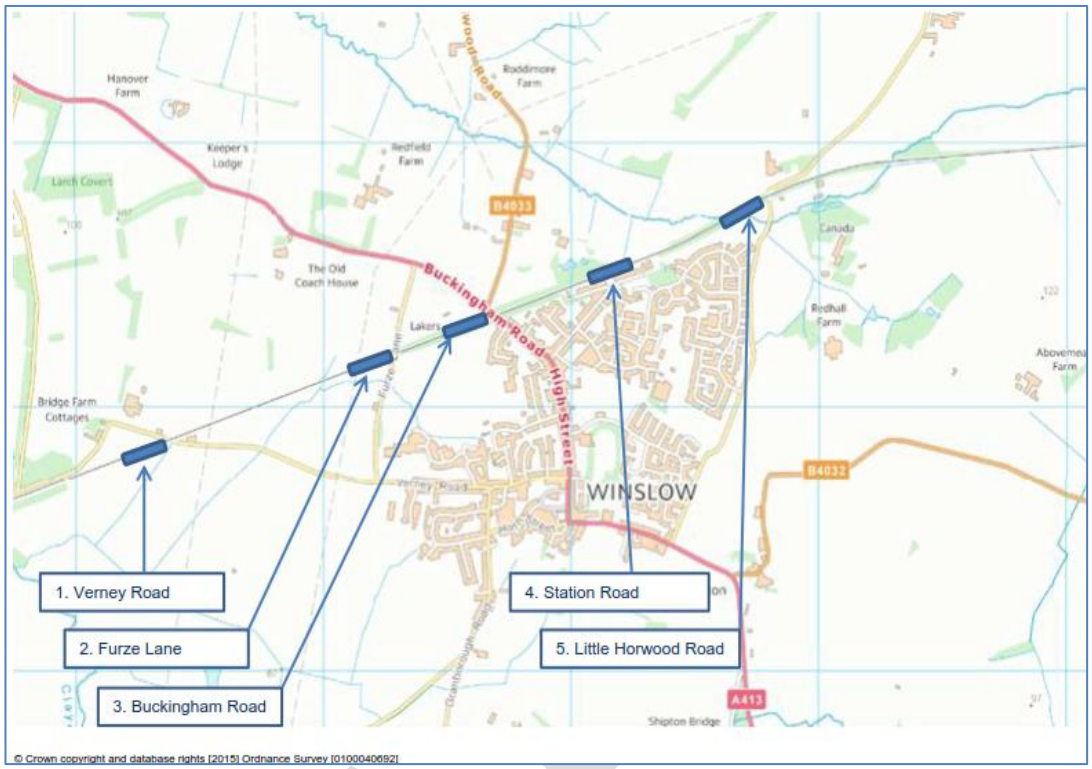

Figure 3.1 Sites considered for the new station at Winslow

3.5.23 Each site has been initially appraised against the following criteria:

- Compliance with national rail standards;
- Compatibility with rail systems[21];
- Land availability;
- Access;
- Interface with third parties;
- Sustainability (including environment);
- Planning policy and consents;
- Construction; and
- Cost.

3.5.24 The results of this option appraisal are set out in Table 3.2.

Table 3.2 Station site at Winslow - Assessment Scoring*

Criteria	Site 1	Site 2	Site 3	Site 4	Site 5
Compliance	5	5	5	2	5
Rail systems	3	3	3	5	2
Land availability	4	4	4	1	3
Access	1	2	5	1	2
Interface with third parties	4	3	3	1	3
Sustainability	3	3	5	1	1
Planning	1	1	5	1	1
Construction	4	4	3	2	2
Cost	4	3	3	3	2
Total	29	28	36	18	24
Rank	2	3	1	5	4

*The scoring system used is as follows: 1 – notable disadvantages, 2-3 – meets criteria, 4 – notable benefits, 5 – greater benefits.

[21] Station and platform design is governed by a suite of railway group standards, published by the Rail Safety and Standards Board, and by company standards published by Network Rail. Requirements given in these standards include: minimum platform width of 2.5m (but could be increased should passenger flow increase substantially); limitations on horizontal curvature and consideration of vertical gradient through platforms; and mandatory offset of platform edge from rail to ensure platforms match with stepping distance from train doors.

