A303 Amesbury to Berwick Down

TR010025

Volume 6

6.1 Environmental Statement

Chapter 3: Assessment of alternatives

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

October 2018

3 Assessment of alternatives

3.1 Scheme history

3.1.1 In 2013, HM Treasury's Investing in Britain's Future (Ref 3.1) set out a programme of infrastructure investment, including provision for a feasibility study for the A303/A30/A358 corridor (Ref 3.2), which comprises:

a) the A303 between the M3 and the A30;

b) the A30 between the A303 and the M5; and

c) the A358 between the A303 and the M5.

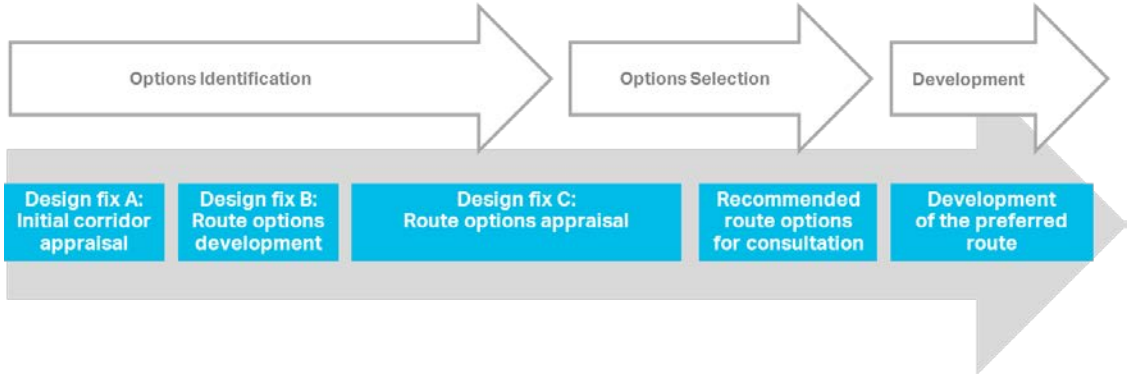
3.1.2 That study concluded that the problems experienced along the corridor should be addressed through the introduction of a number of new dual carriageway sections, including the A303 Amesbury to Berwick Down scheme.

3.1.3 Following the completion of the feasibility study in December 2014, the Department for Transport (DfT) published its Road Investment Strategy for 2015-20 (Ref 3.3) containing proposals for creating an A303/A358 dual-carriageway to the South West, including dualling of the A303 from Amesbury to Berwick Down (the Scheme) which would include a twin-bore tunnel at least 2.9km long through the WHS.

3.2 Selection of the Scheme

3.2.1 The process of options identification and route selection leading to the Scheme is summarised below. The process was split into the stages shown in Figure 3.1.

Figure 3.1: Option identification and selection process



Options identification

3.2.2 The process of options identification and route selection leading to the Scheme is summarised below. The process followed the following stages:

a) Corridor identification and initial sifting of corridors (Stage 1);

b) Design development of route options within preferred corridors (Stage 2);

c) Route options appraisal and sifting to identify options to take forward for further appraisal (Stage 3);

d) The selection of two preferred routes, which were taken to non-statutory public consultation in January/March 2017 (Stage 4);

e) The selection of a Preferred Route which was announced by the Secretary of State in September 2017 and which forms the basis of the Scheme (Stage 5).

3.2.3 Table 3.1 summarises the process that has led to the development of the Preferred Route and includes the main reasons for selection of chosen options and the rejection of the alternatives, taking into account the effects of the development on the environment.

Table 3.1: Development of the preferred route

Options Identification Stage	Details
Stage 1 - Corridor identification and initial sifting of corridors	A review of 60 route options was undertaken. These options were grouped into seven separate corridors: • Corridor A – surface routes more than 1km north of the existing A303 (outside Stonehenge WHS); • Corridor B – surface routes more than 1km north of the existing A303 (at least partially within Stonehenge WHS); • Corridor C – surface routes within 1km of the existing A303 (at least partially within Stonehenge WHS); • Corridor D – partially tunnelled route options within 1km (on plan) of the existing A303 (at least partially within Stonehenge WHS); • Corridor E – surface routes more than 1km south of the existing A303 (partially within Stonehenge WHS); • Corridor F (north) – surface routes south of the existing A303 (wholly outside WHS) and north of Salisbury; • Corridor F (south) – surface routes south of the existing A303 (wholly outside WHS) and north of Salisbury, further south than Corridor F (north); and • Corridor G – surface routes south of A303 (outside Stonehenge WHS) and south of Salisbury. A multi-criteria assessment using the Client Scheme Requirements, the Early Assessment and Sifting Tool (EAST) from WebTAG and National Policy Statement for National Networks (NPSNN) environmental aspects was carried out to recommend better performing corridor(s) to be taken forward for further consideration. A summary of the main environmental reasons for excluding five of these eight corridors at the next stage is given below: Corridor A was excluded in part because of the location of settlements means there would be limited scope to realign the A303 to the north of the WHS although a route which skirts the northern boundary of the

Options Identification Stage	Details
	WHS was also considered. Such an option would reduce severance within the WHS, but it would also have substantial harmful impacts. On balance, potential harm to the WHS was considered to have the potential to outweigh the benefits associated with the removal of the A303 through the WHS and so Corridor A was excluded entirely. Corridors B, C and E which would be Surface route options within the WHS would offer transport benefits and could be delivered at a lower cost than a tunnelled solution but would be considered wholly unacceptable from a cultural heritage point of view and so were excluded. In particular a surface route close to the existing alignment would fail to reduce severance within the WHS and would cause substantial harm to the Outstanding Universal Value (OUV) of the site and whilst they might reduce the visual and noise impacts of the road on the Stonehenge monument itself, any such route would still fundamentally affect the character of the WHS. Corridor G, a surface route to the south of Salisbury, was excluded because the length of such an option would lead to substantially increased habitat loss and severance compared to other corridors. This option, whilst offering improved access to Salisbury would fail to reduce journey times for users of the A303 and would not, therefore, meet the objectives for the Scheme. Two corridors, Corridor D, Corridor F (north) and Corridor F (south) were taken forward for further consideration for the following reasons: • Corridor D, a tunnelled route through the WHS, would reduce severance within the WHS and improve the setting of key assets such as Stonehenge. The surface elements may cause adverse effects on the character of the WHS but it was considered that substantial harm could be avoided with appropriate design. A tunnelled route has the potential to contribute to the enhancement of the historic landscape within the WHS. Despite its high capital cost, a tunnelled route would deliver transport and economic benefits in line with the objectives for the Scheme. • Corridor F surface route options to the south of the WHS would remove the A303 from the WHS in its entirety. This would bring benefits by reducing severance and improving the setting of key assets, including the Stonehenge monument. These benefits would need to be balanced against potential adverse environmental effects of constructing a longer route within a high quality, unspoilt landscape, leading to increased loss of habitats. To varying degrees, depending on the alignment, surface route options to the south of the WHS would also offer a less direct route for through traffic and would therefore offer reduced transport benefits. More traffic would also be left on local roads, giving rise to adverse impacts on local villages.
Stage 2 - Design development of route options within preferred corridors	Stage 2 involved developing route options within the corridors identified from Stage 1 (described in 7.2.2) and rationalising them based on impacts on the key constraints. A total of ten route options were developed for further appraisal, seven within Corridor D and three within Corridor F. The options within Corridor D incorporated varying lengths of tunnel (2.9km or 4.5km), different locations for the tunnel portals, as well as a northern or southern bypass of Winterbourne Stoke. The three route options within Corridor F largely represented a northern, central and southern option. The three route options within Corridor D incorporating the 4.5km tunnels had costs significantly in excess of the available budget for the

