highways england

A66 Northern Trans-Pennine project

Route development report

Volume 2

Appendices and Plans and Profiles

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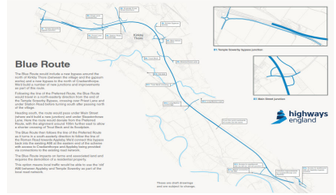
A Sifting matrices

A.1 Temple Sowerby to Appleby - Blue Route versus Red Route sifting matrix

Alternative Option Name	**Temple Sowerby to Appleby - Blue Route Vs Red Route**		
Description	Assessment of Blue Route vs Red Route for the central section of the Temple Sowerby to Appleby scheme. Due to local topography the new Trout Beck crossing is expected to have a height from ground level of approximately 18m. The Red Route seeks to reduce impact on the SAC by crossing Trout Beck and its floodplain at a narrower point than the Blue Route. The Red Route has a similar horizontal alignment to the Blue Route at its west end but it should be noted that the vertical alignments differ. At the east end around Crackenthorpe the route alignments are the same. The Red Route will allow the de-trunked A66 to become the local road connection between Appleby and Temple Sowerby. The Red Route will not require a bridge to be constructed at Powis House on Long Marton Road. The Red Route results in the new A66 being approximately 750m closer to the village of Long Marton.		
Drawing (name and link)			
Drawing Image	Alternative - Red Route	Base - Blue Route	
			
Reason for option consideration	The Red Route was developed following analysis of the Environment Agency flood maps for the area around Trout Beck. It gives a shorter crossing point of the Beck of around 300m rather than the 400m crossing that the Blue Route requires. The Red Route moves the alignment away from known cultural heritage sites close to Kirkby Thore. The route is constrained from moving further to the east because of the Gypsum mine workings.		
Assessment outcome (State the result of the assessment)	The assessment demonstrates that the Blue Route is preferred over the Red Route. The assessment demonstrates that the Blue Route performs better in a number of areas such as highway alignment, population and human health and effects on stakeholders.		
Discipline	**Impacts**	**Comparison of Red Route with base Blue Route**	**Justification**
Engineering			
Highways - Standards Compliance	The Red alignment main line has more relaxed horizontal radii than the Blue Route, which could be considered worse geometry, however it does not have the long straight downhill section towards a relaxed curve that the Blue Route alignment does. While this geometry complies with standards it is not desirable. The Red Route alignment has better geometry consistency throughout its length. The Red Route alignment does not require any works to Long Marton (road) at the crossing point. While the existing road geometry is substandard the scheme does not make this worse. The Blue Route alignment does make the vertical geometry at the Long Marton (road) crossing worse than existing.	Worse	The Red Route alignment has better geometrical consistency and does not make the existing side road geometry worse than existing.
Utilities	Statutory Undertakers C2 utility information is not complete at this time. Based on what we do have, the Red Route will likely have a slightly lesser impact on overhead powerlines.	Better	Overall it is anticipated that the Red Route will have a lesser impact than Blue Route.
Geotechnics and Earthworks	Routes are very similar from a geological and earthworks point of view. However, it should be noted that the Red Route crosses the geological fault line from Penrith Sandstone to Eden Shales, which may introduce a higher potential for finding sinkholes along the route, and the risk of dissolution.	Neutral	There is no evidence to suggest that geotechnics and earthworks is a material factor in determining the Current Preferred Alignment for this scheme.
Structures	Although crossing of Trout Beck is expected to be shorter with the Red Route, the local topography means that the structure will need to be around 18m high causing it to stand out within the landscape. The Red Route will also require an additional structure to cross Keld Syke.	Worse	Less structures required with Blue Route and impacts of Trout Beck Crossing greater with regard to the Red Route due to increased height.
Drainage and Hydrology	The proposed drainage design for both route alignments is likely to be similar. They both require three attenuation ponds and will discharge direct to Trout Beck. As there is no requirement for works to Long Marton (Road) the Red Route alignment does not need any of the drainage, ponds or culverts that the Blue Route alignment needs for the side road. Both alignments will span the full width of the 100 year + Climate change Trout Beck / Keld Syke floodplain with a structure and have minimal impact on flood risk.	Better	The drainage systems for the route alignments are similar, but the Blue Route alignment needs drainage for side roads that the Red Route doesn't affect. Flood risk impact is minimal for both alignment options.
Construction Design Management (CDM)	Both routes are similar with the complexity of the construction works required, CDM implications are neutral.	Neutral	There is no evidence to suggest that CDM is a material factor in determining the Current Preferred Alignment for this scheme.

Construction Cost		Based on main line design models only, the cut / fill earthworks requirements of the Blue and Red Route alignments are similar.	Neutral	There is no evidence to suggest that Construction Cost is a material factor in determining the Current Preferred Alignment for this scheme.
Buildability		Both routes involve greenfield construction away from the existing A66. No significant differences between the two routes.	Neutral	There is no evidence to suggest that buildability is a material factor in determining the Current Preferred Alignment for this scheme.
Environment				
Biodiversity	Construction	Designated Sites: Crosses the Trout Beck (River Eden SAC) approximately 1km upstream from the crossing point of the Blue Route Section 41 . Priority Habitats: rivers and streams (Trout Beck, and Keld Sike , loss and shading impacts, pollution potential) affected. Additional impacts to scattered semi-mature to mature trees Protected/notable species - 1 structures and 8 trees with moderate to high bat roost potential being lost. Red Squirrel habitat loss, Badger squirrel loss. Otter habitat loss and disturbance (may be less so due to proximity of exist dairy business. Loss of water vole habitat. Both routes have the potential to impact aquatic species during construction, including the qualifying species of the SAC (Atlantic salmon, bullhead, lamprey and white clawed crayfish) as both crossing locations provide optimal habitat and a migration route. Habitat loss/disturbance through shading of the river is broadly consistent across both routes, however the Red Route has an additional crossing of a Keld Sike which results in additional habitat loss/disturbance through shading. The Nationally Scarce bryophyte Porella pinnata was recorded in the vicinity of the Red Route.	Neutral	Similar impacts to the Trout Beck tributary which forms a part of the River Eden SAC as the Blue Route alternative. The Red Route crosses at a narrower point in the floodplain of the watercourse, resulting in a shorter crossing structure. Construction impacts to freshwater species are considered to be very similar, with the exception of a potential impact (full assessment of impacts pending) on the Nationally Scarce bryophyte Porella pinnata which was recorded in the vicinity of the Red Route.
	Operation	Designated Sites: Crosses the Trout Beck (River Eden SAC) approximately 1km upstream from the crossing point of the Blue Route Section 41 . Priority Habitats: rivers and streams (Trout Beck, and Keld Sike , loss and shading impacts, pollution potential) affected. Additional impacts to scattered semi-mature to mature trees Protected/notable species - 1 structures and 8 trees with moderate to high bat roost potential being lost. Red Squirrel habitat loss, Badger squirrel loss. Otter habitat loss and disturbance (may be less so due to proximity of exist dairy business. Loss of water vole habitat. Habitat loss/disturbance through shading of the river is broadly consistent across both options, however the Red Route has an additional crossing of a Keld Sike which results in additional habitat loss/disturbance through shading. The Nationally Scarce bryophyte Porella pinnata was recorded in the vicinity of the red option.	Neutral	Similar impacts to the Trout Beck tributary which forms a part of the River Eden SAC as the Blue Route alternative. The Red Route crosses at a narrower point in the floodplain of the watercourse, resulting in a shorter crossing structure. Operation impacts to freshwater species are considered to be very similar, with the exception of a potential impact (full assessment of impacts pending) on the Nationally Scarce bryophyte Porella pinnata which was recorded in the vicinity of the Red Route.
Road Drainage and Water Environment	Construction	Both routes require a new crossing over Trout Beck (a tributary within the River Eden SAC). Red Route also requires crossing of Keld Syke	Worse	Blue has one fewer watercourse crossing. Both wide spans of Trout Beck.
	Operation	Road related run off may impact on surface water quality of surrounding watercourses.	Neutral	Red Route is further from the Rivers Trust channel construction scheme, more potential for d/s re-naturalisation schemes. The Blue and Red Route avoid most of the proposed and existing Gypsum mineworkings but the realignment of main street and its connection to the new A66 does pass over them. We are looking to minimise this as much as possible with our design but it cannot be avoided completely . The rest of the Blue and Red routes avoid the primary deposits of gypsum but there is a risk that small pockets of gypsum could be encountered during construction.
Geology, Soils, Contaminated Land and Groundwater	Construction	Land take required within ALC 2, 3a, 3b. Land take required from soils supporting SAC or SSSI. Exposure of contaminated soil sources that may impact on human health, principal aquifers.	Neutral	There is no evidence to suggest that Geology, soils contaminated land and groundwater are a material factor in determining the Current Preferred Alignment for this scheme.
	Operation	Operationally the potential impacts will be similar between alternative routes.	Neutral	There is no evidence to suggest that Geology, soils contaminated land and groundwater are a material factor in determining the Current Preferred Alignment for this scheme.