3.5.25 Site 3 (Buckingham Road) was identified as the preferred site for the new station.

3.5.26 Site 3 allows a coherent station and car park footprint to be developed. Approximately 400m from Winslow centre, pedestrian access is available via the A413 Buckingham Road, which turns into High Street. The A413 Buckingham Road also provides direct access to the town of Buckingham, which, in addition to Winslow itself, is an anticipated origin and destination for passengers using the proposed station. A bus route passes along the A413 Buckingham Road adjacent to the station site. Proximity to a cycleway[22] is another factor that adds to the sustainability of Site 3.

3.5.27 The site benefits from an existing outline planning consent (application ref. 13/02112/AOP on the Aylesbury Vale District Council planning portal). The outline planning application, approved in November 2013, covers the land use and highway access to the site. The land within the railway, including station platforms and footbridges, were not included in the planning application. A reserved matters application (16/03132/ADP) was submitted in August 2016 in relation to access, appearance, landscaping, layout and scale; this application is still awaiting a decision at the time of writing.

3.5.28 The site options not taken forward, as shown in Table 3.2, were less favourable in many areas, particularly in relation to access and sustainability.

High Level Platforms at Bletchley Station

3.5.29 Two different locations were considered for the new high level platforms, being either to the north or west of the existing Bletchley Flyover. The merits of both proposals have been considered against criteria including land availability, whole life cost, sustainability, operational effectiveness, planning and constructability. In relation to the environment, considerations include an existing aggregates business, the access for

[22] The A413 Sustainable Travel Scheme, which introduces a 9km shared cycle and footway corridor that interconnects the town centres of Buckingham and Winslow.

which runs underneath the Flyover, as well as access for future users between the platforms, the existing Bletchley Station and Bletchley town itself.

3.5.30 It was identified that the western option would hinder the potential provision of future capacity improvements around Bletchley Station; therefore the northern location was selected as the preferred option.

3.5.31 Within the Bletchley High Level Platforms layout, options relating to access were evaluated taking into account a number of factors, including efficient passenger movement, visual intrusion, cost and safety.

Aylesbury Vale Parkway Station

3.5.32 Two new platforms and a footbridge are proposed for this station. The location of these must be immediately adjacent to the existing station building, bay platform, railway and signal arrangements are fixed. As such, scope to vary the platform and footbridge positions at this station was limited.

Crossings and Bridge Structures

3.5.33 The Project involves a number of crossings of the railway by public and private roads and other Public Rights of Way (PRoWs). Alternatives for roads and for PRoWs have been considered separately to each other.

3.5.34 In relation to PRoWs, it has been determined that, between Bicester and Bletchley, all foot crossings would be closed, and selected crossings across the rest of the Project would also be closed, based on a risk model approach (similar to that described for road crossings below) thereby increasing the safety of the PRoW crossings affected. Consultation with local authority PRoW officers and landowners has helped identify those crossings which could be consolidated with or diverted to others, and which would require an alternative crossing solution. Options for these solutions include stepped footbridges, ramped footbridges and subways.

3.5.35 As part of the process of identifying closures and alternative solutions, diversity impact assessments have been carried out. These have helped to inform the decision making process.

3.5.36 No new subway options have been taken forward due to concerns over flood risk, cost, constructability and anti-social behaviour or crime. Land take associated with stepped footbridges would be substantially smaller than that required for ramped alternatives, though the latter would bring added accessibility benefits.

3.5.37 In relation to roads, a safety risk assessment of each highway crossing over the railway was undertaken to determine whether it should remain open or be closed. Factors taken into account as part of this decision include the crossing itself, the layout and condition of approach roads, the surrounding environment, traffic levels using the crossing, proposed changes to the rail infrastructure at the crossing location as a result of the Project and whether there are any recorded incidents at the crossing. The process also includes an assessment of options for each crossing (such as closure and diversion via another route, diversion via a new overbridge, retain and upgrade, changes to signalling) and the safety risks associated with each option.