Options Identification Stage	Details
	Scheme and these options were therefore not considered further. The remaining four Corridor D route options each incorporated a 2.9km tunnel under part of the Stonehenge WHS and were approximately 13km in overall length. The assessment and comparison of these route options demonstrated all options were comparable in most variables but there were notable differences specifically in terms of environmental impact. In terms of their impact on the WHS, all of the options would substantially improve the setting and hence significance of many scheduled monuments central to the OUV of the WHS, including Stonehenge itself. The eastern portal location for two options would enable the reconnection of The Avenue which is considered a very substantial benefit. The western portal of these options, however, would have the potential to cause substantial harm to the Normanton Down Barrow and other important monuments, ultimately harming the OUV of the WHS. There was little to differentiate between options routing to the north or south of Winterbourne Stoke based upon the information available at this time. It was therefore concluded that the likely best performing affordable route options within Corridor D were Options D001 and D003 traversing the WHS with bypasses north and south of Winterbourne Stoke respectively. The three options within Corridor F would run south of the WHS connecting to the existing A303 west of Winterbourne Stoke and east of Amesbury. Completely removing the A303 from within the WHS would substantially improve the setting of over 100 scheduled monuments and would provide significant benefits for the WHS in terms of conservation, access and visitor experience. The assessment and comparison of the three Corridor F route options clearly demonstrated that route F010 out-performed the other two route options in all the assessed cases. The best performing options in Corridor D, D001 and D003 and Corridor F, F010, were then assessed in more detail, both qualitatively and quantitatively, in order to determine which should be taken forward into the next stage of public consultation and option selection. Following a design review the location of the eastern tunnel portal for both route options D001 and D003 was moved 40m closer to the existing A303 and this resulted in the route options being renamed: D031 (previously D001) and D032 (previously D003). As part of the option selection and assessment work on revised Route Options D031 and D032, a programme of geophysical surveys was undertaken to investigate the possible presence of buried archaeological features along the two options. This identified two Neolithic long barrows and a henge-type enclosure to the east of the A360 and within the likely construction footprint of both options. These were considered to be important archaeological features that contribute to the OUV of the WHS. These features were considered to be adversely affected by the D031 and D032 route options and the decision was made to adjust both route options by moving them locally further to the south to avoid physical impact on these assets. The amendment of the two route options also aimed to accommodate the junction intentions for each option and maintain full standard highway geometry, whilst minimising impact on key environmental constraints and maintaining the balanced earthworks strategy where

Options Identification Stage	Details
	possible. These changes were introduced into D031 and D032 and the revised route options were re-named as D061 and D062 respectively.
Stage 3 - Route options appraisal and sifting to identify options to take forward for further appraisal	The following options were taken forward for further appraisal: • Option D061: was a part surface/part tunnelled route of total length 12.5km which included a 2.9km tunnel through part of the Stonehenge WHS and a bypass to the north of Winterbourne Stoke. The proposed western portal was located approximately 80m south west of Normanton Gorse, and the eastern portal located approximately 80m east of The Avenue; • Option D062: was a part surface/part tunnelled route of total length 12.6km which included a 2.9km tunnel through part of the Stonehenge WHS and a bypass to the south of Winterbourne Stoke. The proposed western portal was located approximately 80m south west of Normanton Gorse, and the eastern portal was located approximately 80m east of The Avenue; • Option F010: the route leaves the A303 in the west and ran between Winterbourne Stoke and Berwick St. James. The route then continued east, keeping south of the WHS boundary but north of Upper Woodford. The route then ran south of the Boscombe Down Airfield before connecting back to the existing A303 dual carriageway east of Amesbury.
Stage 4 - Recommended Route Options for Consultation	Comparison of the appraisals for each of the three retained options suggested that, on balance, options D061 and D062 performed better than option F010 in terms of the assessed impacts. Key differentiators were F010 being a significantly longer route which would pass through a largely unspoilt, high quality, tranquil landscape with an additional crossing of the River Avon Special Area of Conservation (SAC). It would have a much larger footprint and a greater overall environmental impact, despite having greater benefits for the WHS. There would be disbenefits for road users having to travel on a longer F010 route, offsetting lower construction costs. F010 would also not interact effectively with the local road network, leaving higher levels of rat-running traffic adversely affecting the quality of life in local communities. The two route alignments within Corridor D, namely D061 and D062 were therefore identified as the preferred route options for consultation on the basis that they performed better against Client Scheme Requirements (CSR) and the relevant national and local policy objectives than F010. A Description of Option D061 and D062 is provided below: • Route Option D061 (Published as 'Option 1N' for non-statutory consultation): 2.9km length tunnel with route running north of Winterbourne Stoke, the eastern tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse; • Route Option D062 (Published as 'Option 1S' for non-statutory consultation) – 2.9km length tunnel with route running south of Winterbourne Stoke, the eastern tunnel portal located east of The Avenue and the western tunnel portal located west of Normanton Gorse.
Development of Modified Routes	In response to the findings of archaeological surveys and feedback received during the non-statutory consultation held between January and March 2017 (Ref 3.5), seven modifications of Options 1N and 1S

Options Identification Stage	Details
	were developed for further appraisal and assessment. These were 1Na, 1Nb, 1Nc, 1Nd, 1Sa, 1Sb and 1Sc.
Stage 5 - Identification of the Preferred Route	All modified routes were subject to an assessment that screened the options against key considerations raised from the public consultation, and the associated key engineering and environmental assessment topics, as well as the results of further geophysical surveys, to identify the better performing route options. On the basis of the high level review of the modified route options for 1N and 1S against the key considerations identified at public consultation, it was concluded that the modified Options 1Nb, 1Nc, 1Sb and 1Sc would be rejected in favour of other alternatives, based on them having a less favourable fit within the western part of the WHS and wider landscape and closer proximity to the RSPB Nature Reserve. For the northern bypass options, it was concluded that both 1Na and 1Nd both had the potential to deliver viable routes through the WHS, although 1Na would be in proximity to the RSPB Nature Reserve and would have a direct impact on The Diamond but noting that it would also provide localised screening for some views. 1Sa would be the best performing of the modified southern bypass options through the WHS. Options 1Sb and 1Sc would have a direct impact on newly discovered undesignated archaeology to the south of The Diamond, as well as the Winter Solstice Sunset Alignment (viewed from Stonehenge). The options would also be in proximity to the RSPB Nature Reserve. Options 1Nb and 1Nc were considered to be the most poorly performing of the modified northern bypass options. This is primarily due to the impact on Oatlands Hill and views from within the WHS, and for 1Nb the newly discovered undesignated archaeology south of the Diamond. It was concluded that with all options, the western tunnel portal needed to be moved further away from Normanton Down Barrow Group. This could be achieved by a cover structure extending beyond the start of the bored tunnel section, with the ground level restored above the structure to match existing ground levels. The outcome of this review was that Option 1Na, 1Nd and 1Sa performed better than the other options and were therefore shortlisted for more detailed appraisal. The main environmental differentiators between these three options were as summarised below: In relation to the Historic Environment and WHS overall, there was a preference for Option 1Nd. This was on the basis that the alignment facilitates a preferred exit location from the WHS through a shallow topographic shoulder of land in proximity to the Winterbourne Barrow Group that avoids: • The Winter Solstice Sunset alignment (as viewed from Stonehenge) that is potentially affected by Option 1Sa. • The need for a large cutting through Oatlands Hill that is required for 1Na, resulting in less of a detrimental impact on the setting of the WHS and many scheduled monuments, as well as the open landscape character and views from visual receptors on PRoW, local roads and open access land. • Impacts on a number of newly discovered archaeological sites

Options Identification Stage	Details
	including what are likely to be round barrows in the vicinity of the Park, and a potential Roman settlement that would potentially be affected by Option 1Sa. Whilst there remained the potential for harm to the attributes of OUV and impacts on the fabric and setting of important archaeological remains, Option 1Nd would provide more options to bring overall benefits to the WHS and opportunities for mitigation as part of the design development. In relation to the wider environment and local community, the route alignment of Option 1Nd was predicted to result in a lesser impact on a number of key environmental receptors, as follows: • It presents a lower risk of adverse effects to the River Avon SAC/River Till SSSI, and the aquatic ecology of the River Till, when compared with Option 1Sa which would cross the River Till at a location which is considered more likely to support the qualifying species for the River Avon SAC, as well as other protected and notable species. • It avoids impacting what is considered to be a more complex valley landscape to the south of Winterbourne Stoke that would be affected by Option 1Sa, and is likely to impact the visual amenity of fewer residential and leisure receptors in the vicinity of Winterbourne Stoke and Berwick St James than would be affected with Option 1Sa. • It avoids direct impacts on landscape features such as The Diamond and the wooded enclosure within the Park, and is located further away from the RSPB Normanton Down Nature Reserve, reducing the potential for adverse effects on protected and notable species, including Stone Curlew, when compared with Options 1Na and 1Sa. • It is located closer to the current A303 than Options 1Na and 1Sa, in an area which is already subject to various levels of disturbance from infrastructure. On the basis of the above, Option 1Nd was judged to be the preferred option from an environmental and cultural heritage perspective and was identified as the recommended Preferred Route. The preferred Route (Option 1Nd) was the route which received greater public support, and performed better from a heritage, landscape and biodiversity perspective, and provides greater potential for impacts to be mitigated than the other options. It also performed better in the engineering assessment as it was a slightly shorter route. The option was modified further, and the route through the western part of the WHS altered, to take into account consultation responses. The western portal was moved closer to the existing A303 to mitigate impacts on archaeology, the winter solstice alignment and the RSPB reserve at Normanton Down. This option forms the basis of the Scheme.