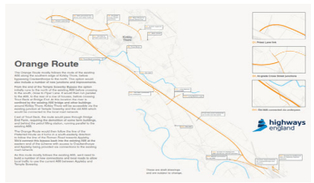
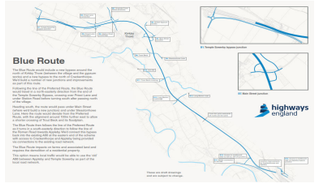
Noise and Vibration	Construction	To inform the comparison assumptions of broad construction activities have been made to broadly determine where there is risk of significant impacts.	Neutral	It is considered that the general construction impacts between the alternatives are broadly similar enough that they would not be considered a factor in selecting a preference.
	Operation	<u>Red Route:</u> 167 residential receptors predicted to experience significant adverse effects 178 residential receptors predicted to experience significant beneficial effects 4 non-residential receptors predicted to experience significant adverse effects 7 non-residential receptors predicted to experience significant beneficial effects <u>Blue Route:</u> 256 residential receptors predicted to experience significant adverse effects 124 residential receptors predicted to experience significant beneficial effects 4 non-residential receptors predicted to experience significant adverse effects 8 non-residential receptors predicted to experience significant beneficial effects	Better	Red Route has over all fewer significant adverse effects and more significant beneficial effects.
Landscape and Visual	Construction	Greater loss of trees. Similar construction between all alternative routes.	Neutral	It is considered that the general construction impacts between the alternative routes are broadly similar enough that they would not be considered a factor in selecting a preference.
	Operation	Impact on landscape character of Trout Beck valley is greater than Blue Route due to the alignment of the route impacting on more rural landscape compared to Blue Route. Scale of the structure required to cross Trout Beck will have impact on the landscape. Greater impact on field pattern. Impact of required detention ponds. Embankment required for Sleastonhowe Lane crossing is a significant earthworks. Two watercourse crossings required compared to one on the Blue Route. Additional impacts on the views from the PRoW 341017 connecting Long Marton to Powis House Impacts on views from the road connecting Long Marton to A66. Crosses the Roman Road and impacts on a number of mature trees and dissects the bridle way that follows the alignment of the Roman Road .	Worse	The key differences in the impact from this alternative are related to the alignment being situated in a more rural landscape and the impacts of the larger structure required to cross the Trout Beck as well as additional impacts on mature trees alongside the Roman Road.
Population and Human Health	Construction	Based on draft DCO boundary: - Blue Route requires direct acquisition and demolition of two residential receptors to accommodate the scheme. Based on draft DCO boundary: - Red Route alternative requires direct acquisition and demolition of one residential receptor to accommodate the scheme, however it also requires an entire area allocated for housing (Townhead)	Worse	Potential requirement for landtake from a housing allocation makes this the less preferable of the alternative routes.
	Operation	From a Human Health perspective as per the Noise and Vibration assessment compared to the blue option the red option has: - fewer residential receptors at risk of experiencing adverse noise impact - greater number of receptors expected to experience a beneficial effect from noise	Better	The impacts are assessed as better for the Red Route as fewer receptors are at risk of experiencing adverse noise impact there are a greater number of properties experiencing a beneficial effect.
Air Quality	Construction	No material differences between these alternatives identified.	Neutral	No material differences between these alternatives identified.
	Operation	<u>Blue Route:</u> Whilst it is likely that a number of sensitive receptors in close proximity to the Red Route will experience a deterioration in air quality compared to the existing situation, no receptors are predicted to experience any significant adverse effects or pollutant concentrations above the AQO. <u>Red Route:</u> It is likely that a number of sensitive receptors in close proximity to the Red Route will experience changes in air quality (both positive and negative due to the shifting alignment), no receptors are predicted to experience any significant adverse effects or pollutant concentrations above the AQO.	Neutral	As no receptors are expected to experience any significant adverse effects or pollutant concentrations above the AQO for either the Blue or the Red Route then this has been assessed as neutral

Material Assets and Waste	Construction	One demolition would be required to facilitate this - Winthorn House. Red Route is a slightly longer route however the estimated carbon cost embedded in the materials required is similar to that of Blue Route.	Neutral	Blue Route requires two residential demolitions - Winthorn, and Dunelm House, both residential properties. Although a detailed calculation has not been undertaken the demolitions are not of a scale to materially affect the waste calculations.
	Operation	No significant differences in impact from a materials and waste perspective.	Neutral	There is no evidence to suggest that Material Assets and Waste is a material factor in determining the Current Preferred Alignment for this scheme.
Cultural Heritage	Construction	<u>Assets adversely affected by Blue Route:</u> Kirkby Thore Roman Fort and Associated Vicus Roman Camp 350m east of Redlands Bank - This impact may remain significant after mitigation Sleastonhowe Lane Enclosure and Dyke Keld Sike Crackenthorpe Dyke <u>Assets adversely affected by Red Route:</u> Sleastonhow Lane Enclosure and Dyke Long Marton Mound Enclosure Troutbeck earthworks and Brandcrook Enclosure Some environmental mitigation would be intrusive	Better	Red Route has less impact on designated heritage assets compared to Blue Route, especially after mitigation has been implemented. Red Route sits outside of the scheduled monument designated land.
	Operation	<u>Assets beneficially affected by Blue Route:</u> Kirkby Thore Roman Fort and Associated Vicus Roman Camp 350m east of Redlands Bank <u>Assets are beneficially affected by Red Route:</u> Kirkby Thore Roman Fort and Associated Vicus Roman Camp 350m east of Redlands Bank	Neutral	Both Blue and Red alternative will have operational benefits on two heritage assets due to reduction in traffic noise and visibility affecting the setting of these assets
Climate	Construction	Green house gas modelling has indicated the Red Route alternative has the potential to lead to approximately 613,835 tCO2e.	Worse	The Red Route alternative gives rise to an increased GHG release compared to the Blue (602,166 tCO2e).
	Operation	Unlikely to be any significant differences in the operational climate impacts between the Red and Blue Route alternatives.	Neutral	There is no evidence to suggest that Climate during the operational phase is a material factor in determining the Current Preferred Alignment for this scheme.
Traffic and Economic				
Traffic Volume		No significant differences.	Neutral	There is no evidence to suggest that Traffic Volume is a material factor in determining the Current Preferred Alignment for this scheme.
Journey Time Savings		No significant differences.	Neutral	There is no evidence to suggest that Journey time savings is a material factor in determining the Current Preferred Alignment for this scheme.
Safety		No significant differences.	Neutral	There is no evidence to suggest that Safety is a material factor in determining the Current Preferred Alignment for this scheme.
Economy (not modelled with TUBA)		No significant differences.	Neutral	There is no evidence to suggest that Economy is a material factor in determining the Current Preferred Alignment for this scheme.
Accessibility including WCH Opportunities		No significant differences.	Neutral	There is no evidence to suggest that Accessibility including WCH Opportunities are a material factor in determining the Current Preferred Alignment for this scheme.
Stakeholder				
Land Take		Will affect landowners who were not previously affected by the Blue Route. Route is closer to British Gypsum mine workings and is longer than Blue Route.	Worse	Red Route has potential for more objections as very different to original preferred route. Affects a number of previously unaffected landowners.
Residential		Greater effect on a single landowner than Blue Route. Takes route further away from Kirkby Thore but closer to Long Marton.	Worse	Feedback has been received via CLG that Long Marton residents are unhappy with the prospect of route moving closer to the village.

Commercial	Closer to British Gypsum mine workings and has greater potential to affect future operations at the mine.	Worse	Route is close to boundary of mineral working site; possible that some encroachment may occur. Route may also affect future aspirations for development of the mineral working site.
Recreation and Leisure	No significant differences.	Neutral	There is no evidence to suggest that Recreation and Leisure is a material factor in determining the Current Preferred Alignment for this scheme.
Wider Community Issues	Moves the route closer to Long Marton by approximately 750m. Results in a circa 18m height structure which will have detrimental effect on views across the valley and the setting.	Worse	Feedback to date indicates that a route closer to Long Marton would be objected to be residents and Parish Council. Visual intrusion of new structure is also an issue.
	Conclusion		
	Although the Blue and Red Route share many similarities it is clear that by moving further to the east a number of additional landowners would be affected and the effects of the route on Long Marton would be increased. Additionally the crossing of Trout Beck although shorter would result in a structure which would be much more visible within the landscape due to its increased height and the way the land falls in this area. The assessment demonstrates that on balance the Blue Route performs better than the Red Route.		

Note: policy considerations are covered as part of the Route Development Report.

A.2 Temple Sowerby to Appleby - Blue Route versus Orange Route sifting matrix

Alternative Option Name	**Temple Sowerby to Appleby - Blue Route Vs Orange Route**		
Description	Assessment of Blue Route vs Orange Route alignment alternatives for the West and Central sections of the Temple Sowerby to Appleby scheme.		
Drawing (name and link)			
Drawing Image	Alternative - Orange Route		Base - Blue Route
			
Reason for option consideration	The Orange Route alignment was developed as an alternative which crossed the Trout Beck at a point where it was already constrained by the existing A66 Bridge at Bridge End. It was considered that this may have an overall lesser effect on the River Eden Special Area of Conservation (SAC) as it already affected by the existing infrastructure in the area. By moving to a more online solution the new A66 is kept within an already developed corridor. However, this route alignment alternative would have more detrimental effects on the cultural heritage sites that are located within the existing A66 corridor.		
Assessment outcome (State the result of the assessment)	The assessment demonstrates that the Blue Route alignment alternative is preferred over the Orange Route alignment. The Blue Route alignment performs better in a number of different areas most notably with regard to drainage and hydrology, cultural heritage and effects on stakeholders.		

Discipline	**Impacts**	**Comparison of Orange Route with base Blue Route**	**Justification**
Engineering			
Highways - Standards Compliance	The Orange Route alignment main line has better quality geometry overall. It has fewer horizontal relaxations and the ones it does have are generally less severe than the Orange Route alignment main line. Vertically, the Orange Route alignment alternative does not have the long steep climb that the Orange Route has and again has fewer relaxations. There are three departures from standard, in relation to visibility, required for both the Blue and Orange Route alignments. The side roads alignments for the Orange Route are also to a higher geometrical standard. Generally, they tie into longer lengths of side road, thus providing more space and opportunity to include alignments to the required standards, with better tie-ins to the existing road alignments. The side roads are also there to serve HGV's, so high standard roads are essential and advisable. In contrast, the side roads on the Orange Route are required to reconnect to existing substandard geometry roads, therefore a number of departures from standard will be required to ensure the new sections are in keeping with the existing and do not cause drivers to increase speeds in locations where it is not safe to do so.	Better	The Orange Route alignment has better geometry and requires fewer relaxations and departures from standard than the Blue Route alignment. In addition the existing side roads for the Orange Route are constructed to a better standard to connect into.
Utilities	Statutory undertakers C2 utility information is not complete at this time. Based on current information, the Orange Route will cross the existing A66 in more places and is likely to have a greater impact on Openreach and water supply assets. However it will have a reduced impact on the public and private infrastructure that serves the British Gypsum plant and less impact on the gas pipelines and overhead power to the north east of Kirkby Thore.	Neutral	Based on currently available information there is no evidence to suggest that utilities are a material factor in determining the Current Preferred Alignment for this scheme.
Geotechnics and Earthworks	Orange Route requires less earthworks to construct and would not have any potential impact on the British Gypsum mine workings. Blue Route is a longer and carries a risk of being impacted by old mine workings.	Better	Orange Route is shorter in length and thus requires less earthworks and is located away from any mineral extraction sites.
Structures	Flood modelling results received so far indicate that a longer structure is likely to be required for the Orange Route than was first envisaged (350m vs 110m). This would lead to a similar length structure being required for both the Blue and the Orange Routes.	Neutral	This has been scored as neutral given that the anticipated lengths and therefore costs of the Trout Beck crossing will be similar for both route alignments.
Drainage and Hydrology	Both route alignments can be adequacy drained to nearby watercourse and suitable water quality treatment can be provided. The Orange Route alignment has a greater impact on the 100 year + CC flood plain and will require mitigation measures to be undertaken that the Blue Route alignment will not. Both alignments will span the full width of the 100 year + Climate change Trout Beck floodplain with a structure and have minimal impact on flood risk.	Worse	The Orange Route alignment has a greater impact on the 100 year + CC flood plain and will require mitigation measures that the Orange Route alignment does not. Flood risk impact is minimal for both alignment options.
Construction Design Management (CDM)	Both options are similar with the complexity of the construction works required so CDM implications are neutral.	Neutral	There is no evidence to suggest that CDM requirements are a material factor in determining the Current Preferred Alignment for this scheme.