3.5.38 The environmental considerations associated with the options proposed for road crossings are as follows:

- Where crossings are retained, the operation of the Project could lead to a small increase in the time for which vehicles would wait for trains to pass. This would be unlikely to have significant environmental impacts. Land take would not be required for this option;
- Where crossings would be closed and subject to diversion via a different route, there could be an increase in travel time for some road users. As above, no land take would be required for this option; and
- Where crossings would be closed and subject to diversion via a new overbridge at or near to the crossing, there would be a small reduction in the time vehicles would take to travel over the railway as they would no longer have to wait at a crossing. This would be unlikely to be significant. The provision of a new overbridge would require permanent land take and could therefore give rise to effects in relation to land use, cultural heritage, ecology and landscape, among others, depending on the location.

3.5.39 Following the safety risk assessment exercise, a number of crossings are proposed to be closed. Of these, it is proposed to replace most of these with an overbridge. One exception to this is at Berry Lane where, following consultation, it is preferable to the landowner and stakeholders for a diversion via another crossing to be put in place and a new access road provided.

3.5.40 The layout of the proposed overbridges within the Project Area have been subject to the VfM process (Value for Money, the EWR Alliance design option process), with a number of preferred alternatives chosen so as to reduce the environmental effects associated with the introduction of a new infrastructure element and the permanent land take this would require. Table 3.3 sets out the main options considered for each proposed overbridge, as well as for the proposed changes to existing overbridges.

Table 3.3 Overbridge Location Options

Overbridge	Options Considered	Preferred Option and Environmental Considerations
Charbridge Lane, Bicester	• Dual carriageway sub-structure, single carriageway highway • Single carriageway highway and structure • Dual carriageway structure and highway	• Dual carriageway structure, single carriageway highway The larger the structure, the greater the land take, but the more flexibility this allows for managing traffic levels in the future without additional disruption to the railway. Affected nearby land uses include the allotments adjacent to the east of the crossing and the Tythe Barn wedding venue (and Listed Building) located just to the south of the crossing.
Bicester Road, Launton	• New offline[23] structure • Existing online[24] structure proposal	• New offline structure An offline structure requires more land take and brings new infrastructure closer to the village of Launton and a number of Listed Buildings. However, less disruption to traffic would occur during construction as the existing road could be left open for longer. This option also allows re-provision of the allotments affected by constructing a new replacement overbridge at Charbridge Lane.

[23] 'Offline' refers to the fact that the new structure will not be on the same alignment as the existing crossing

[24] 'Online' refers to the fact that the new structure will be located on the same alignment as the existing crossing

Overbridge	Options Considered	Preferred Option and Environmental Considerations
Launton Level Crossing	• East of level crossing • Further east of level crossing • West of level crossing • Further west of level crossing • On site of existing level crossing	• East of level crossing The preferred option minimises loss of a flood plain and also requires the shortest length of new highway.
Verney Junction	• Overbridge to west of hamlet • Overbridge further west of hamlet • Underpass to west of hamlet	• Overbridge to west of hamlet The preferred option avoids land take of a wildlife site and reduces land take of farmland. However, this alignment is closer to nearby residential properties than the other options.
Furze Lane, Winslow	• Partially offline alignment to the west • Offline alignment to the west • Online alignment	• Partially offline alignment to the west The preferred option requires greater land take but integrates better with a nearby residential development and cemetery access.
Salden Road	• Offline alignment to the west • Partially offline alignment to the west • Online alignment	• Offline alignment to west The preferred option avoids land take and direct loss of ancient woodland at Salden Wood, an irreplaceable habitat. In addition, culverts run under the existing bridge infrastructure. Constructing an offline solution also reduces traffic disruption during construction.
Berry Lane, Aspley Guise	• Close and divert via new access track • Online bridge • Offline bridge to the east	• Close and divert via new access track The preferred option avoids a new piece of infrastructure, land take and visual intrusion. Traffic using Berry Lane will have to travel a short extra distance to cross the railway.
Marston Road, Lidlington	• Online • Offline, incl. roundabout • Offline	• Online The preferred option avoids a community woodland and cultural heritage asset to the north of the railway. There would be less visual intrusion to residential properties but would require the demolition of one property adjacent to the existing crossing.
Kempston Hardwick	• Online bridge • Offline bridge	• Online bridge The preferred option avoids an existing watercourse (and therefore another crossing/culvert) and a floodplain. An online solution could cause greater disruption to traffic during construction.