3.2.4 Full details of the options identification and selection process, along with the development of the Preferred Route can be found in the Scheme Assessment Report (Ref 3.4) available at:

www.highways.gov.uk/A303Stonehenge/consultation

3.2.5 The Secretary of State announced the Preferred Route on 12th September 2017 and it is this route which forms the basis for the Scheme assessed within this ES. Since that time the development of the Scheme design has been undertaken in accordance with the criteria for 'good design', outlined in the NPSNN.

3.2.6 The local design refinement options which have been considered within the development of the Scheme submitted for development consent are reported below.

3.3 Scheme development

Alternative options presented for consultation

3.3.1 Five options remained under consideration at the statutory consultation held between February 2018 and April 2018 and decisions have now been made in relation to those options. The main reasons for the selection of the relevant option and the rejection of the alternative, taking into account the consultation feedback and the effects of the development on the environment, are reported below. Where environmental considerations are set out in Table 3.2 to Table 3.17, only those environmental topics that were impacted by the design options are presented. Other environmental topics which were not impacted or for which there were no differences between the options are not referred to.

3.3.2 Table 3.2 reviews the two options presented for the southern parapet of the River Till Viaduct.

Table 3.2: River Till viaduct options

	(a) Open southern parapet	(b) Southern parapet with vertical barrier
Landscape / Visual	Retaining an open parapet would reduce the scale of the River Till Viaduct in views from Public Rights of Way and Winterbourne Stoke, to the south of the viaduct, in comparison to the vertical screen. However, as views of vehicles would remain with an open parapet, this option is **less preferable** from a landscape and visual perspective.	An opaque barrier would to an extent, screen vehicles from Public Rights of Way and Winterbourne Stoke, to the south of the viaduct, and is **more preferable** in terms of landscape and visual effects but would not be essential in mitigating significant adverse effects
Ecology	**More preferable** as retaining an open parapet would be expected to be slightly beneficial compared to the alternative in terms of reducing shading to the River Till (SSSI and SAC) beneath the viaduct.	**Less preferable** as an opaque barrier would be expected to be slightly worse than the alternative as it could slightly increase shading to the River Till (SSSI and SAC) beneath the viaduct.

	(a) Open southern parapet	(b) Southern parapet with vertical barrier
Noise	**Less preferable** as retaining an open parapet would allow vehicle noise to propagate south from the bridge.	**More preferable** as this would help somewhat in reducing vehicle noise at receptors to the south of the bridge (but is not essential in mitigating significant adverse effects).
Water Environment	The point on shading made in respect of ecology above is also relevant in the context of the River Till and the Water Framework Directive Assessment. This option may therefore be slightly more preferable in relation to the water environment.	The point on shading made in respect of ecology above is also relevant in the context of the River Till and the Water Framework Directive Assessment. This option is likely to be slightly less preferable than the open parapet option in relation to the water environment.

3.3.3 The decision was taken to include a southern parapet with an opaque vertical barrier up to 1.5m high (or an extended parapet) to respond to the strong preference at consultation to screen vehicles from the view points from the south. This approach is considered beneficial from both the noise and landscape perspectives.

3.3.4 Table 3.3 reviews the two options presented for location of Green Bridge Four at, or near, the existing A360 alignment.

Table 3.3: Green bridge options

	(a) At A360 alignment	(b) 150m east of A360 alignment
Landscape / Visual	This is the **more preferable** option from a landscape and visual perspective as it retains the linear form to the western edge of the WHS and pattern of the A360 alignment. However, there is no marked difference in the assessment conclusions between this option and the 150m east option, as the functionality of the green bridges remains in both options, and no landscape and visual receptors are adversely affected.	**Less preferable** as this option slightly deviates from the existing north to south linear pattern of the A360 and the overall linear form to the western edge of the World Heritage Site. However, there is no marked difference in the assessment conclusions as the functionality of the green bridge remains in either option, and no landscape and visual receptors are adversely affected.
Cultural Heritage	In terms of cultural heritage, this is the **more preferable** option. The location would maintain the connectivity between the monument groups, would limit land take and therefore limit the removal of archaeological remains within the WHS (including damage to the scheduled boundary bank (NHLE 1010837) It would also maintain the historic route along the A360 on the	In terms of cultural heritage, this is the **less preferable** option. Although the revised location would maintain the connectivity between the monument groups, it would increase land take within the WHS for its construction and also the removal of archaeological remains situated within its construction footprint. There would also be a direct physical impact on the scheduled boundary

	(a) At A360 alignment	(b) 150m east of A360 alignment
	WHS boundary. No difference in overall assessment conclusions.	bank (NHLE 1010837). The historic route along the western boundary of the WHS would also be altered and diverted. It would not materially enhance the connectivity between the monument groups above and beyond that of Option A, hence little additional benefit to OUV. No difference in overall assessment conclusions.

3.3.5 The Scheme now includes a longer Green Bridge Four (also known as a 'land bridge') and this would be approximately 150m in length and be to the east of the A360 alignment. The extended length of the bridge compared to the other green bridges, responds to stakeholder feedback and consultation responses to provide greater visual connectivity between barrow groups to the north and south of the Scheme, as well as providing an NMU route and the agricultural and ecological benefits common to the other green bridges. A wider green bridge at the proposed location would improve the physical and visual connection between the northern and southern parts of the WHS and the monuments within it, in particular the Neolithic and Bronze Age funerary and ritual monuments to the north and south of the Scheme. The 'land bridge option' was well supported during the supplementary consultation undertaken 16th July to 14th August 2018 (refer to section 3.3.12).

3.3.6 Table 3.4 reviews the two options presented for the approach to the western portal:

Table 3.4: Western portal approach options

	(a) Vertical Retaining Walls	(b) Grass Slopes
Landscape / Visual	**Less preferable** option in terms of landscape and visual, as this provides a hard engineered landscape from any viewpoints close to the cutting and from the new road.	**More preferable** option in terms of landscape and visual, as this provides a more natural landscape from any viewpoints close to the cutting and from the new road.
Ecology	**Less preferable** option in terms of ecology as this provides less opportunity for grassland habitat creation. The reduced land take associated with this option is slightly beneficial but the adjacent habitat is arable and of relatively low value as habitat	**More preferable** option in terms of ecology as this provides an opportunity for grassland habitat creation on a greater area of the cutting slope.

	(a) Vertical Retaining Walls	(b) Grass Slopes
Cultural Heritage	**More preferable** over the grass slopes option in terms of OUV as minimises land take and visibility of portal, traffic, signage and buildings in views from key monument groups in WHS, and avoids scheduled monument (Bronze Age land boundary earthwork). Signage and buildings also assumed to be less visible.	**Less preferable** over the retaining wall option in terms of OUV impact, due to increased land take with impact on scheduled monument (Bronze Age land boundary earthwork), likely greater visibility of portal, traffic, signage and buildings in views from key monument groups in WHS, notably Winterbourne Stoke Crossroads barrow group.
People and communities	**More preferable** as the reduced land take associated with this option is slightly beneficial as it minimises the loss of arable land.	**Less preferable** as the increased land take associated with this option is slightly worse than the alternative as there would be a slightly greater loss of arable land from adjacent areas
Water Environment	This option would be **less preferable** if piling or foundations are more extensive or deeper and the impacts on groundwater flows greater than for the alternative. The land take associated with the option may be slightly better than the alternative in relation to the lesser volume of chalk aquifer removed.	This option would be **more preferable** if the piling or foundations are less extensive or deep and so reduce any impact on groundwater flows. The land take associated with the option may be slightly worse than the alternative in relation to the greater volume of chalk aquifer removed.
Materials	This option is likely to be **more preferable** in terms of materials as it would lead to slightly less excavation than the alternative.	This option is likely to be **less preferable** in terms of materials as it would lead to slightly more excavation than the alternative.