Construction Cost		Based on main line models only, the Cut / Fill requirements of the Orange Route alignment are significantly less than the Orange Route alignment. Orange Route (Cut – 331,837m3, Fill – 594,699m3) Orange Route (Cut – 1,392,462m3, Fill – 494,709m3). Orange Route will impact Bridge End Farm requiring additional land purchase and demolition of the existing buildings.	Neutral	Orange Route requires significantly less earthworks to construct the main line but would require increased land costs due to the need to purchase and demolish Bridge End Farm.
Buildability		Orange Route is much closer to the existing A66 and it will be a significant challenge to keep the A66 running during construction, requiring a greater amount of traffic management than the Orange Route.	Worse	The off line nature of the Blue Route means that majority can be built away from the existing A66.
Environment				
Biodiversity	Construction	Designated Sites: Crosses the Trout Beck (River Eden SAC) 50m south of existing A66; Temple Sowerby Moss SSSI Ancient Woodland and Veteran Trees: Losses and disturbance to Chapel Wood Ancient Woodland (AW). Section 41 Priority Habitats: rivers and streams (River Eden at Trout Beck just before confluence with the River Eden, loss and shading impacts, pollution potential) affected. Additional impacts to lowland fen and wet woodland (Temple Sowerby SSSI) habitats of loss and shading are also anticipated. Protected/notable species - 3 structures and 11 trees with moderate to high bat roost potential being lost. Red squirrel habitat loss, Badger squirrel loss. Otter habitat loss and disturbance (may be less so due to proximity of exist dairy business). Loss of water vole habitat. Both options have the potential to impact aquatic species during construction, including the qualifying species of the SAC (Atlantic salmon, bullhead, lamprey and white clawed crayfish) as both crossing locations provide optimal habitat and a migration route. Habitat loss/disturbance through shading of the river is consistent across both routes. The Orange Route has an additional crossing of a ditch (unnamed tributary of Trout Beck) but this considered to be of low conservation value and not significant to the assessment.	Neutral	Similar impacts to the Trout Beck tributary which forms a part of the River Eden SAC as the Blue alternative - whilst Orange Route crosses at an already constrained point, the Orange Route has been designed in such a way that the intention is not to constrain the floodplain or the watercourse itself. Similarly with the Chapel Hill AW. There are greater impact to the Temple Sowerby Moss SSSI as part of Orange Route compared to Orange Route. There are more structures with medium to high bat roost potential are being lost as a result of the Orange Route alternative. Orange Route is predominantly online, resulting in lesser impact to surrounding habitats. Construction impacts to freshwater species are considered to be very similar.
	Operation	Designated Sites: Crosses the Trout Beck (River Eden SAC) 50m south of existing A66; Temple Sowerby Moss SSSI Ancient Woodland and Veteran Trees: Losses and disturbance to Chapel Wood AW. Section 41 . Priority Habitats: rivers and streams (River Eden at Trout Beck just before confluence with the River Eden, loss and shading impacts, pollution potential) affected. Additional impacts to lowland fen and wet woodland (Temple Sowerby SSSI) habitats of loss and shading are also anticipated. Protected/notable species - 18 potential bat crossing points affected. Permanent impact of increased road related disturbance and potential risk to water quality to watercourse Detailed fluvial geomorphology modelling is being undertaken to assess the likely impact of the Orange, Blue and Red Routes on river processes (erosion, deposition, sediment transport etc.) and impact to the SAC (this is currently pending). This modelling will provide evidence that one route alternative is preferred in terms of operations phase impacts on fluvial geomorphological process. However at this stage impact of both route alternatives are considered likely to be similar. The Orange Route would likely result in potentially significant water quality improvements (and indirect benefits for freshwater ecology) during operation through the removal of diffuse and point source pollution sources associated with Bridge End Farm, which would be lost.	Neutral	Similar impacts to the Trout Beck tributary which forms a part of the River Eden SAC as the Blue Route alternative - whilst Orange Route crosses at an already constrained point, the Orange Route has been designed in such a way that the intention is not to constrain the floodplain or the watercourse itself. Similarly with the Chapel Hill AW. There are more structures with medium to high bat roost potential are being lost as a result of the Orange Route alternative, however fewer crossing points affected. Potential operations phase impacts on fluvial geomorphology as a result of each route alternative is currently unknown (modelling is pending). Potentially significant water quality improvements in the SAC associated with the removal of Bridge End Farm under the Orange Route alternative.
Road Drainage and Water Environment	Construction	Requires the crossing of a watercourse which forms a part of the River Eden SAC.	Neutral	Similar construction requirements, crossing SAC. Slightly more interaction with the River Eden itself in high flood event. The Blue Route avoids most of the proposed and existing Gypsum mineworkings but the realignment of main street and its connection to the new A66 does pass over them. We are looking to minimise this as much as possible with our design but it cannot be avoided completely . The rest of the route avoids the primary deposits of gypsum but there is a risk that small pockets of gypsum could be encountered during construction. Similar water course crossings. On balance these potential impacts would be considered equal.
	Operation	There is risk of impacts to water quality as a result of road run off.	Neutral	Similar number of watercourse crossings.
Geology, Soils, Contaminated Land and Groundwater	Construction	Land take required within ALC 2, 3a, 3b. Land take required from soils supporting SAC or SSSI. Exposure of contaminated soil sources that may impact on human health, principal aquifers.	Neutral	There is no evidence to suggest that Geology, soils, contaminated land and groundwater are a material factor in determining the Current Preferred Alignment for this scheme.

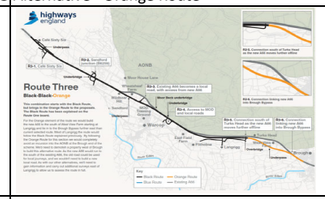
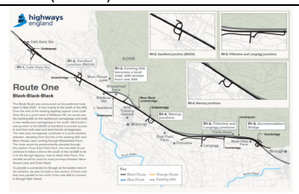
	Operation	Operationally the potential impacts will be similar between route alternatives.	Neutral	There is no evidence to suggest that Geology, soils, contaminated land and groundwater are a material factor in determining the Current Preferred Alignment for this scheme.
Noise and Vibration	Construction	Although a detailed assessment of construction noise has not been undertaken, assumptions of broad construction activities have been made in order to broadly determine where there is risk of significant impacts.	Neutral	Although a detailed assessment of construction noise has not been undertaken, Construction activities assumed to be broadly the same between Blue and Orange therefore broad impacts will be the same and this is therefore not deemed to be a material factor in determining the Current Preferred Alignment for this scheme.
	Operation	<u>Orange Route Alternative:</u> 20 residential receptors predicted to experience significant adverse effects 61 residential receptors predicted to experience significant beneficial effects 3 non-residential receptors predicted to experience significant adverse effects 4 non-residential receptors predicted to experience significant beneficial effects <u>Blue Route Alternative:</u> 256 residential receptors predicted to experience significant adverse effects 124 residential receptors predicted to experience significant beneficial effects 4 non-residential receptors predicted to experience significant adverse effects 8 non-residential receptors predicted to experience significant beneficial effects	Better	Orange Route has overall fewer significant effects than Blue Route and is therefore preferred.
Landscape and Visual	Construction	Similar construction between all route alternatives.	Neutral	There is no evidence to suggest that Landscape and visual effects during the construction phase are a material factor in determining the Current Preferred Alignment for this scheme.
	Operation	Less of an impact to the north west and to the east of Kirkby Thore in terms of loss of field boundaries, field patterns, loss of trees etc. as the new link roads are narrower than the proposed bypass and a longer online section. Greater impact on Priest lane and its surroundings, potential impact on the views from Priest lane towards the AONB to the north. Link roads create more infrastructure to the west of Piper Lane. Impacts on views of open countryside from Piper Lane looking west. Impacts on residents between Spittals Farm and Bridge End Farm will be greater compared to Orange Route alternative.	Better	Assessment work indicates that Orange Route would have a lesser impact on Landscape and less visual intrusion than the Orange Route. Maintaining the route along the existing A66 corridor is beneficial in landscape and visual terms.
Population and Human Health	Construction	Based on draft DCO boundary: Blue Route requires direct acquisition and demolition of two residential receptors to accommodate the scheme. Blue Route potentially requires land take from an area of common land, however further design review will be undertaken to seek retention of this land and therefore, this is not deemed to be significant. Blue Route potentially requires land that the Appleby Horse Fair uses annually, however further design review will be undertaken to seek retention of this land and therefore it is not deemed to be a significant effect. Based on draft DCO boundary: Orange Route requires direct acquisition and demolition of one residential receptor to accommodate the scheme. Orange Route requires approximately 30% of a housing allocation. Orange Route potentially requires a portion of land take from Acorn Bank National Trust site, however further design review to be undertaken to seek retention of this land and therefore it is not deemed significant Orange Route potentially requires land take from an area of common land, however further design review will be undertaken to seek retention of this land and therefore, this is not deemed to be significant. Orange Route potentially requires land take from a recreational ground (Piper Lane), however further design review will be undertaken to seek retention of this land and therefore, this is not deemed to be significant.	Worse	Potential requirement for land take from a housing allocation makes the Orange Route the less preferable of the alternatives.
	Operation	From a Human Health perspective as per the Noise and Vibration assessment compared to the blue option the orange option has: - fewer residential receptors at risk of experiencing adverse noise impact - less receptors expected to experience a beneficial effect from noise	Neutral	The impacts are assessed as neutral as although fewer receptors are at risk of experiencing adverse noise impact there are a greater number of properties experiencing a beneficial effect with regard to the Blue Route