Construction Access Strategy

3.5.41 The Project has considered two strategic options for access during its construction. The drivers behind the consideration of alternatives are:

- The linear layout of the Project and lack of existing bespoke access;
- The nature and condition of the existing highway network;
- The need to not only achieve access to the Project Area, but also between different parts of the Project Area;
- The likelihood of construction of other developments during the construction phase of the Project; and
- The volume of material movement and associated plant required to construct the Project.

3.5.42 One option that has been considered is to use the existing highway network to access the Project Area and carry construction traffic between different areas of the Project Area for construction. There are a number of environmental considerations to this option:

- This would place the maximum amount of construction traffic on the local highway network;
- Limited new road infrastructure would be required as the option would make use of the existing network, but due to the narrow and rural nature of the existing roads, extensive packages of highway/junction improvement or street furniture alteration works would likely be required ahead of the construction phase;
- During the construction phase, there would be potential for conflict between construction traffic and local network users, particularly during peak times and extensive traffic/route management would be required to facilitate traffic movements between different parts of the Project Area;
- The condition of the existing highway could be detrimentally affected during the construction phase, potentially requiring condition or repair works post-construction; and
- Receptors alongside the existing highway network could be affected by air, noise and dust emissions from the construction traffic travelling between different parts of the Project Area.

3.5.43 The alternative to be progressed involves the creation of a haul road network within the Project Area, which will link the construction compounds and provide a route for construction traffic moving within and between different areas of the Project. Whilst the existing road network

will be used to access the Project Area, movements within the Project Area will take place off the public highway. This will reduce the volume of construction traffic using the existing road network. As with the previous option, there are a number of environmental considerations with this option:

- There will be fewer traffic movements on the road network in rural areas;
- An increase in land take of third party land to accommodate the haul road within the Project Boundary;
- With all the construction traffic movements between different parts of the Project Area taking place off the existing network, there will be less potential for the condition of the highway to be affected and less potential for traffic, safety, air quality or noise impacts at receptors along the existing highway network;
- Fewer interventions would be required to junctions, highways or street furniture to allow passage of construction traffic and such traffic would be confined to designated routes between the strategic road network and construction compound accesses; and
- The Project construction programme is less vulnerable to planned or emergency works taking place on the existing highway network.

Transport of Materials to and from the Project Area

3.5.44 During the initial consideration of the options for the construction methodology of the Project, two alternative methods of transporting materials to and from the Project have been identified; either by rail or by road, not discounting the possibility of a combination of both.

3.5.45 During the initial stages of construction, particularly along those sections of the Project where there is currently no operational railway, it would not be possible to arrange transport of materials by rail. The road network would therefore be required to support the material movements.

3.5.46 In addition, there are also limited points of access to the Project via rail. There is also the fact that materials would need transporting to and from the points where it is loaded onto the rail network. In both these situations, there would be a possibility that these loading/access points could end up bearing a disproportionate amount of traffic, and associated environmental effects would increase, arising from construction of the

Project. The alternative transport approach, by road, would allow the traffic movements to be dispersed more evenly within the transport network.

3.5.47 At this stage of the design, it is therefore proposed that the majority of materials are transported to and from the Project by road, with rail infrastructure materials, ballast, rail and sleepers transported via the existing established rail network. This is in conjunction with the arrangement to move materials within the Project Area via haul roads and not using the local road network.

Access during Operation

3.5.48 Access to the Project during operation will be limited to that provided for maintenance staff. There will be no public access to the Project, except for provision of access to existing station facilities. With the exception of the proposed new Winslow Station and the Bletchley High Level Platforms, existing arrangements will be used for station accesses.

Compounds

3.5.49 Most aspects of the construction layout (in terms of location across the Project and size) have been developed iteratively in consultation with local stakeholders, taking account of the likely Project requirements, project team experience on similar infrastructure developments and a series of environmental principles.

3.5.50 During the early stages of the Project design, an initial version of the construction compound layout was produced based upon the principle that a small number of large strategic compounds would be required at certain locations, with a number of smaller compounds spaced at regular intervals between them. An effort was made to locate the compounds in locations close to the road network, with a clear route to the strategic road network, avoiding environmental features identified as part of a desk study exercise.