3.3.7 The Scheme now includes vertical retaining walls because of the reduced land take impacts and particularly the reduced impacts on heritage. This approach was also well supported during the consultation process.

3.3.8 Table 3.5 reviews the two options presented for the western portal.

Table 3.5: Western portal canopy options

	(a) Full canopy with buildings external to canopy	(b) Canopy with ventilation slots with some buildings under canopy
Landscape / Visual	This is the **more preferable** option in terms of landscape and visual as it retains the surface landform above the tunnel and therefore the existing landscape pattern and coherency. The buildings at the portal would be screened by their position below the surface level.	This is the **less preferable** option in terms of landscape and visual as the ventilation slots would alter the surface landform and land use above the tunnel, thereby reducing the landscape coherency and pattern, compared to the full canopy option.

	(a) Full canopy with buildings external to canopy	(b) Canopy with ventilation slots with some buildings under canopy
Cultural Heritage	**More preferable** option because provides a more natural landscape in views from Normanton Down Barrows and Longbarrow.	**Less preferable** option because less natural landscape with fenced ventilation slots in views from Normanton Down Barrows, Lake Barrows and Longbarrow.

3.3.9 The Scheme now includes a full canopy with buildings external to the canopy because this was judged to be more preferable from the perspectives of both landscape and heritage and was also well supported during the consultation process.

3.3.10 Table 3.6 reviews the two options presented for the Countess Junction:

Table 3.6: Countess junction options

	(a) A303 flyover comprising two bridges with central embankment	(b) A303 flyover comprising a single viaduct (without a central embankment)
Landscape / Visual	This is the **more preferable** option in terms of landscape and visual as it enables landscaping adjacent to the flyover. The landscaping aids in visually screening the flyover as well as reflecting the vegetated character of this part of Amesbury, and improves the overall aesthetic quality of the Scheme.	This is the **less preferable** option in terms of landscape and visual as it results in an expansive area of hard surfacing below the viaduct, which is not considered to provide the aesthetic quality of the central embankment option and the open form of the single viaduct results in a greater visibility of this part of the Scheme.
Ecology	**More preferable** option in terms of ecology as it provides scope for replacement for loss of existing planting and better shelter to aid crossing of the Scheme by bats.	**Less preferable** option in terms of ecology for crossing by bats due to open structure.
Cultural Heritage	**More preferable** option in terms of cultural heritage because green central embankment provides more 'natural' setting for the listed Countess Farm buildings.	**Less preferable** option in terms of cultural heritage because single viaduct creates a more intrusive 'engineered' setting for the listed Countess Farm buildings.
Noise	**More preferable** option to minimise the propagation of traffic noise across the junction.	**Less preferable** option as allows traffic noise from the roundabout and A345 to propagate across the junction.
Water Environment	**More preferable** in terms of the water environment if bridge piling or foundations are less extensive or go less deep and so reduce any impact on groundwater flows. Less preferable option if the embankment leads to an increase in flood risk by blocking or changing	**Less preferable** in terms of the water environment if bridge piling or foundations is more extensive or go deeper than the alternative option and impact more on groundwater flows. More preferable option as an open viaduct would minimise any changes

	(a) A303 flyover comprising two bridges with central embankment	(b) A303 flyover comprising a single viaduct (without a central embankment)
	floodwater's overland flow routes.	to flood risk by having less blocking of overland flow routes.
Materials	**More preferable** option in relation to materials as the creation of the embankment enables more excavated materials to be reused within the Scheme which assists with balancing the Scheme's overall earthworks.	**Less preferable** option in relation to materials as there is a reduced requirement for fill material and this may adversely affect the earthworks balance of the Scheme, giving an increased surplus of excavated materials.

3.3.11 The Scheme now includes a flyover comprising two bridges with a central embankment because this was judged to be strongly preferable on a range of environmental criteria and was also well supported during consultation.

Alternative options presented for supplementary consultation

3.3.12 Three changes were presented for consideration at the supplementary consultation held between 17th July and 14th August 2018 and decisions have now been made in relation to those options. The main reasons for the selection of the relevant option and the rejection of the alternative, taking into account the consultation feedback and the effects of the development on the environment, are reported below. Only those environmental topics that were impacted by the design options are presented. Other environmental topics which were not impacted or for which there were no differences between the options are not referred to. These options were:

a) To remove the previously proposed link between Byways AMES 11 and AMES 12 within the WHS;

b) To widen the green bridge proposed near the existing Longbarrow Roundabout; and

c) To move the proposed modification of Rollestone crossroads

3.3.13 The location and extent of the 'land bridge', the extended Green Bridge Four east of the new Longbarrow junction, was presented at consultation and was well supported. The 'land bridge' has now replaced the shorter green bridge previously identified in the design on the western boundary of the WHS. This option was considered preferential due to the increased visual and physical connectivity between key barrow groups with the WHS.

3.3.14 The option not to provide a new connection south of the existing A303 to provide a motorised connection between byways 11 and 12 was presented at consultation and was well supported. The option was considered preferential as

it avoids having an additional route open to vehicle traffic within the WHS. This route would likely have adversely affected the setting of the Normanton Down Barrow Group and increased disturbance of nesting stone curlew in the Normanton Down RSPB reserve. This option has now been taken forward within the Scheme design.

3.3.15 The high load route (see section 2.3.61 and Figure 2.6) along the A360 and along the Packway, requires improvements to the Rollestone Corner Junction to enable large HGVs to navigate between the A360 and the Packway and vice versa by accommodating the required swept paths. Two options were presented at the supplementary consultation; Option 1 was located entirely outside of the WHS, while Option 2 was located partially within the WHS.

3.3.16 Table 3.7 reviews the two options presented for the Rollestone Corner Junction option.

Table 3.7: Rollestone corner junction options

	Option 1 – Located outside the WHS	Option 2 – Located inside the WHS
Archaeology	**Less preferable** as Bronze Age archaeological remains are likely within the vicinity of Option 1 as the area is rich in scheduled barrows and barrow groups. Most notably, the area for the pair of barrows scheduled as NHLE 1010891 lies 25m to the south of the option where it ties in to the present road. It is likely that further previously unknown archaeological remains survive within the option footprint.	**More preferable** as this option moves the land take further from the pair of barrows scheduled as NHLE 1010891, and recent archaeological evaluation shows that no buried remains would be affected.
Built heritage	**More preferable** as a listed milestone (NHLE1284782) would be avoided by the Scheme construction, but the removal of the current B3086, which it is situated adjacent to, would result in an impact to its setting as it would be situated in an area of chalk grassland at a field edge, rather than adjacent to the current road.	**Less preferable** as the location of a listed milestone (NHLE1284782) would be impacted by this option, as although retained and protected in situ, its setting would be altered by removal of the original line of the B3086 to the north.
WHS	**Less preferable:** Option 1 would not adversely impact the OUV of the WHS or any of its seven attributes. Works within the WHS for Option 1 would be very minor, to accommodate realigned fence lines; any adverse effect on the integrity or authenticity of the WHS would be insignificant. However, the WHS boundary in this area has been identified as a priority for amendment (extension) as part of a proposed boundary review – if this was	**More preferable**: Option 2 would not adversely impact the OUV of the WHS or any of its seven attributes. Although Option 2 would entail new land take within the WHS, the length of new infrastructure would be small and the impact on the integrity or authenticity of the WHS would be minor. The WHS boundary in this area has been identified as a priority for amendment (extension) as part of a proposed boundary review. If the boundary extension is implemented,

	Option 1 – Located outside the WHS	Option 2 – Located inside the WHS
	implemented, Option 1 would then lie within the WHS, with a concomitant impact on integrity and authenticity.	both options 1 and 2 would lie within the WHS; however, the reduced land take required for Option 2 would have a lesser impact on the integrity and authenticity of the WHS.
Landscape and visual	**Less preferable** with a larger footprint with an alignment more dispersed from the existing junction such that the impact to the wider landscape pattern would be greater.	**More preferable** with a smaller footprint with less direct change to the landform; in addition to its alignment being consolidated in closer proximity to the existing junction, such that the impact to the wider landscape pattern would be less.