Air Quality	Construction	No material differences between these alternatives identified.	Neutral	No material differences between these alternatives identified.
	Operation	<u>Blue Route alternative:</u> Whilst it is likely that a number of sensitive receptors in close proximity to the Blue Alternative will experience a deterioration in air quality compared to the existing situation, no receptors are predicted to experience any significant adverse effects or pollutant concentrations above the AQO <u>Orange Route alternative:</u> It is likely that a number of sensitive receptors in close proximity to the Orange Route will experience changes in air quality (both positive and negative due to the shifting alignment), no receptors are predicted to experience any significant adverse effects or pollutant concentrations above the AQO.	Neutral	As no receptors are expected to experience any significant adverse effects or pollutant concentrations above the AQO for either the Blue or the Orange Route then this has been assessed as neutral.
Material Assets and Waste	Construction	One demolition would be required to facilitate this - Bridge End Farm. As an online upgrade, the carbon cost of materials is less than for the offline alternatives (155,437 tCO2e for Orange Route compared to 569,065 tCO2e for Blue Route).	Better	Blue Route requires two residential demolitions - Winthorn, and Dunelm House, both residential properties. Although a detailed calculation has not been undertaken the demolitions are not of a scale to materially affect the waste calculations.
	Operation	No significant differences in impact from a materials and waste perspective.	Neutral	There is no evidence to suggest that Material Assets and Waste during the operations phase are a material factor in determining the Current Preferred Alignment for this scheme.
Cultural Heritage	Construction	<u>Assets adversely affected by Blue Route:</u> Kirkby Thore Roman Fort and Associated Vicus Roman Camp 350m east of Redlands Bank - this impact may remain significant after mitigation Sleastonhowe Lane Enclosure and Dyke Keld Sike Crackenthorpe Dyke <u>Assets adversely affected by Orange Route:</u> Kirkby Thore Roman Fort and Associated Vicus - this impact may remain significant after mitigation Roman Camp 350m east of Redlands Bank - this impact may remain significant after mitigation Crackenthorpe Dyke Roman roads - The Street, Maiden Way and Borrowbridge to Kirkby Thore St Giles Chapel Kirkby Thore Station (site of) Possible Romano-British cemetery site	Worse	There are more heritage assets that would be affected by the construction of the Blue Route alternative compared to the Orange Route. Due to the longer offline construction of the Blue Route alignment there is a greater potential for encountering undiscovered archaeology, this does not outweigh the impact to numerous known and designated cultural heritage assets.
	Operation	<u>Assets beneficially affected by Blue Route:</u> Kirkby Thore Roman Fort and Associated Vicus Roman Camp 350m east of Redlands Bank <u>Assets adversely affected by Orange Route:</u> Kirkby Thore Roman Fort and Associated Vicus - this impact may remain significant after mitigation Roman Camp 350m east of Redlands Bank - this impact may remain significant after mitigation	Worse	Orange Route will continue to adversely impact on two cultural heritage assets in operation, while the Blue Route alternative will have operational benefits on two heritage assets due to reduction in traffic noise and visibility affecting the setting of these assets.
Climate	Construction	Green house gas modelling has indicated the Orange Route has the potential to lead to approximately 177,289 tCO2e. New crossing of Trout Beck would have a similar length to that required for the Blue Route. Orange route is however approximately 1km shorter than the Blue Route meaning less material will be required during construction.	Better	The Orange Route gives rise to a reduced GHG release compared to the Blue Route (602,166 tCO2e).
	Operation	Unlikely to be any significant differences in the operational climate impacts between the Orange and Blue Route alternatives.	Neutral	The impacts would be the same as the Blue Route.
Traffic and Economic				
Traffic Volume		The Orange Route leads to a marginal increase (circa 300 AADT vpd or around 1%) in flow on the A66 mainline at Kirkby Thore.	Better	Traffic modelling work indicates an increase.
Journey Time Savings		The Orange Route saves around 40 seconds due to its shorter length (280 secs v 320 secs).	Better	Orange Route is shorter in length.
Safety		No significant differences in impact from a safety perspective.	Neutral	There is no evidence to suggest that safety is a material factor in determining the Current Preferred Alignment for this scheme.
Economy (not modelled with TUBA)		Due to traffic flow increases and journey time savings, a small increase in Traffic Economic Efficiency Benefit (£15 million) has been identified.	Better	Modelling work has identified increased benefits associated with Orange Route.

Accessibility including WCH Opportunities	Both routes will ensure that any severed Public Rights of Way (PRoW) are reconnected. Grade separated crossings will be used and length of detrunked A66 which will be same for both options provides local access.	Neutral	There is no evidence to suggest that Accessibility is a material factor in determining the Current Preferred Alignment for this scheme.
Stakeholder			
Land Take	Orange Route affects a number of landowners who were previously unaffected.	Worse	Additional Landowners affected by Orange Route.
Residential	Demolition of Bridge End Farm. Route is closer to a number of properties.	Worse	Demolition required.
Commercial	The Orange Route will have a greater effect on British Gypsum as junction at Main Street is removed and HGVs will need to travel further to gain access. Businesses along Orange Route effected including Bridge End Farm, Bridge Inn and Low Moor Caravan Park.	Worse	Larger negative effects on a number of businesses along the Orange Route.
Recreation and Leisure	No significant impacts.	Neutral	There is no evidence to suggest that Recreation and Leisure is a material factor in determining the Current Preferred Alignment for this scheme.
Wider Community Issues	No significant impacts.	Neutral	There is no evidence to suggest that Wider Community issues are a material factor in determining the Current Preferred Alignment for this scheme.
	Conclusion		
	The assessment demonstrates that the Blue Route alignment alternative is preferred over the Orange Route alignment. The Blue Route alignment performs better in a number of different areas most notably with regard to drainage and hydrology, cultural heritage and effects on stakeholders. Given the impact the Orange Route would have on the Kirkby Thore Roman Fort and Associated Vicus Scheduled Ancient Monument, would be a need to demonstrate exceptional circumstances in order to put forward the Orange Route alternative for examination. This would require a case for the scheme to be made that potential substantial harm or loss of significance is necessary in order to deliver substantial public benefits that outweigh that loss or harm.		

Note: policy considerations are covered as part of the Route Development Report.

A.3 Appleby to Brough (Warcop) (Eastern Section) - Black Route versus Orange Route sifting matrix

Alternative route Name	**Appleby to Brough - Eastern Section - Black Route Vs Orange Route**
Description	Assessment of Black Route vs Orange Route for the eastern section of the Appleby to Brough scheme. The Orange Route seeks to avoid any direct impact on the Area of Outstanding Natural Beauty (AONB) and takes the new A66 dual carriageway from a point near to Turks Head on an alternative alignment to the south of West View Farm and connects back into the existing A66 dual carriageway near to Musgrave Lane overbridge. The Orange Route will allow the de-trunked A66 to become the local road connection to Brough Main Street and will allow the existing north and south movements from properties on the south side of the old A66 to be maintained. The Orange Route will require the acquisition of one residential property and will impact West View Farm considerably. In discussion with local stakeholders, including landowners, Parish Councils and Statutory Bodies this route has limited support. However, it will be taken forward to Statutory Consultation in Autumn 2021 as alternative route for the eastern section of the scheme.
Drawing (name and link)	
Drawing Image	Alternative - Orange Route  Base (for info) - Black Route 
Reason for route consideration	The Black Route was designed to remain outside the AONB as much as possible, however through design development it has become apparent that the eastern tie-in cannot be constructed and local access cannot be maintained without some construction being carried out within the AONB. The setting impact on the AONB of a new route to the south of the existing A66 has also been considered further at this stage. This work has led to a review of the route alignment to determine whether there are alternatives that either remain completely outside the AONB, thus avoiding any direct impact, and that could minimise impact on the setting impact on the AONB as a result of the scheme.
Assessment outcome (State the result of the assessment)	The Black Route is preferred over the Orange Route. The Black Route is deemed to be better than the Orange Route in 10 of the discipline areas assessed, worse in only 3 areas and Neutral in the remaining 25 areas. The assessment demonstrates there are detrimental effects on the environment, landscape and recreational opportunities associated with the Orange Route (wholly outside the AoNB), which in combination outweigh any positive impacts for these routes (when compared to the routes with some incursion in the AONB). These considerations in combination provide the basis of the exceptional circumstances for development of the routes within the AONB.

Discipline	**Impacts**	**Comparison of Orange Route with base Black Route**	**Justification**
Engineering			
Highways - Standards Compliance	Both the Black and Orange Routes can be constructed in accordance with the current design standards.	Neutral	There is no evidence to suggest that Highways Standards compliance is a material factor in determining the Current Preferred Alignment for this scheme.
Utilities	Both the Black and Orange Routes can be constructed without major disruption to any Statutory Undertakers utilities.	Neutral	There is no evidence to suggest that utilities is a material factor in determining the Current Preferred Alignment for this scheme.
Geotechnics and Earthworks	There will be increased earthworks by adopting the Orange Route as a large embankment will be required to take the route alignment to the south of West View Farm and enable construction of a structure over Low Gill Beck and an underpass under new A66 to accommodate livestock, agricultural vehicles and WCH users.	Worse	Earthworks requirement is less for the Black Route.
Structures	Greater structures complexity and size. A large structure over Low Gill Beck is required to span the beck and floodplain compared to the provision of simple accommodation structures for the Black Route.	Worse	Within Black Route two structures are required (farm underpass and accommodation overbridge) Within Orange Route two structures are required (and farm underpass and Low Gill Beck overbridge) However a larger structure is required over Low Gill Beck to span the beck and floodplain.
Drainage and Hydrology	Both routes require a number of drainage attenuation ponds to be constructed, impact is considered Neutral.	Neutral	There is no evidence to suggest that drainage is a material factor in determining the Current Preferred Alignment for this scheme.
Construction Design Management (CDM)	Both routes similar with the complexity of the construction works required so CDM implications are Neutral.	Neutral	There is no evidence to suggest that CDM is a material factor in determining the Current Preferred Alignment for this scheme.
Construction Cost	Increased cost impact. It is assumed that costs for the Orange Route will be greater as longer in length by approximately 500m. Additional earthworks will be required as well as the need for a larger structure to cross Low Gill Beck and floodplain. Land costs will also increase with Orange Route being longer in length.	Worse	There will be increased earthworks, increased land take and the need to import fill. A larger structure is required over Low Gill Beck to span beck and floodplain compared to culvert extension in Black Route. Increased length of new dual carriageway construction of approximately 500m to tie back into Brough Bypass by Musgrave Lane overbridge. Cost of acquiring Mains House and considerable impact on West View Dairy Farm.
Buildability	The Orange Route would be easier to build despite the increased structures complexity over the Low Gill Beck as it can be built "off line" keeping the old A66 open to traffic and only impacting road users to complete tie into Brough Bypass.	Better	The Black Route has more works adjacent to the old A66 with the construction of the new dual carriageway, local road, farm access and accommodation bridge which may result in increased road user impact, although not expected.