3.5.51 As environmental desk studies and field survey work progressed, additional information has been fed into the compound layout design

process to ensure that environmental features have been taken into account. This has brought about some early changes in the layout and location, for example:

- At Charbridge Lane, Bicester, where options were being considered both sides of the road, the presence of flood risk to the west of the road meant that a preferred strategic compound location to the east of the road has been selected;
- A large compound has been considered on undeveloped land close to Aylesbury Vale Parkway Station, with options to the west and east of the station. The presence of archaeological remains to the east of the station, which are to be preserved in situ, mean that the layout has been refined to accommodate only a small compound to the east of the station, with the main compound being to the west; and
- Temporary construction roads have been designed to avoid features such as mature woodland or ponds.

3.5.52 Further consideration of alternatives has taken place in consultation with local landowners and tenants, where the proposed locations have been reviewed against their commercial or land holding operations and interests and a process of micro-siting has been undertaken to determine the final scale and locations.

3.6 Embedding Environment and Sustainability into Iterative Design

3.6.1 As part of the governance process for EWR2, NR is obligated to focus on a series of requirements set out by the Secretary of State[25]. These 'requirements' are grouped under safety, reliability, capacity and environment.

3.6.2 The requirements for environment, set out below are purposed to make railway projects more environmentally sustainable:

- Carbon and Energy - seek to reduce the carbon embedded in new infrastructure projects throughout the life of a project. This should include the use of a suitable carbon accounting methodology;
- Climate Adaptation – confirm how decision-making processes and investment plans will take appropriate account of the risks and opportunities from anticipated climate change; and

[25] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3641/railways-act-2005.pdf

- Wider Environmental Impacts - demonstrate how the Government's broader environmental agenda is addressed including protecting and enhancing the natural environment, using resources in a way that is sustainable and promoting good health and quality of life through effective management of air quality and noise.

3.6.3 NR reflected these environmental requirements in the specification for EWR2 whereby sustainability and sustainable development are core principles adopted by the EWR Alliance, who are designing and will construct EWR2.

3.6.4 To deliver the requirements, the EWR Alliance developed a sustainability strategy. The strategy commits to four high level objectives that are applicable throughout the project lifecycle, under which sit 21 specific objectives. The high level objectives are as follows:

- Minimise adverse impacts on the environment and deliver environmental benefits throughout the project lifecycle;
- Understand, manage and value the needs and expectations of our stakeholders and leave a lasting positive legacy in the local community;
- Contribute to the regions aspirations for economic growth during construction and operation and represent value for money; and
- Develop a collaborative, diverse and inclusive team that attracts and retains the best talent, considers safety a priority, and has a positive impact on people's health and wellbeing.

3.6.5 The following sections describe the tools and methods applied to EWR2 to deliver these environmental and sustainability commitments, namely:

- Sustainability Options Appraisal Tool (SOAT);
- Carbon Footprinting;
- Mitigation Hierarchy and Design Integration;
- Biodiversity Net Gain;
- CEEQUAL, the evidence-based sustainability assessment, rating and awards scheme for civil engineering; and
- Building Research Establishment Environmental Assessment Method (BREEAM).

Sustainability Options Appraisal Tool (SOAT)

3.6.6 The SOAT is a spreadsheet based assessment tool that poses a range of social, economic and environmental themes/questions. The SOAT scores the potential sustainability performance of preferred options within a rail development.

3.6.7 For EWR2, the tool has been used during the feasibility stage of design to provide an indication of the performance of different approaches to achieving the required service pattern, for example a range of locations and layouts for passing loops and chords. The process applied a consensus-based approach to a wide and comprehensive range of sustainability questions relevant to the rail industry. The topics used are detailed in Table 3.4.

Table 3.4 SOAT Topics for Option Evaluation

SOAT – Sustainability Topics For Option Evaluation		
Land Use	Energy, Carbon And Climate Change	Consultation And Engagement
Landscape	Materials Resource Efficiency	Business, Services and Amenity
Ecology	Waste Management	Employment, Skills And Training
Historic Environment	Transport and Access	Health and Safety
Water	Neighbours And Local Residents	Land Acquisition

3.6.8 For example, approaches for different sections of EWR2 have been subject to evaluation, with a score allocated to the performance of each alternative in each of the above topic categories. The performance scores have been reached through a moderated process, in that agreement has been by consensus via a series of workshops at which representatives from NR and the design team, including environmental/sustainability specialists, all have given input.