3.3.17 Option 2 was selected as although heritage impacts are comparable, option 2 would move the land take further from the pair of barrows scheduled as NHLE 1010891 and is deemed slightly more preferable than Option 1. In addition, Option 2 responds to a landowner request to reduce the land take for this junction alteration and was well supported during the supplementary consultation.

Design development options

3.3.18 Collaboration between the environmental disciplines and scheme engineers has been an integral part of the design development process. Weekly meetings were held to discuss the development of the Scheme design. These sought to minimise environmental impacts of the design, with environmental specialists feeding into design aspects in order to avoid environmental constraints and minimise environmental effects, whilst taking into account response received during the statutory consultation. Examples include altering the horizontal alignment of the carriageway to avoid heritage assets within and outside of the WHS and the selection of a viaduct crossing of the River Till to reduce impacts on the SSSI / SAC.

3.3.19 A number of specific options have been considered in relation to the Scheme since the Preferred Route Announcement in September 2017. These can be summarised as follows:

a) B3083: alignment;

b) River Till viaduct: structural form, single deck or twin deck;

c) Rollestone Corner Junction: layout;

d) Longbarrow junction: location, layout, lighting;

e) Western portal: location, canopy options, vertical alignment;

f) Eastern portal: location;

g) Countess junction: layout, structural form; and

h) Consideration of extended tunnel option.

B3083 alignment

3.3.20 The Scheme would cross over the B3083 approximately 500m north of Winterbourne Stoke. Two options were considered for this crossing, both of which were designed to accommodate the required elevation of the new underbridge:

a) Option 1 was to make online alterations to the existing B3083 alignment, by lowering the B3083 by approximately 5m.

b) Option 2 was to move the future B3083 crossing point approximately 50m to the west, requiring a realignment of the B3083 of approximately 700m in length to accommodate this.

3.3.21 These two options are discussed further in Table 3.8.

Table 3.8: B3083 alignment options

	Option 1 – Online alterations with a 5m lowering of the B3083	Option 2 – 700m offline realignment, 50m west of existing B3083
Ecology	**More preferable** in terms of habitat loss as the majority of works would take place within the existing highway boundary. Both options would result in the loss of species rich hedgerows which line the existing B3083.	**Less preferable** due to loss of habitat, although this would largely be arable fields and is considered to be of low ecological value. Both options would result in the loss of species rich hedgerows which line the existing B3083.
Heritage	**More preferable** due to reduced construction requirements within undeveloped land and the subsequent potential to impact on unknown archaeological remains.	**Less preferable** due to greater construction requirements within undeveloped land and the subsequent potential to impact on unknown archaeological remains.
Landscape and visual	**More preferable** as the online alterations would not require additional land take above the existing footprint of the B3083 and would therefore reduce the development requirements within the landscape north of Winterbourne Stoke.	**Less preferable** as the new offline alignment would locally fragment the existing landscape to the north of Winterbourne Stoke.
People and communities	**Less preferable** as the B3083 would be required to be closed for a minimum of 12 months, causing substantial disruption to the residents of Winterbourne Stoke, Rollestone and Shrewton.	**More preferable** as the B3083 could remain open throughout the construction period.

	Option 1 – Online alterations with a 5m lowering of the B3083	Option 2 – 700m offline realignment, 50m west of existing B3083
Groundwater	**Less preferable** as the alignment crosses a dry valley containing head superficial deposits that may be subject to groundwater flooding at extreme groundwater levels. Dewatering is likely to be required during construction.	**More preferable** as the realignment of the B3083 to the east would be at a slightly higher elevation. It is considered that this design would have reduced dewatering requirements.
Engineering	**Less preferable** as extensive excavations, retaining walls and dewatering activities during construction would be required.	**More preferable** as construction of the new alignment would require less engineering elements and dewatering and would simply connect to the existing B3083 when construction was complete. Would also allow the B3083 to remain open during construction.

3.3.22 The decision was made to progress Option 2. While both options were considered to perform differently for each topic considered, Option 2 had the benefit that the existing B3083 would be able to remain open for the majority of the construction period. By comparison, Option 1 would require the B3083 to be closed for a minimum of 12 months, causing substantial disruption to the residents of Winterbourne Stoke, Rollestone and Shrewton.

3.3.23 Neither option was considered likely to lead to significant adverse environmental effects, particularly when the ability to mitigate the effects of the B3083 diversion for Option 2 was taken into account. Such mitigation includes:

a) replacement planting of hedgerows with an overall increase in hedgerow length;

b) provision of woodland planting to provide landscape integration and visual amenity; and

c) a comprehensive pre-construction archaeological investigation to determine impacts on known and unknown archaeological features.

River Till viaduct

3.3.24 Where the Winterbourne Stoke bypass section of the Scheme crosses the River Till, approximately 400m north of the existing A303 crossing at Winterbourne Stoke, a new structure is required.

Structural Form

3.3.25 Two options were considered for the form of the new structure:

a) Option 1 was a five span viaduct bridge.

b) Option 2 was a flood arch / culvert embankment bridge.

3.3.26 These two options are discussed further in Table 3.9.

Table 3.9: River Till viaduct structural form options

	Option 1 – five span viaduct bridge	Option 2 - flood arch / culvert embankment bridge.
Ecology	**More preferable** as a smaller footprint limits habitat loss from within the River Till SSSI / River Avon SAC. Piles would be located outside of the Till river channel and therefore be entirely passable by fauna.	**Less preferable** as the increased footprint would require land take and vegetation loss from the River Till SSSI / River Avon SAC. The structure may be impassable for some fauna and alter flow rates and sedimentation downstream, affecting attributes for which the SSSI / SAC is designated.
Landscape and visual	**More preferable** as the comparatively open structure would be less intrusive within the landscape and allow views of the Till Valley beneath the structure.	**Less preferable** as the flood arch design would be intrusive within the landscape of the Till Valley and restrict views beneath the structure.
Floodplain	**More preferable** as the viaduct design would only require piles to be located within the floodplain, thereby maintaining floodplain capacity and conveyance with minimal effects on flow rates and sedimentation.	**Less preferable** as the design would require the introduction of earthworks between culverts into the floodplain. This would likely result in a significant reduction in floodplain capacity and conveyance, adversely affecting the watercourse by altering the boundary and riparian shape and substrate, flow rate and extent, downstream sediment and habitat connectivity.

3.3.27 The decision was made to progress Option 1, primarily due to the reduced impact on the River Till and floodplain.

Viaduct options

3.3.28 Following the decision on the structural form of the River Till crossing, four options were considered for the design of the viaduct:

a) Option 1 was a five span, twin deck, post-tensioned concrete box-girder structure of approximately 215m.

b) Option 2 was a three span, twin deck, post-tensioned concrete box-girder structure of approximately 215m.

c) Option 3 was a five span, twin deck, steel girder and concrete slab composite structure of approximately 215m.

d) Option 4 was a five span, twin deck, steel box-girder structure of approximately 215m.

3.3.29 These options are discussed further in Table 3.10.

Table 3.10: River Till viaduct options

	Option 1	Option 2	Option 3	Option 4
Ecology	**More preferable** as the incremental launching construction methodology minimises construction impacts on the River Till as there would be reduced works required within the channel.	**Less preferable** as the alignment to the west of the River Till required for this option would likely require land take from Parsonage Down SSSI. Additionally, the cantilevering arrangement to the three span option would result in a reduction in height from ground level to the bridge structure (deeper deck), therefore potentially increasing shading effects on the River Till.	**Less preferable** as the steel structure would have greater maintenance requirements which would necessitate more frequent works within the River Till over the structure's lifespan.	Considered to be the same as Option 3.
Floodplain	**Less preferable** in terms of five piers requiring land take from the floodplain. An incremental launching construction methodology would take place from entirely within the footprint of the proposed embankments, thereby avoiding land take from the floodplain.	**More preferable** as fewer piers reduces land take from within the floodplain and a cantilevering construction method would take place from entirely outside of the floodplain.	**Less preferable** as the steel structure would require more frequent maintenance works to take place within the floodplain.	Considered to be the same as Option 3.