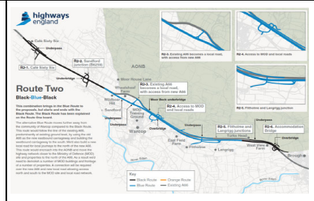
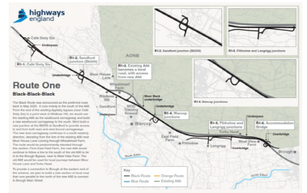
Environment				
Biodiversity	Construction	Designated Sites: North Pennine SPA and SAC is 255m and the River Eden SAC and River Eden tributaries SSSI are 700m south of this scheme. Appleby Fells SSSI is 1.5km north of the eastern end of this scheme and Hellbeck and Swindale Woods SAC and SSSIs are 520m north of this scheme. Sandford Mire CWS is 190m south of this scheme. Scheme passes to the south of the North Pennines Area of Outstanding Natural Beauty (AONB) Ancient Woodland and Veteran Trees: N/A Section 41 . Priority Habitats: Several watercourse crossing required. Habitat loss and damage as a result of scheme construction, including woodland. Protected/notable species - Potential loss of terrestrial habitat for great crested newt; potential loss of suitable habitat for barn owl; loss of a structure with bat roost potential; fragmentation of habitat suitable for badger; impact to highly suitable otter habitat on Lowgill Beck.	Worse	Construction impacts of the Orange Route will be largely similar to those of the Black Route with a number of exceptions which, on balance, make this alternative less preferred than the baseline including: - additional watercourse crossing of Lowgill Beck which will increase the potential for impacts to the watercourse. This watercourse is hydrologically linked to the River Eden to there is a risk to mobile species related to the SAC designation that may be present in the watercourse; - increased degradation of riparian habitat due to crossing of wide river corridor. - increased loss of woodland, reduced loss of a number of other priority habitats. - increased risk of impact to habitat with potential to support protected species such as barn owl, bat, otter, and badger.
	Operation	Orange Route will result in permanent loss of land and habitat fragmentation. Severance of corridors providing commuting routes for species. Shading impacts on watercourses as a result of new watercourse crossings. Anticipated increase in noise and light levels leading to disturbance of species. Increased mortality of some species due to Road Traffic Accidents.	Worse	Additional watercourse crossings compared to the Black Route increases the risk of impacts to the watercourses in the area and increased habitat fragmentation.
Road Drainage and Water Environment	Construction	The Black Route would result in an extension to the structure which crosses Low Gill Beck where it is already constrained by the A66. The Orange Route requires a new crossing of Lowgill Beck which leads to the potential for impacts to this watercourse as a result of potential constraint of the floodplain, and impacts of construction related run off affecting water quality. Alternative is located within Environment Agency Flood Zone 2 and 3, and within high and medium risk areas for pluvial flood risk. Watercourse crossings during construction may result in changing surface water flow rates, which may affect flood risk to downstream receptors; predominantly agricultural land. New crossing of Lowgill Beck may lead to impacts to water quality and hydromorphology. Construction activities in or in close proximity to watercourses pose a potential risk to water quality.	Worse	The Orange Route alternative requires a new crossing of a water course compared to the Black Route which would cross this water course at the point where it is already constrained.
	Operation	No major impacts assuming structures are designed appropriately to minimise impacting floodplains. However, the additional crossings of Lowgill Beck increase the potential for continued impacts to these watercourses, with risk of road run off affecting water quality.	Worse	Additional watercourse crossings compared to the Black Route increases the risk of impacts to the watercourses in the area and increased habitat fragmentation.
Geology, Soils, Contaminated Land and Groundwater	Construction	Orange Route alterative avoids the North Pennines UNESCO Global Geopark, the border of which follows that of the AONB. No known areas of contamination are present.	Better	Orange Route alternative sits to the south of the Geopark designated area and avoids any direct impact on it.
	Operation	Operationally the potential impacts will be similar between alternatives.	Neutral	There is no evidence to suggest that Geology Soils, Contaminated Land and groundwater during operation is a material factor in determining the Current Preferred Alignment for this scheme.
Noise and Vibration	Construction	Although a detailed assessment of construction noise has not been undertaken, assumptions around broad construction activities have been made in order to broadly determine where there is risk of significant impacts.	Neutral	Although a detailed assessment of construction noise has not been undertaken, construction activities assumed to be broadly the same between the Black and Orange Routes therefore broad impacts will be the same.
	Operation	75 residential receptors and 2 non-residential receptors expected to experience significant adverse impacts 9 residential and 1 non-residential receptors expected to experience a significant beneficial impact 31 Public Rights of Way (PRoWs) likely to experience adverse impacts 3 PRoWs likely to experience beneficial impacts	Worse	Compared to the Black Route, there are: - more residential receptors at risk of experiencing adverse noise impact - more receptors expected to experience a beneficial effect from noise - greater number of PRoWs being at risk of adverse noise impact, though there are also more PRoWs that may have beneficial impacts, there are fewer beneficial impacts than there are adverse. On balance, it is considered Black Route is preferred over the Orange Route as the number of receptors likely to experience an adverse impact outweighs the number expected to experience a beneficial impact.

Landscape and Visual	Construction	Landscape and Visual: For both the Orange and the Black Route construction will result in the loss of a woodland on either side of Lowgill Beck and loss of hedges and hedge trees. The Orange Route will lead to an alteration of part of a continuous small scale field pattern that extends south from the existing A66 contrasting with the large, regular fields in the AONB on the north side of the A66 which would be affected by the Black Route.	Neutral	Impacts are considered to be largely the same between Orange and Black Routes.
	Operation	<u>Landscape and Visual:</u> The Orange Route alternative will introduce a large structure and embankment into a small scale landscape. This will not be characteristic of the baseline and will result in permanent loss of trees, woodland and hedges and alteration of field pattern and size. There will also be considerable impacts on landscape character of the Broad Valleys sub-type. The Orange Route alternative will sever PRoW to the south of West View Farm and be a very noticeable feature in views from the PRoW network in this area and a notable influence on views from Brough Castle.	Worse	Overall the impacts are considered to be greater with the Orange Route alternative due to the scale of the offline section and the impacts on landscape character, setting of the AONB and impacts on visual amenity.
Population and Human Health	Construction	Based on indicative DCO boundary: The Black Route will not require any land take or demolitions of residential receptors. The Black Route will not effect any business receptors at the eastern extents of this scheme The Black Route will not require land take from any community assets. The Black Route will sever/interact with a lesser number of PRoW than the Orange Route The Black Route will require land take from a number of key land holdings Based on indicative DCO boundary: The Orange Route alternative will require land take and demolition of one residential receptor - Mains House. The Orange Route alternative will require almost all of Rowan House Housing Allocated Land. The Orange Route alternative will not effect any business receptors at the eastern extents of this scheme. The Orange Route alternative will not require land take from any community assets as the Black Route. The Orange Route alternative will sever/interact with a greater number of PRoW than the Black. The Orange Route alternative will require land take from a number of key land holdings including Heron Farm.	Worse	Comparatively, the Orange Route alternative will have a greater impact on the local population through additional land take of agricultural, commercial, and residential property, as well as the severance of PRoWs.
	Operation	Impacts assumed to be similar for both routes. There may be some impact on the Rowan House residential allocation.	Neutral	There is no evidence to suggest that Human Health and Population during operation is a material factor in determining the Current Preferred Alignment for this scheme.
Air Quality	Construction	Although works required closer to Brough in order to tie-in to existing A66, construction impacts assumed to be generally similar across the project.	Neutral	There is no evidence to suggest that Air Quality is a material factor in determining the Current Preferred Alignment for this scheme.
	Operation	Some sensitive receptors are likely to experience minor changes in air quality both positive and negative.	Neutral	There is no evidence to suggest that Air Quality is a material factor in determining the Current Preferred Alignment for this scheme.
Material Assets and Waste	Construction	The Orange Route requires the demolition of a residence.	Neutral	Although a detailed calculation has not been undertaken the demolitions are not of a scale to materially affect the waste calculations.
	Operation	No significant differences in impact from a materials and waste perspective.	Neutral	There is no evidence to suggest that Material assets and waste is a material factor in determining the Current Preferred Alignment for this scheme.
Cultural Heritage	Construction	No heritage features would be directly impacted by the Orange Route alternative.	Neutral	There is no evidence to suggest that Cultural Heritage is a material factor in determining the Current Preferred Alignment for this scheme.
	Operation	No heritage features would be directly impacted by the Orange Route alternative.	Neutral	There is no evidence to suggest that Cultural Heritage is a material factor in determining the Current Preferred Alignment for this scheme.
Climate	Construction	Green house gas modelling has indicated route alternatives utilising the Orange alternative has the potential to lead to increased green house gas emissions compared to route routes that do not utilise the Orange alternative , Black-Black-Orange (232,833 tCO2e) and Black-Blue-Orange (239,355).	Worse	The Orange Route gives rise to an increased GHG release compared to the Black Route. Black-Black-Black (205,094 tCO2e).

	Operation	Unlikely to be any significant differences in the operational climate impacts between the Orange and Black Route alternatives.	Neutral	The impacts would be the same as the Black Route.
Traffic and Economic				
Traffic Volume		No Significant differences.	Neutral	There is no evidence to suggest that traffic volume is a material factor in determining the Current Preferred Alignment for this scheme.
Journey Time Savings		Orange route is slightly longer than Black.	Worse	Orange route would involve a slightly longer journey time as route is longer
Safety		No Significant differences.	Neutral	There is no evidence to suggest that Safety is a material factor in determining the Current Preferred Alignment for this scheme.
Economy (not modelled with TUBA)		No Significant differences.	Neutral	There is no evidence to suggest that Economy is a material factor in determining the Current Preferred Alignment for this scheme.
Accessibility including WCH Opportunities		A number of rights of way are severed by Orange Route and blocked by Black Route, but diversions via underpasses and overbridges are included in both routes to ensure connectivity is maintained so Neutral impact.	Neutral	There is no evidence to suggest that Accessibility (including WCH Opportunities) is a material factor in determining the Current Preferred Alignment for this scheme.
Stakeholder				
Land Take		No land take from AONB in Orange Route compared to Black Route.	Better	Black Route results in minor encroachment into AONB
Residential		1 No. residential property (mains House) will need to beacquired and demolished in order to construct Orange Route.	Worse	No properties need to be acquired or demolished with the Black Route.
Commercial		Increased agricultural land take.	Worse	The increased land take from West View farm will affect future expansion plans and will affect farm productivity due to loss of productive land. This could result in a considerable blight claim.
Recreation and Leisure		A number of rights of way are severed by Orange Route and blocked by Black Route, but diversions via underpasses and overbridges in both routes ensure connectivity maintained so Neutral impact.	Neutral	There is no evidence to suggest that recreation and leisure is a material factor in determining the Current Preferred Alignment for this scheme.
Wider Community Issues		When discussing the Orange Route with local stakeholders, including landowners, Parish Council and Statutory Bodies opposition has been encountered.	Worse	Local opposition to the Orange Route.
	Conclusion			
	Black Route results in minor encroachment into AONB. Orange Route is completely outside AONB. Orange Route results in demolition of Mains House. No demolition associated with Black Route. Orange Route requires creation of a new route corridor south of the existing A66. This is deemed to have significant negative effects upon the setting of the AONB in this location and compares poorly in this regard with impact on setting in comparison to the Black Route. Orange Route results in additional agricultural land take. Embankment and larger structure over Low Gill Beck required for the Orange Route From meetings and discussions held to date there seems to be opposition to the Orange Route. The feedback received to date indicates that the Black Route is preferred particularly by affected landowners.			