3.6.9 The output from SOAT provides designers with an indication of the relative sustainability of each option whilst also highlighting design measures that could either reduce adverse sustainability impacts or enhance lifecycle performance.

Carbon Footprinting

3.6.10 A carbon footprinting exercise gave a quantitative analysis and comparison of key components of the design, in terms of their embodied carbon or carbon footprint. A carbon footprint[26] is a measure of the total greenhouse gas (GHG) emissions caused directly and indirectly by a person, organisation, event or product. It considers the GHG associated with the full life cycle impact. The carbon footprint is expressed in terms of a 'carbon dioxide equivalent' (CO_2e) and includes both the embodied carbon in materials and products, and carbon emissions associated with other (energy) sources.

3.6.11 Like SOAT, the outputs of this exercise have fed into the option development process for EWR2 and informed a 'carbon challenge workshop' designed to target and implement measures to reduce the carbon footprint of EWR2.

3.6.12 To carry out this exercise, the EWR Alliance has adopted the Rail Safety and Standards Board's (RSSB) Rail Carbon Tool, which enables the calculation and analysis of GHG emissions associated with rail projects.

3.6.13 Studies considered emissions associated with each stage of the design development and implementation of EWR2. The studies considered:

- Products and materials – embodied emissions associated with construction materials/products;
- Construction transport – emissions resulting from fuel consumed during the transportation of products and materials and also during the transport of waste;
- Construction installation process – emissions associated with construction;
- Operational energy use – emissions associated with energy use during the operation of the Project (but excluding rolling stock); and
- Replacement – embodied emissions associated with replacement materials/products.

[26] The Carbon Trust, https://www.carbontrust.com/resources/guides/carbon-footprinting-and-reporting/carbon-footprinting, accessed 23.06.16

Class I Fencing

3.6.14 The consideration of the provision of Class I fencing across the Project provides an example of how the application of the Rail Carbon Tool can affect design. The tool has revealed that the provision of Class I fencing throughout the Project would contribute a significant amount of the total embodied carbon emissions associated with the Project. Of this percentage, over half would come from the end posts, which are steel with a concrete foundation.

3.6.15 The application of the tool has therefore served to identify an opportunity to reduce the Project's carbon footprint materials by reconsidering the fencing strategy and materials used in fence construction. Whilst a security assessment has determined that the use of Class I fencing is a safety requirement for some parts of the Project, a study has been undertaken to identify where existing fences could be retained or where a fence type that is lower in embodied carbon could be proposed, thereby achieving a reduction in the embodied carbon of the Project.

Water Footprinting

3.6.16 The water footprint of the Project will be the total volume of freshwater required to complete construction. Following the Water Footprint Network's methodology[27], an assessment has been made of embodied water associated with construction materials.

3.6.17 The Water Footprint Impact (WFI) of each material is calculated by combining the volume of water with the stress of the locality from which the water was associated. The total WFI for the Project is the sum of WFIs of the individual materials.

3.6.18 The water footprinting exercise has identified those construction materials that contribute most to the embodied water of the Project. As the Project moves through detailed design and into the specification and procurement of construction materials, decisions will take into account the findings of this exercise to achieve sustainable outcomes.

[27] As published in 'the Water Footprint Assessment Manual' (2011, Hoekstra et al)

Mitigation Hierarchy and Design Integration Workshops

3.6.19 A key aspect of the EIA process is the consideration of the mitigation hierarchy[28], which sets out that the proposal of measures to address likely significant effects should first seek to avoid any impacts being created. Where this is not possible, measures should then seek to reduce any impacts that arise. Where design cannot avoid or reduce impacts, only then should measures to remedy or compensate for such impacts be considered.

3.6.20 To ensure that the mitigation hierarchy is embedded within the Project design, a series of design integration workshops have been held between the environmental topic specialists, and the engineering and construction teams. These workshops have taken place following the collection of baseline environmental information and during an initial assessment of likely significant effects. Their purpose is to explore how the findings of these assessments could influence the design to avoid or minimise some likely significant effects.