	Option 1	Option 2	Option 3	Option 4
Groundwater	**Less preferable** as would require five sets of piers and therefore there would be greater interaction with groundwater and hydrogeology.	**More preferable** as three sets of piles would have a reduced interaction with groundwater and hydrogeology.	Considered to be the same as Option 1.	Considered to be the same as Option 1.
Engineering	**More preferable** as the five span arrangement suits crossing the River Till and bridleway to the west of the river while keeping structural depth to a minimum.	**Less preferable** as the three span arrangement does not suit crossing the River Till or bridleway to the west of the river as well as the five span options.	**Less preferable** as the steel structure would have greater maintenance requirements over the structure's lifespan.	Considered to be the same as Option 3.

3.3.30 The decision was taken to progress Option 1 primarily on the basis of the ecological and engineering considerations outlined above.

Viaduct deck options

3.3.31 Two options were considered for the viaduct deck:

a) Option 1 was a single deck structure, approximately 28m wide and 8-10m height.

b) Option 2 was a twin deck structure with a separation between decks of 5-10m (28m wide plus 5-10m deck separation and 8-10m height).

3.3.32 The key differentiator between the two options is shading of vegetation beneath the viaduct. In light of concerns regarding the impacts of shading, with associated loss of vegetation underneath the structure adversely affecting the SAC, a shading study was undertaken to ascertain the effects of shading from structures on riparian vegetation. This study found that single deck bridges have an adverse effect unless at a height which avoids shading. It was not feasible for Option 1, with the dual carriageway in a single width, to be raised high enough to avoid the adverse effects of shading. Option 2, with twin decks separated by 5-10m, would allow enough light below the structures to maintain vegetation whilst keeping the structure at a reasonable height. On this basis, the decision was made to progress Option 2.

Longbarrow junction

3.3.33 At present traffic flow along the A303 is impeded by Longbarrow roundabout. To enable continuous traffic flow along the new A303, the Longbarrow Roundabout would be removed from the alignment, with a reconfiguration of the junction to allow entry and exit to the A303 via slip roads on to the A360. This new junction would allow unimpeded traffic flow along the new A303.

Location

3.3.34 Three options were considered:

a) Option 1 was a dumbbell configuration located approximately 300m west of the existing Longbarrow Roundabout. Slip roads would not enter the WHS, although this would require a departure from design standards.

b) Option 2 was in the same location and of the same configuration as Option 1, however a design review was undertaken which identified that the eastern entrance and western exit slip roads would need to be located within the WHS to meet DMRB design standards.

c) Option 3 was the same configuration as Option 2 but with the junction moved approximately 200m west to avoid slip roads entering the WHS.

3.3.35 These options are discussed further in Table 3.11.

Table 3.11: Longbarrow junction location options

	Option 1 - located approximately 300m west of the existing Longbarrow Roundabout (slip roads outside of the WHS)	**Option 2 - the same location as Option 1 with slip roads inside the WHS to meet DMRB design standards.**	**Option 3 - the same as Option 2 but located approximately 500m west of the existing Longbarrow Roundabout to avoid slip roads entering the WHS.**
Heritage	**Less preferable** as although the design would distance the sight and sound of traffic at the junction from the Winterbourne Stoke barrow group, including the Neolithic Longbarrow, this would be a reduced benefit to OUV in comparison to Option 3.	**Less preferable** as approximately 200m of slip roads would be located within the WHS. In addition, although the design would distance the sight and sound of traffic at the junction from the Winterbourne Stoke barrow group, including the Neolithic Longbarrow, this would be a reduced benefit to OUV in comparison to Option 3.	**More preferable** as it would not require additional land take from the WHS and the greater distance from the WHS would further remove the sight and sound of traffic at the junction from the Winterbourne Stoke barrow group, including the Neolithic Longbarrow. This would be an increased benefit in terms of OUV by reducing the existing adverse

	Option 1 - located approximately 300m west of the existing Longbarrow Roundabout (slip roads outside of the WHS)	Option 2 - the same location as Option 1 with slip roads inside the WHS to meet DMRB design standards.	Option 3 - the same as Option 2 but located approximately 500m west of the existing Longbarrow Roundabout to avoid slip roads entering the WHS.
			impacts of the A303 and A360 on the setting of the barrow group.
Engineering	**Less preferable** as locating the slip roads entirely outside of the WHS would require a departure from design standards, reducing the operational safety of the design.	**More preferable** as the design would not require departures from design standards.	**More preferable** as the design would not require departures from design standards.

3.3.36 The decision was made to progress Option 3. Option 1 would require a departure from design standards while having reduced benefits in comparison to Option 3, while Option 2 would require land take from the WHS whilst also having reduced benefits for OUV in comparison to Option 3. Option 3 was preferential in terms of both increased benefits to OUV and not requiring any departure from design standards.

Layout

3.3.37 Two options were considered:

a) Option 1 was the dumbbell roundabouts and connecting bridge at grade with A303 within cutting.

b) Option 2 was the A303 at grade with roundabouts within cutting and connecting link under-bridged below the A303.

3.3.38 These two options are discussed further in Table 3.12.

Table 3.12: Longbarrow junction layout options

	Option 1 - roundabouts and connecting bridge at grade.	Option 2 - A303 at grade with roundabouts and connecting link below
Landscape and visual	**More preferable** as there would be reduced earthworks associated with the A360 north and south tie-ins and reduced embankments on the approach to the Till Valley.	**Less preferable** as there would be substantially increased earthworks associated with the deeper cuttings on the A360 north and south tie-ins, and the larger embankments required on the

	Option 1 - roundabouts and connecting bridge at grade.	Option 2 - A303 at grade with roundabouts and connecting link below
		approach into the Till Valley.
Heritage	**More preferable** as placing the A303 within cutting at the boundary of the WHS would result in greater benefits to OUV by reducing impact on receptors within the WHS, including the Winterbourne Stoke barrow group.	**Less preferable** as keeping the A303 at grade would have a greater visual impact to key receptors within the WHS, including the Winterbourne Stoke barrow group.

3.3.39 The decision was made to progress Option 1, primarily due to its reduced landscape and visual impacts and the benefits to the OUV of the WHS. To further reduce the landscape and visual impacts, the design was developed further to lower the A360 north and south tie-ins as well as the roundabouts so that they would be recessed into the surrounding landscape by approximately 2m.

Lighting

3.3.40 Two options were proposed for lighting at Longbarrow junction – lit or unlit. Environmental appraisal strongly favoured the unlit option, as having a lit junction would significantly reduce the benefits of moving the junction westwards. This was due to the lit junction being visually intrusive in views to, and from within, the WHS, whereas having an unlit junction would eliminate additional light intrusion.

3.3.41 Following this recommendation, safety concerns were raised over having an unlit junction. A technical review was undertaken and it was confirmed that there were no economic or safety benefits supporting the installation of road lighting, however the review did recommend the introduction of traffic signals at the junction and these have now been incorporated into the design. It has been concluded that the junction would remain unlit.

Western portal

Location

3.3.42 Three options were proposed for the location of the western portal:

a) Option 1 was located immediately south of the existing A303, approximately 1.4km east of the existing Longbarrow Junction.

b) Option 2 was located immediately south of the existing A303, approximately 1km east of the existing Longbarrow Junction.

c) Option 3 was located immediately south of the existing A303, approximately 500m east of the existing Longbarrow Junction.