Note: policy considerations are covered as part of the Route Development Report.

A.4 Appleby to Brough (Warcop) (Central Section) - Black Route versus Blue Route sifting matrix

Alternative Option Name	**Appleby to Brough - Central Section - Black Route Vs Blue Route**
Description	Assessment of Black Route vs Blue Route for the central section of the Appleby to Brough scheme.
Drawing (name and link)	Option 2 (Black-Blue-Black) GAs issued 12-08-21
Drawing Image	Alternative - Blue Route 
	Base (for info) - Black Route 
Reason for option consideration	In late December 2020, a letter was received from a landowner, proposing an alternative route for the new A66 dual carriageway. This proposal positioned it to the north of the existing A66, further encroaching into the Area of Outstanding Natural Beauty (AONB) and Ministry of Defence (MOD) land. Although this alternative proposed has considerably less impact on the AONB than the Warcop Parish Council Northern route, it would result in a direct impact on the AONB and residential properties in this location. It would also result in considerable disruption for the MOD and their training ranges. Some opposition was also raised by Warcop PC with regard to Black Route with regard to its proximity to properties to the south and the height of the proposed embankment which would be around 8m high. Since this proposal letter, the design team have considered the request to move the new A66 further north away from East Field Farm and Warcop village and have developed the alternative proposed Blue Route The concept of minor encroachment into AONB and relocation of MOD facilities to the north has been discussed with Natural England and the MOD. This has not been ruled out and so development of the Blue Route was undertaken as it will result in the route being at a lower level closer to the existing A66 and further away from both properties adjacent to the southern edge of the A66 and Warcop village.
Assessment outcome (State the result of the assessment)	The assessment demonstrates that the Blue Route is preferred over the Black Route. The assessment demonstrates that the Blue Route performs better in a number of areas such as flooding and noise and vibration. More widely, the assessment demonstrates there are detrimental effects on the environment, landscape and recreational opportunities associated with the Black Route (wholly outside the AoNB), which in combination outweigh any positive impacts for these routes (when compared to the routes with some incursion in the AONB). These considerations in combination provide the basis of the exceptional circumstances for development of the routes within the AONB.

Discipline	Impacts	Comparison of Blue Route with base Black Route	Justification
Engineering			
Highways - Standards Compliance	The Blue Route can be built in accordance with current design standards, similar with the Black Route. The westbound and eastbound junctions at Warcop have been designed with appropriate merges, diverges and connections to local roads that will allow the MOD Heavy Equipment Transporter (HET) access and egress from the training camp as well as from and to the new A66.	Neutral	Both routes have been designed to accommodate any identified vehicles that will use the route or the side road junctions including tank transporters and farm vehicles.
Utilities	Both the Black and Blue Routes can be constructed without major disruption to any Statutory Undertakers utilities. Within Blue Route works the electric transformer that serves the MOD compound and ranges will be impacted and need relocation as the new local road will be built over its current location.	Neutral	There is no evidence to suggest that utilities is a material factor in determining the Current Preferred Alignment for this scheme.
Geotechnics and Earthworks	Reduced Earthworks and material import. The Blue Route will be predominantly "at grade", at a level similar to existing ground with a potentially small embankment, less than 2m high, through the floodplain section adjacent to Warcop village. An overbridge with embankments will be required to take the local road and westbound junction connection up and over the new A66 to connect with the local road on the north side. The Black Route will require a larger embankment, circa 8m high. Initial earthworks calculations from the buildability Contractor suggest there is a scheme fill material deficit of 500,00m3 with the Black Route which is reduced to circa 150,000m3 with Blue Route. As well as reducing the amount of imported fill material required it will reduce vehicle movements during construction thus reducing congestion and disruption on A66 and local area.	Better	The Blue Route alternative allows a reduction in height of the embankment included in the Black Route. The Blue Route results in a significant decrease in the requirement for fill material from 500,00m3 to circa 150,000m3.
Geo-environmental	The Blue Route has more of an impact on the MOD facility with a significant risk of increased contamination in soil and groundwater likely to be encountered in the vicinity of Warcop depot and other MOD / agricultural land within the proposed land take area to the north of the existing A66. Presence of underground fuel storage tanks and maintenance workshops also pose a challenge to remove. Risk of UXO / munitions. presence to be investigated /confirmed with MOD records, surveys, etc.	Worse	The Blue Route will introduce a greater land take which is likely to be significantly impacted by hydrocarbons/ solvents / asbestos etc and other contaminants from many years of MOD service and refuelling activities that will require further investigation and remediation prior to construction works commencing. There is also a potential for significant volumes of contaminated soils requiring disposal / remediation off site and for contaminated groundwater to be present, again requiring remediation. Other undisclosed MOD activities on proposed area of land take (landfills/ made ground / dumps / UXO / munitions risk etc.
Structures	Additional structure required. In the Blue Route as we are reducing the embankment height closer to existing levels that reduces the height of the new structure over Moor Beck compared to Black Route, so we will not be able to put WCHs under the structure. An additional reduced height underpass for WCHs will be required to the west of Moor Beck.	Worse	Difference in required structures numbers and form. Black Route requires three structures Moor Beck bridge inc. WCH provision, Warcop underbridge and Gatehouse overbridge. Blue Route requires four structures, reduced height WCH underpass, Moor Beck bridge, Warcop overbridge and Flitholme underbridge.

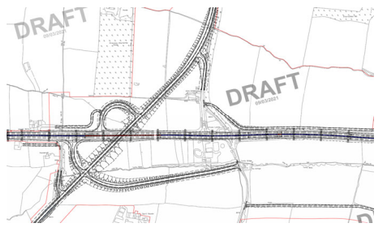
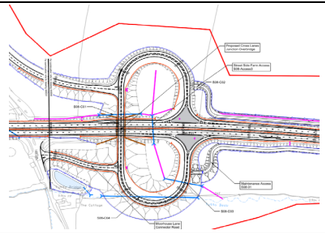
Drainage		Reduced impact on floodplain. Both routes are located in the floodplain east of Warcop village. The Blue Route is designed to be predominantly at grade past Warcop Village on a minimal embankment due to floodplain. This route will reduce loss of floodplain due to construction of larger embankments a spart of the Black Route. Blue Route will require additional drainage attenuation pond.	Better	In Black Route a larger embankment will be required, circa 8m high, resulting in greater loss of floodplain. One additional local crossing of Moor Beck will be required at Warcop Village (these has been reduced from two, as existing Moor beck Bridge can be demolished to reduce crossings in the area). Embankments will be required to provide access route to overbridge over new A66 and local road. Within Blue Route drainage design an additional drainage pond may be required increasing agricultural land take outside of floodplain.
Construction Design Management (CDM)		Both routes are similar with the complexity of the construction works required so CDM implications are Neutral.	Neutral	There is no evidence to suggest that CDM is a material factor in determining the Current Preferred Alignment for this scheme.
Construction Cost		It is assumed that costs will be similar. There will be reductions due to reduced earthworks, reduced land take and the need to import fill. However, additional structure required and in Blue Route the local road will require replacement along with MOD tank compound and filling station.	Neutral	Neutral cost impact as additional works required for Blue Route would be offset by reduction in earthworks required compared to Black Route.
Buildability		There may be a construction duration increase due to the need to rebuild the local road in new location prior to construction of new dual carriageway, as new dual carriageway built over old A66 compared to Black Route where old road is left in place and not disturbed. However construction duration of dual carriageway would be reduced without the need to import so much fill material to construct the embankments.	Neutral	There is no evidence to suggest that buildability is a material factor in determining the Current Preferred Alignment for this scheme.
Environment				
Biodiversity	Construction	Designated Sites: North Pennine SPA and SAC is 255m north and the River Eden SAC and River Eden tributaries SSSI are 700m south of this scheme. Appleby Fells SSSI is 1.5km north of the eastern end of this scheme and Hellbeck and Swindale Woods SAC and SSSIs are 520m north of this scheme. Sandford Mire CWS is 190m south of this scheme. Scheme passes to the south of the North Pennines Area of Outstanding Natural Beauty (AONB) Ancient Woodland and Veteran Trees: N/A Section 41 . Priority Habitats: Several watercourse crossing required - potential for pollution and contamination during construction. Habitat loss and damage as a result of scheme construction, including woodland. Protected/notable species - Potential loss of terrestrial habitat for great crested newt; potential loss of suitable habitat for barn owl.	Worse	Construction of the Blue Route will be largely similar to those of the Black with a number of exceptions which, on balance, make this alterative less preferred than the baseline including: - two additional watercourse crossings which will increase the potential for impacts to the watercourses. These watercourses are hydrologically linked to the River Eden which gives rise to the risk of encountering mobile species related to the SAC designated that may be affected by construction related impacts; - reduced impact on Sandford Mire CWS - significant increase loss of 500m of woodland, reduced loss of a number of other priority habitats and the protected species supported by them - greater impact to suitable barn owl habitat in the removal of vegetation and agricultural structures; - greater impact to GCN through loss of suitable terrestrial habitat - impact to habitat with potential to support otter - potentially reduced construction impact as a result of fewer ponds being required
	Operation	Permanent loss of land and habitat fragmentation. Severance of corridors providing commuting routes for species. Shading impacts on watercourses as a result of new watercourse crossings. Anticipated increase in noise and light levels leading to disturbance of species. Increased mortality of some species due to RTAs.	Worse	Additional watercourse crossings compared to the Black Route increases the risk of impacts to the watercourses in the area.
Road Drainage and Water Environment	Construction	As with Black Route, the Blue Route alternative is located within Environment Agency Flood Zone 2 and 3, and within high and medium risk areas for pluvial flood risk. Watercourse crossings during construction may result in changing surface water flow rates, which may affect flood risk to downstream receptors; predominantly agricultural land Construction activities in or in close proximity to watercourses pose a potential risk to water quality. New watercourse crossings may result in impact to hydro morphology.	Better	Blue Route sits more north of the floodplain of Cringle Beck reducing the risk of impacts on the floodplain. The increased distance of Blue Route from Cringle Beck allows for more opportunity to reduce the risk of construction related impacts to the watercourse. On balance, Blue Route is preferred and provides benefit.
	Operation	New crossings of Moor Beck and the confluence of Moor Beck and East Sike increases the potential for continued impacts to these watercourses as a result of road run off affecting water quality.	Better	There may be increased operational impacts to the hydro morphology of Moor Beck and East Sike, however the Blue alternative sits further from the Cringle Beck floodplain, reducing the potential for long term constraint of the floodplain.
Geology, Soils, Contaminated Land and Groundwater	Construction	Requires construction within the area designated as the North Pennines UNESCO Geopark No known areas of contaminated ground are affected by the Blue Alignment, however there is some risk of unknown contamination related to the MOD land.	Neutral	Potential impact on the North Pennines UNESCO Geopark designation are largely similar to the baseline as both require some construction within its designated area. Baseline does not impact on any known areas of contamination and so impact is considered the same across both.
	Operation	Risk of impact to the groundwater through continued operation and operation of road drainage.	Neutral	This impact is considered the same across the Blue and the Black Route alternatives.
Noise and Vibration	Construction	Although a detailed assessment of construction noise has not been undertaken, assumptions around broad construction activities have been made in order to broadly determine where there is risk of significant impacts.	Neutral	Although a detailed assessment of construction noise has not been undertaken, construction activities assumed to be broadly the same between Black and Blue Routes therefore broad impacts will be the same.
	Operation	42 residential receptors expected to experience significant adverse impacts 7 residential and 2 non-residential receptors expected to experience a significant beneficial impact 31 Public Rights of Way (PRoWs) are expected to experience significant adverse effects.	Better	Compared to the Black alternative, there are: - fewer residential receptors at risk of experiencing adverse noise impact - more receptors expected to experience a beneficial effect from noise - greater number of PRoWs being at risk of adverse noise impact