3.6.21 A schedule of possible mitigation measures to avoid or reduce potential impacts has been prepared, setting out the environmental topic area affected, the possible impact and associated intervention, and whether the intervention would be part of the design or the construction strategy.

3.6.22 Examples of measures taken forward into the design as a result of this exercise include, but are not limited to:

- Relocation of replacement bridge at Salden Wood to avoid land take of irreplaceable ancient woodland;
- Relocation of construction compounds to avoid floodplain, archaeological features or provide a buffer to sensitive receptors (human and ecological);
- Adjustment of haul road alignment to avoid waterbodies and areas of woodland; and
- Review of locations of proposed track discontinuities (point ends at switches and crossings) to ensure a buffer between them and sensitive noise receptors could be achieved.

[28] State of EIA Practice IEMA 2012

3.6.23 The EWR Alliance has carried out a formal design option process, known as the Value for Money process (VfM). This process balances the consideration of a number of criteria in design decision making, specifically - environment and sustainability, community and external stakeholders, constructability, internal stakeholders, safety, technical/quality, cost (capital), whole life cost, programme and resources. The process documents the justifications behind design decisions and selected options in a series of reports. Section 3.5 discusses the main alternatives considered.

Consultation and Engagement

3.6.24 During the development of the design, the EWR Alliance has consulted extensively with stakeholders and communities local to the Project. Land and property owners, local authorities, the local community and other interest groups have been invited to comment on the Project or particular aspects of it. The activities undertaken to consult and engage with stakeholders and a summary of the consultation responses received during the development of the proposal are to be set out in a Consultation Report which will accompany the TWAO Application.

3.6.25 All comments received are subject to review and, where appropriate, incorporated into design decision making. Wherever elements of the design are subsequently subject to revision, environmental considerations are integral to the reassessment and decision making process.

Biodiversity Net Gain

3.6.26 The EWR Alliance is committed to the achievement of a measurable net gain in biodiversity consistent with the Government's broader environmental agenda.

3.6.27 The Biodiversity Net Gain process is based upon DEFRA's piloted tool for calculating loss and gains[29]. The process follows the application of the mitigation hierarchy, in that the design must seek first to avoid and then minimise and restore the loss of biodiversity. Through the Net Positive

[29] https://www.gov.uk/government/publications/technical-paper-the-metric-for-the-biodiversity-offsetting-pilot-in-england

initiative, the Project has made use of DEFRA's metric to calculate biodiversity loss and measure the level of biodiversity gain.

3.6.28 Further details of the Biodiversity Net Gain initiative, its aims and methodology are detailed within Appendix 9.19.

CEEQUAL

3.6.29 CEEQUAL is the international evidence based sustainability assessment, rating and awards scheme for civil engineering, infrastructure and, landscaping and works in public spaces. It is an industry-recognised assessment of standards for environmental sustainability. The EWR Alliance is targeting an 'excellent' score for client, design and construction phases of the assessment.

3.6.30 The infrastructure and environmental elements of EWR2 (with the exception of the Winslow Station building, which is being assessed under BREEAM) have been entered into the CEEQUAL scheme to ensure sustainability and environmental factors are given consideration when making design choices. Further, the CEEQUAL process will help to drive environmental and sustainability improvements in the construction and operational phases.

3.6.31 Building Research Establishment Environmental Assessment Method (BREEAM)

3.6.32 BREEAM is an established method for assessing, rating and certifying the sustainability of buildings. The proposed station building at Winslow is the subject of a BREEAM assessment. This assessment covers several aspects of the station building design, including use of materials, water management, waste management, land use and ecology, and pollution. Winslow, being the only new station, will target a BREEAM Very Good rating as a minimum.

3.6.33 Following the BREEAM assessment has helped guide the designers toward a lower impact station design, with particular emphasis on minimising energy demands through use of efficient materials and the application of low to zero carbon technologies.

3.7 Conclusion

3.7.1 The approach to the development of the preferred options is iterative and allows consideration of sustainability and environmental factors throughout. Design choices made by the Project take account of comments received during consultation with statutory consultees, interest groups, the local community and landowners. This will be summarised in the Consultation Report which will be submitted with the TWAO Application. As a result, the Project as proposed and assessed in this Draft ES represents the optimum design when the technical, environmental and financial appraisals are considered together.