3.3.43 These options are discussed further in Table 3.13.

Table 3.13: Western portal location options

	Option 1	Option 2	Option 3
Ecology	**Less preferable** as the portal would be located within an area of grassland reversion which would be affected temporarily by construction and permanently by habitat loss. There would also likely be some indirect disturbance impacts experienced by the RSPB reserve located approximately 250m south.	**More preferable** as the portal would be located in an area of land under arable use and is therefore considered to be of low value to biodiversity.	Considered to be the same as option 2.
Heritage	**Less preferable** as it is likely that a Scheduled Monument (barrow) would be partially or totally removed to enable the portal to be constructed in this location, adversely affecting attribute two of OUV (physical remains of Neolithic and Bronze Age monuments). Additionally there are multiple assets in the vicinity of the proposed portal for which setting is a key attribute and which may be adversely affected.	**More preferable** as there would be no physical impacts on Scheduled Monuments which contribute to OUV. Additionally, the portal is not located between major monument groups and therefore has comparatively reduced impact on attribute five of OUV (the siting of monuments in relation to each other).	**Less preferable**, as although there would be less land take from within the WHS, the portal would be located between the Winterbourne Stoke barrow group and the Diamond Group, adversely affecting attribute five of OUV (the siting of monuments in relation to each other). Additionally, the cutting emerging from the western portal would likely result in physical impact on a Scheduled Monument (prehistoric linear boundary), adversely affecting attribute two of OUV (physical remains of Neolithic and Bronze Age monuments).

	Option 1	Option 2	Option 3
Landscape and visual	**Less preferable** as locating the portal eastwards would increase the land take required for surface highway within the WHS and therefore would have increased negative effects in landscape and visual terms.	**More preferable** as locating the portal westwards would be comparatively positive in landscape and visual terms as there would be less land take into the WHS.	**Less preferable**, as although requiring the least land take from the WHS, the location of the portal between two important barrow groups would detract significantly from the views to and between these monuments.

3.3.44 The decision was made to progress Option 2, primarily due to heritage and landscape and visual impacts and land take within the WHS. Despite requiring the least land take within the WHS, Option 3 was rejected as it would likely require the partial removal of a Scheduled Monument and would place the portal and carriageway between two important heritage features, both of which would adversely affect OUV.

3.3.45 Following further consideration of the heritage and landscape and visual implications of the location of the western portal, it was recommended that mitigation in the form of a canopy was included in the design to reduce the portal's visual impacts (refer to sections 3.3.8 and 3.3.9).

Portal approach

3.3.46 Two options were proposed for the approach to the portal entrance:

a) Option 1 was a 200m fully covered canopy approach to the portal with tunnel service buildings external to canopy.

b) Option 2 was a 200m canopy cover approach with three ventilation / lighting structural strips and tunnel service buildings partially within the canopy section.

3.3.47 Both options were taken forward for consideration at public consultation and are discussed in sections 3.3.8 and 3.3.9. The decision was made to adopt Option 1 with the full canopy.

Vertical alignment

3.3.48 Approximately 1km of highway is required between the western boundary of the WHS and the western portal entrance. Three options were proposed for this approach to the western portal through the WHS.

a) Option 1 was the highway within a 5m cutting approach through the WHS, with the cutting deepening approximately 400m prior to the portal entrance to meet the depth of the western portal at approximately 15m.

b) Option 2 was an at grade approach through the WHS, with the highway entering a cutting approximately 500m before the western portal and dropping down to meet the portal depth of approximately 15m.

c) Option 3 was the highway within a 2m cutting approach through the WHS, with the cutting deepening approximately 500m prior to the portal entrance to meet the depth of the western portal at approximately 15m.

3.3.49 These options are discussed further in Table 3.14.

Table 3.14: Western portal approach options

	Option 1 – 5m cutting approach	Option 2 – at grade approach	Option 3 – 2m cutting approach
Heritage	**More preferable** as a 5m cutting is likely to be more effective in screening the sight and sound of traffic within this area of the WHS. There are numerous assets which would benefit from the improvement or recreation of historic sightlines between key monuments and therefore this option would be beneficial to OUV.	**Less preferable** as this option would not remove or improve the existing impact of the sight and sound of traffic on the setting of assets within this area of the WHS and views between them.	**Less preferable** as the 2m cutting would not effectively conceal tall vehicles and the sight and sound of traffic would continue to impact the setting and views between assets within this area of the WHS.
Landscape and visual	**More preferable** as setting the highway 5m below existing ground level in a partially retained cut would effectively reduce the visual impact of the highway and traffic within the WHS along this section of the alignment.	**Less preferable** as this option would provide no screening of the views of the highway and traffic within the WHS. There would be no improvements in comparison to the existing A303 which is currently at grade within this location.	**Less preferable** as a 2m cutting would not provide full screening of the highway and vehicles. There would only be minor improvements to the existing conditions within this location.
Noise	**More preferable** as the deeper the cutting the more effective it would be in shielding traffic noise from the surrounding area.	**Less preferable** as having the A303 running at grade, rather than in a 5m or 2m cutting, would remove the shielding provided by the cutting walls and traffic noise would be able to disperse into the surrounding area.	**Less preferable**, although a 2m cutting is likely to still provide some shielding, and therefore a reduction in traffic noise levels in the vicinity, though the benefit of the cutting would be reduced.

	Option 1 – 5m cutting approach	Option 2 – at grade approach	Option 3 – 2m cutting approach
Groundwater	**Less preferable** as a 5m cutting running for approximately 1km has a greater potential to interrupt and limit groundwater flows which could affect the flow into the River Avon and groundwater springs.	**More preferable** as only 500m would be within cutting and therefore there would be reduced interaction with, and less interruption of, groundwater flows.	**Less preferable**, as although still within a cutting, the reduced depth of 2m is likely to have less interaction with groundwater flows than the 5m cutting proposed for option 1.
Materials	**Less preferable** as the 5m cut would result in a substantial quantity of earthwork material being excavated, which would require on or off site management.	**More preferable** as running the A303 predominantly at grade would reduce the quantity of earthworks material excavated, reducing the need for suitable on or off site management.	**Less preferable** as a 2m cutting would reduce the quantity of earthworks material excavated in comparison to option 1, therefore reducing the need for suitable on or off site management.

3.3.50 The decision was made to progress Option 1 as Options 2 and 3 would either provide no, or limited, visual and noise screening of vehicles, and would thereby adversely affect the OUV of the WHS.

Eastern Portal

Location

3.3.51 Two options were considered for the location of the Eastern Portal:

a) Option 1 was located approximately 300m east of Stonehenge Cottages and 75m north of the existing A303.

b) Option 2 was located approximately 200m east of the proposed location for Option 1.

3.3.52 These two options are discussed further in Table 3.15.

Table 3.15: Eastern portal location options

	Option 1 - 300m east of Stonehenge Cottages and 75m north of the existing A303	Option 2 - approximately 200m east of the proposed location for Option 1
Heritage	**Less preferable** due to the greater land take requirement from the WHS and impacts on OUV. The portal entrance and surface road would be closer to several Scheduled Monuments	**More preferable** as there would be reduced land take within the WHS and impacts on OUV. The portal entrance and surface road would be at a greater distance from several Scheduled

	Option 1 - 300m east of Stonehenge Cottages and 75m north of the existing A303	Option 2 - approximately 200m east of the proposed location for Option 1
	(including the Avenue) and restrict the number of heritage assets being physically and visually reconnected.	Monuments (including the Avenue), thereby allowing a greater number of assets to be physically and visually reconnected.
Engineering	**Less preferable** due to overhead powerlines being located in close proximity to the portal entrance and being a constraint to construction activities.	**More preferable** as the portal entrance would be at a greater distance from the overhead powerlines, therefore reducing constraints to construction.

3.3.53 The decision was made to progress Option 2 as this option would avoid constraints associated with the proximity of overhead power lines and was comparatively beneficial in terms of impact on the WHS and OUV.

Countess roundabout

3.3.54 Traffic flow along the A303 is currently impeded by Countess Roundabout. To facilitate continuous traffic flow, the removal of Countess Roundabout from the A303 would be required, with reconfiguration of the junction to allow entry and exit to the A303 via slip roads, therefore allowing unimpeded traffic flow along the A303.

Layout

3.3.55 Two options were considered for the layout of the reconfigured junction:

a) Option 1 was a raised circularity configuration with the A303 at grade.

b) Option 2 was raising the A303 on a flyover above the existing Countess Roundabout.