Landscape and Visual	Construction	<u>Landscape and Visual:</u> The Blue Route has a smaller embankment east of Wheat Sheaf Farm albeit still of notable scale and is largely at grade to Toddygill Bridge. There is a different junction arrangement at Fell Lane compared to the Black Route. Visual impacts will be less than for the Black Route alternative. <u>AONB:</u> The north side of the junction will involve removal of an MOD compound in the AONB to accommodate the junction and earthworks, resulting in direct impacts on the AONB. To the east of the junction there will be a side road that encroaches into the AONB and will result in the removal of the southern part of a woodland.	Neutral	While physical impacts on the AONB will be less with the Black Route, the impacts on setting will be considerable albeit in a limited area. Conversely while the impacts of the Blue Route on setting of the AONB will be less than those of the Black Route, the physical impacts will be greater and when impacts on setting are also considered the comparison with Black Route is neutral.
	Operation	<u>AONB:</u> The Blue Route will introduce a large embankment in the vicinity of Wheat Sheaf Farm which will affect the setting of the AONB in a limited area. Traffic using the scheme will be elevated above existing ground level and will impinge upon views towards the AONB from a more limited area than with Black Route. The new junction at Fell Lane will result in permanent impacts on the AONB albeit displacing the MOD compound. In addition to the mainline impacts on setting of the AONB and permanent change to landscape character there will be permanent impacts on the AONB from the new link road.	Neutral	On balance there are equally significant potential impacts as a result of both the Black and the Blue Routes, though they affect different receptors.
Population and Human Health	Construction	The Black Route will not require any land take from residential receptors. The Black Route will require land take from 2 business receptors - Taylor & Braithewaite, and Apple Tree Barn. The Black Route will require land take from community receptors - including the direct acquisition of Warcop Playing Field (MOD) and Great North Air Helipad. The Black Route will sever/interact with numerous PRoWs. The key agricultural land holdings (known at this time) are affected by all options The Blue Route will require land take from two residential properties - Toddygill Hall and East Field. The Blue Route will require land take from 2 business receptors - Taylor & Braithewaite, and Apple Tree Barn. The Blue Route will require land take from community receptors - including the direct acquisition of Warcop Playing Field (MOD) and Great North Air Helipad. This option requires more land take from MOD Training Establishment than the Black Route. The Blue Route will severe/interact with numerous PRoW The key agricultural land holdings (known at this time) are affected by all options	Worse	Compared to the Black Route, the Blue Route will have a greater impact on local residents including the requirement for land take from residential receptors which isn't required in the Black Route. Blue Route will also require additional land take from the MOD Training establishment compared to the Black Route.
	Operation	The requirement to relocate the MoD Playing Field and MoD Helipad to the south of the existing A66 would be required under both the blue and Black Routes. From a Human Health perspective as per the Noise and Vibration assessment compared to the black option the blue option has: - fewer residential receptors at risk of experiencing adverse noise impact - more receptors expected to experience a beneficial effect from noise - a greater number of PRoWs being at risk of adverse noise impact	Better	The requirement to relocate the MoD Playing Field and MoD Helipad to the south of the existing A66 would be required under both the blue and Black Routes. From a Human Health perspective it is considered that the Blue option is a preferred alternative to the Black as a result of the improvement as outlined in the Noise and Vibration assessment.
Air Quality	Construction	Whilst the route is situated further from the village of Warcop compared to the Black Route, construction impacts assumed to be generally similar across the project.	Neutral	There are unlikely to be differences in the impacts between Black and Blue Routes.
	Operation	Some sensitive receptors are likely to experience minor changes in air quality both positive and negative.	Neutral	There are unlikely to be differences in the impacts between Black and Blue Routes.
Material Assets and Waste	Construction	Two structures would need to be demolished in order to enable the construction of the Blue Route: an existing retaining wall, and Toddygill Bridge.	Neutral	The Black alternative also requires two structures to be demolished, including the retaining wall, though the Black Route alternative requires the demolition of an existing underpass. Although a detailed calculation has not been undertaken the demolitions are not of a scale to materially affect the waste calculations.
	Operation	No significant differences in impact from a materials assets and waste perspective.	Neutral	There is no evidence to suggest that Material assets and waste is a material factor in determining the Current Preferred Alignment for this scheme.
Cultural Heritage	Construction	There are direct impacts to an additional heritage feature known as Platform Earthworks to the north of the existing A66 just east of the existing MOD site as a result of the Blue Route.	Worse	Additional heritage features are potentially impacted as a result of the Blue Route compared to the Black Route.
	Operation	No difference	Neutral	There is no evidence to suggest that Cultural heritage is a material factor in determining the Current Preferred Alignment for this scheme.
Climate	Construction	Green house gas modelling has indicated route alternatives utilising the Blue alternative has the potential to lead to higher modelled green house gas emissions.	Neutral	Both of the modelled routes utilising the Blue Route have a higher modelled tCO2e than the Black Route however in the context of the scheme, this is not considered a significant enough difference to be of concern. This number will be refined as the scheme progresses and construction detail is finalised.
	Operation	Unlikely to be any significant differences in the operational climate impacts between the Blue and Black Routes	Neutral	Unlikely to be any significant differences in the operational climate impacts between the Blue and Black Routes.

Traffic and Economic			
Traffic Volume	No significant differences	Neutral	There is no evidence to suggest that Traffic Volume is a material factor in determining the Current Preferred Alignment for this scheme.
Journey Time Savings	No significant differences	Neutral	There is no evidence to suggest that Journey Time Savings is a material factor in determining the Current Preferred Alignment for this scheme.
Safety	Blue Route will be quicker to build and moves route away from Farm Buildings.	Better	Blue Route has positive impact.
Economy (not modelled with TUBA)	No significant differences	Neutral	There is no evidence to suggest that Economy is a material factor in determining the Current Preferred Alignment for this scheme.
Accessibility including WCH Opportunities	Underpass for Flitholme connected to old A66 provided, this results in removal of local road from Langrigg to Gatehouse and associated overbridge. WCH Provision is provided to ensure any severed footpaths are connected under the new A66. Footpath 372/020 is not stopped up. Bridleway diversion for 350/021 similar to proposed diversion for Black Route so neutral impact.	Better	In Black Route, in order to allow Flitholme residents to old A66 it was necessary to construct a "staggered crossroads" and new local road from Langrigg to Gatehouse on south side of new A66 with an overbridge to connect to old A66 resulting in increased land take and impact on residents at Langrigg (Inc. Thompsons). In Black Route, An existing footpath (372/020) past East Field Farm would be stopped up in Black Route, However, in Blue Route we can provide a diversion to Flitholme Lane so the new underpass can be used to gain access to routes north of the old A66.
Stakeholder			
Land Take	The Blue Route is on a much less embankment than the Black Route and agricultural land take will be reduced, but we encroach into the MOD land on north side to build local road and are required to replace the MOD tank and refuelling compound so overall land take will be similar. Majority of land lost is used for agriculture and is of lower grade and mainly grazing via tenancy	Neutral	Land take from MOD is by agreement, so land costs less, but costs of relocating compound will be borne by pro
Residential	Land take from 2 No residential properties (Toddygill Hall and East Field gate) on north side of A66 and these object to the Blue Route. Concerns have been raised by the owners and occupiers of East Field Farm regarding the location of the Brough Hill Fair into what is left of the MOD bivvy site due to proximity.	Worse	No land take from residential properties in Black Route (In the Black Route, the Bivvy site would not be big enough so would have to be relocated elsewhere).
Commercial	East Field Farm - Mr Heron promoted the suggestion of the new A66 moving further to the north away from the farm onto the north side of the existing for a number of issues ranging from biosecurity to vehicle accident strikes. The Blue Route moves the edge of the new A66 to approximately 30m from the edge of the farm buildings, an improvement on the circa 15m in the Black Route.	Better	Blue Route results in reduced effects on farm operations
Recreation and Leisure	In Black and Blue Routes the MOD playing field is lost. In both options we have agreed a replacement location with MOD onto another one of their fields, so this is a neutral impact.	Neutral	The existing MOD playing field location means it is wet and often not able to be used for periods. The existing is also adjacent to A66 and alternative location is closer to the village, shielded by Eden Valley Railway so will be a better location.
Wider Community Issues	Brough Hill Fair - Blue Route allows what is left of the MOD Bivvy site and existing Brough Hill Fair Field to be used as replacement site and provide and area to match the existing that is lost to the scheme. The Black Route does not allow this and an alternative site will be required to be found that is not near the existing and we do not yet have any landowner agreement for an alternative site away from it's current location. Langrigg junction (Thompsons and Hughes supported by Warcop PC) We are able to provide underpass for Flitholme connected to old A66 provided, this results in removal of local road from Langrigg to Gatehouse and associated overbridge and staggered crossroads at Langrigg.	Better	There is agreement from the MOD to use what is left of the Bivvy Site in combination with the remainder of the existing Fair site for the Blue Route. Discussions have taken place with a traveller representative, and as long as an appropriate amount of land good access and facilities can be provided in the relocated and reconfigured Brough Hill Fair site this should be workable, subject to further detail. By comparison the Black Route does not provide adequate land to accommodate the Brough Hill Fair in this location. Residents at Langrigg (Thompsons/Hughes) have objected to the Black Route which in order to allow Flitholme residents to old A66 it was necessary to construct a "staggered crossroads" and new local road from Langrigg to Gatehouse on south side of new A66 with an overbridge to connect to old A66 resulting in increased land take and impact on residents.
	Conclusion		
	Black Route results in A66 being on a circa 8m embankment through this section. Blue Route results in much lower embankment of around 2m with sections at grade. Black Route therefore results in greater loss of floodplain. Blue Route is further north and results in minor encroachments into AONB and MOD land. Blue Route moves route further away from Eastfield Farm and Warcop Village. Blue Route is better in terms of Noise and Vibration as more receptors are expected to experience a beneficial effect from noise. Blue Route results in extensive works to MOD assets including moving fuel filling station and tank storage sheds. Assets are amalgamated into one location rather than two and old dilapidated buildings are removed. Results in improved views post construction. Black Route maintains existing A66 as a local road. Blue Route requires construction of new local access road as A66 is used as eastbound carriageway. Blue Route results in need to take land from residential properties on the north side of the A66.		