3.3.56 These two options are discussed further in Table 3.16.

Table 3.16: Countess junction layout options

	Option 1 raised circulatory	Option 2 raised A303
Ecology	**Less preferable**, as the larger footprint required to accommodate extensive engineering and earthworks to raise the circulatory would result in greater habitat loss to the north and south of the A303, including woodland within Amesbury Abbey. Construction activities would be required where the A345 bisects the River Avon SAC / River Avon System SSSI, resulting in higher levels of indirect disturbance impacts	**More preferable** as the smaller footprint would reduce habitat loss and construction activities would be at a greater distance from the River Avon SAC / River Avon System SSSI. A reduced operational lighting requirement would limit light pollution which could affect surrounding woodland habitat and qualifying features of the River Avon SAC / River Avon System SSSI.

	Option 1 raised circulatory	Option 2 raised A303
	associated with increased levels of noise, vibration, light pollution and human activity. Option 1 would also be less preferable in terms of operational impacts as there would be higher levels of light pollution, likely affecting surrounding woodland habitat and qualifying features of the River Avon SAC / River Avon System SSSI.	
Flood risk	**Less preferable** as areas to the north and south of the existing Countess Roundabout are classified as Environment Agency Flood Zones. The large footprint of Option 1 would require increased levels of development within the floodplain.	**More preferable** as the comparatively smaller footprint would limit development within the floodplain.
Heritage	**Less preferable** as the large earthworks and associated larger footprint would bring the structure closer and therefore increase the impact on setting of the listed buildings at Countess Farm. Land take may be required from the Registered Park and Garden at Amesbury Abbey, which may also bring the Scheme closer to the Blick Mead site.	**More preferable** as the junction would be contained within the existing highway boundary. No land take required from the Registered Park and Garden at Amesbury Abbey.
Engineering	**Less preferable** as extensive construction of structures and retaining walls would be required to raise the circulatory above the A303.	**More preferable**, as although a large bridge would be constructed, this is comparatively simpler than raising the circulatory.

3.3.57 A decision was made to progress Option 2, primarily due to the extensive engineering works required for raising a circulatory system above the A303, and their associated environmental impacts.

Structural form

3.3.58 Following the decision on the layout of the reconfigured Countess Roundabout, four options were considered for the structural form and general arrangement of the flyover:

a) Option 1 was twin single span concrete structures with vertical abutments. The centre of the roundabout would have a filled embankment to the level of the raised A303.

b) Option 2 was the same as Option 1 except with raked abutments.

c) Option 3 was twin three span structures with revetments and a filled embankment at the centre of the roundabout.

d) Option 4 was a six span steel composite structure with an open plan underneath.

3.3.59 These options are discussed further in Table 3.17.

Table 3.17: Countess junction structural form options

	Option 1 - two span with vertical abutments and filled embankment	Option 2 - two span with raked abutments and filled embankment	Option 3 - three span with revetments and filled embankment	Option 4 - open plan
Ecology	**More preferable** as the filled embankment can be used for habitat creation and would help to facilitate passage by bats over the structure.	Considered to be the same as Option 1.	Considered to be the same as Option 1.	**Less preferable** as there would be limited opportunities for habitat creation and planting to assist in bat passage over the structure.
Heritage	**More preferable** as the filled central embankment would provide a more 'natural' setting for the listed Countess Farm buildings.	Considered to be the same as Option 1.	Considered to be the same as Option 1.	**Less preferable** as the open plan viaduct creates a more intrusive 'engineered' setting for the listed Countess Farm buildings.
Groundwater	**More preferable** as the bridge piling or foundations are likely to be less extensive and / or deep and so reduce any impact on groundwater flows.	Considered to be the same as Option 1.	Considered to be the same as Option 1.	**Less preferable** as bridge piling or foundations are likely to be more extensive or go deeper than the alternative option and impact more on groundwater flows.
Flood risk	**Less preferable** as the embankment may lead to an increase in flood risk by blocking or changing floodwater's overland flow routes.	Considered to be the same as Option 1.	Considered to be the same as Option 1.	**More preferable** as the open viaduct would minimise any changes to flood risk by having less blocking of overland flow routes.

	Option 1 - two span with vertical abutments and filled embankment	Option 2 - two span with raked abutments and filled embankment	Option 3 - three span with revetments and filled embankment	Option 4 - open plan
Noise	**More preferable** as the filled embankment would provide screening of the propagation of noise across the junction from north to south, and vice versa.	Considered to be the same as Option 1.	Considered to be the same as Option 1.	**Less preferable** as the open structure, with no filled embankment at the centre, would provide no screening of the propagation of noise across the junction from north to south, and vice versa, though the difference would be unlikely to be significant as majority of traffic would be on the mainline.
Landscape and visual	**More preferable** as the filled embankment would reduce the visual impact arising from views across beneath the flyover of the 'dead space' and traffic.	Considered to be the same as Option 1.	Considered to be the same as Option 1.	**Less preferable** as there would likely be greater impacts on character at a local level (due to the more urban design and 'dead space' beneath the flyover), and a greater visual impact arising from views across beneath the flyover of the 'dead space' and traffic.
Materials	**More preferable** as the creation of the embankment enables more excavated materials to be reused within the Scheme which assists with balancing the scheme's overall earthworks.	Considered to be the same as Option 1.	Considered to be the same as Option 1.	**Less preferable** as there is a reduced requirement for fill material and this may adversely affect the earthworks balance of the Scheme, giving an increased surplus of excavated materials.

	Option 1 - two span with vertical abutments and filled embankment	Option 2 - two span with raked abutments and filled embankment	Option 3 - three span with revetments and filled embankment	Option 4 - open plan
Engineering	**More preferable** as the conventional construction of the design, with a deck lifted into place, would be simpler to construct and would have minimal traffic management measures. The concrete structure would also require less maintenance.	**Less preferable** as the raked abutments would be more complex to design and construct.	**Less preferable** as the revetments would be more complex to design and construct.	**Less preferable** as the steel structure would be more complex to construct and would require increased maintenance levels.

3.3.60 Options 2 and 3 were not taken forward as they were considered to have the same likely environmental effects as Option 1, while being more complex to design and construct. Options 1 and 4 were for taken forward for consideration at public consultation. The decision was made to adopt Option 1, with the flyover comprising two bridges with central embankment (see sections 3.3.10 and 3.3.11).

Extended tunnel options

3.3.61 In response to feedback from ICOMOS, consideration has been given to extending the tunnel (longer than 3km) in a westerly direction to or beyond the western boundary of the WHS. Options considered included a cut and cover tunnel extending from the current western end of the bored tunnel to the western perimeter of the WHS; and continuing the bored tunnel to an appropriate portal location beyond the western boundary of the WHS. While both options would have heritage benefits with regard to the OUV of the WHS, they were both discounted on the grounds of a significant increase in Scheme cost as well as an increase in construction period.

3.4 Construction options

Tunnelling methodology

3.4.1 Two tunnelling concepts and five techniques for tunnel construction were considered as follows:

a) Option 1: Open Face Tunnelling

i. Open Shield

ii. Sprayed Concrete Lining

b) Option 2: Closed Face tunnelling

i. Slurry TBM

ii. Earth Pressure Balance TBM

iii. Variable Density TBM

3.4.2 Open face tunnelling was excluded as this would require very extensive dewatering of an extent that would be unacceptable in the context of a major aquifer. In addition, within the variable geology present, open-faced tunnelling is also likely to be less safe than the closed-faced alternatives.

3.4.3 It was therefore concluded that safe construction of the main tunnel bore could only be completed by the three closed face techniques, which would greatly lower the need for dewatering. In the UK it has become normal practice to tunnel water bearing chalk (as in the case with the Scheme) with a slurry machine although in this case, the machine choice would be left to appointed contractor.

References

Ref 3.1: Investing in Britain's Future; HM Treasury (2013): (https://www.gov.uk/government/publications/investing-in-britains-future)

Ref 3.2: A303/A30/A358 Corridor Feasibility Study; C2HM Hill (2015): (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/410454/a303-stage-1-report.pdf)

Ref 3.3: Road Investment Strategy: for the 2015/16 – 2019/20 Road Period; Department of Transport (2015): (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf)

Ref 3.4: A303 Stonehenge Amesbury to Berwick Down Scheme Assessment Report (2017): (https://highwaysengland.citizenspace.com/cip/a303-stonehenge/results/sar-volume-1.pdf)

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