Note: policy considerations are covered as part of the Route Development Report.

A.5 Cross Lanes Junction sifting matrix

Alternative Name	**Cross Lanes Alternative Layout**		
Description	Compact grade separated junction. Proposed link road connecting Rutherford Lane (south) and the B6277 Moorhouse Lane (north). Located west of the existing Cross Lanes priority junction. All movements are retained between the A66, Rutherford Lane and Moorhouse Lane. It should be noted that the alternative layout has been developed to concept stage and that the layout can be further refined. For the purposes of assessment, the alternative layout as shown has been directly compared to the baseline option.		
Drawing (name and link)	HE565627-AMY-HML-S08-SK-CH-000010.pdf		
Drawing Image	Alternative		baseline (for info)
			
Reason for option consideration	Local stakeholder concerns about potential for increased traffic on the B6277 due to the junction upgrade – this perceived increase in traffic was then validated by the traffic models. Addresses WCH focus group safety concerns which suggested that Rutherford lane to the B6277 is a popular route for walking/cycling and the route has to cross the existing A66 on a left right stagger with no formal crossing facilities. Potential to remove an existing central reserve opening and an additional two direct accesses onto the A66 at the scheme extents. Address landowner concerns on the impact on arable land - however acknowledging they and also additional landowners would be potentially impacted with an alternative option. Reduce the visual impact of the junction overbridge on nearby properties.		
Assessment outcome (State the result of the assessment)	Alternative option is preferred. The alternative option is favoured for traffic, safety and WCH improvements, whilst acknowledging that engineering and environmental impacts can be reduced through further design refinement of the layout. The alternative complies more favourably with Highways England Imperatives of Safety, Customer Service and delivering the Road Investment Strategy.		
Suggested improvements (State any possible improvements or variations of the option that may have resulted from the assessment)	Amend horizontal geometry to allow structure to be reduced in length and skew reduced. Refinement of footprint of the alternative option to reduce extent of earthworks. Refinement of landscape integration and design. Further work on access to Moorhouse Lane and Cross Lanes Organic Farm shop - proposal to move access road to the north of the shop.		
Discipline	**Impacts**	**Comparison with baseline option**	**Justification**
Engineering			
Highways - Standards Compliance	The alternative junction extends the scheme extents further to the west to facilitate the proposed link road connecting Rutherford Lane to the B6277. The alternate design improves links across the A66 corridor for all road users and prevents users from crossing the A66 at grade, improving driver safety. Access is provided to and from the A66 via new compact loop slip roads A crossroad is shown where the south compact connector road meets the proposed link road. This may introduce conflicts between road users particularly if a large proportion of the traffic flow on the minor road is a cross movement.	Better	The design standards for the alternative option are the same as the baseline option. No departures from standard are required. Two additional direct accesses are removed from the A66, re-routing to the alternative junction which improves the standard of the A66. A refinement of the proposed layout would see the cross roads on the south side of the junction replaced with a stagger junction. The alternative option has more conventional turning movements than the baseline option - in the baseline option the priority junction where the proposed B6277 meets the compact connector road may introduce conflicts between users with varying destinations. It is possible to refine the horizontal alignment of the link from Rutherford Lane to the B6277 Moorhouse Lane by incorporating desirable minimum horizontal curvature or including the link as part of the compact junction. This would allow the bridge to be straightened, reducing the skew, and resulting in a comparable length of structure as the baseline option. Relaxations in horizontal alignment can be introduced assuming stopping sight distance is not reduced. The baseline junction is as compact a footprint as it can be.
Utilities	The western junction option will impact on BT Openreach, water mains and overhead electricity cables	Neutral	The impact to services and diversion length are likely to be similar for both the baseline and alternative option.
Geotechnics and Earthworks	Historical borehole records available in the BGS website do not provide sufficient coverage to inform the assessment of ground conditions in this area, with only shallow information available for the current alignment of the A66. Depth to bedrock is unknown. **Earthworks** Alternative option bulk quantities Area – 58,080m2 Cut – 1,360m3 Fill – 130,510m3	Worse	In comparison to the baseline option, the alternative option will result in a larger quantum of earthworks, mostly additional fill (circa 29%), with a similar percentage increase in extent. Not enough information is yet available to assess the ground conditions at the alternative structure location. Preliminary ground investigation planned to inform the assessment of ground conditions and preliminary foundation design already undertaken. This doesn't cover the alternative junction location. The revised junction is also positioned outside the area covered in the PSSR. An additional desktop review of existing information needs to be undertaken. An increase in earthworks quantum and extent, the lack of GI data on geo hotspots or unfavourable ground conditions means the impact is considered worse compared to the baseline.

Structures	Clear span 55m (avoids the need to span over slip road) Construction fully online, (single carriageway in each direction is a significant constraint in terms of TM). Multiple span structure, closed likely to be most efficient. High skew span. Potential for further refinement to reduce impact.	Worse	The span is approximately 55m and on a high skew when compared to the baseline option of 40m on a 90deg crossing. Similar to the baseline option, the alternative option will require online construction. However there is more available carriageway space than the baseline option so traffic management not as constrained. Likely to be a multiple span structure, compared to a single span structure in the baseline option. The length and skew dictates that bearings are required to accommodate movement (rather than integral like the baseline option), therefore more onerous maintenance requirements.
Drainage and Hydrology	Due to the nature of the junction crossing numerous watercourses in multiple locations, one additional outfall has been identified below: - North section of Moorhouse Lane discharging into Manyfold Beck. It should also be noted that all outfalls may require retention basins in order to satisfy water quality requirements irrespective of storage requirements. This will become clearer once updated HEWRAT assessments have been undertaken. A similar number and total length of culverts are required when compared to the baseline. Significant increase in cut off ditches There is an increase in area of high surface water flood risk located along Tutta Beck, within the extents of the new junction when compared to the baseline.	Worse	<u>Outfall Location:</u> One additional outfall is required, which would be into Manyfold Beck to the north of the scheme due to the need for an additional attenuation pond to collect run-off from the realigned B6277 to the north of the A66. <u>Surface Water Storage Details:</u> One additional pond required to the northern extent of the realigned B6277. <u>Culverts:</u> A similar number and total length of culverts are required when compared to the baseline. <u>Cut off ditches:</u> Significant increase in cut off ditches (approx. 1km) to intercept overland flows around the Eastbound connector road, the Cross Lanes Link Road and the section of Moorhouse Lane located south of the A66 mainline. In the baseline option the northern side of A66 mainline and western side of Moorhouse Lane requires ditches to incept overland flows. It should be noted that this length of cut of drains could be reduced through design refinement and the relocation of the Moorhouse Lane link road <u>Flooding Impacts:</u> Both junction options are located in an area at risk from high surface water flooding which will potentially impact culvert design and may require additional flood mitigation measures. Considering the additional outfall, retention pond and increase in cut off drainage, the alternative is considered marginally worse.
Construction Design Management (CDM)	Potential increase in construction risk due to bridge structure span/skew and complexity. Increase in overall construction boundary, resulting in additional works and exposure to risk. Potential increase in maintenance requirements (structure bearings).	Worse	Structure clear span is greater than baseline option (approx. 15m) - however there is opportunity to reduce this length of structure similar to the baseline option. The overall footprint of the scheme is greater by approx. 29% which could be refined, reducing extent of earthworks. Additional ongoing maintenance associated with the structure bearings - however opportunity to reduce length and make structure integral. Operational benefits with the removal of direct accesses and left right stagger from Rutherford Lane to B6277 Moorhouse Lane.
Construction Cost	Increased construction costs associated with the additional cut/excavation, longer structure and larger footprint.	Worse	The additional larger footprint, structure length and total excavation would have a negative impact on costs, compared to the baseline.
Buildability	Reduction in fill requirements and large embankments. Increase in bridge structure span and complexity. Increased number of side road connection points.	Neutral	Increase in complexity due to from of structure (multi-span) associated with the alternative option Potential reduction in fill requirements of the approach roads, negating the need for larger embankments to form the junction Increase in bridge span noted however there is potential opportunity to reduce in length and straighten the structure resulting in similar level of complexity compared to the baseline option. More options with traffic management due to the increased carriageway width available (existing dual/ transition section) and construction durations would be similar to the baseline option. Sterile zones within the footprint could be utilised for basins or environmental mitigation however footprint could be refined. The alternative proposal has significantly more side roads to connect to existing road points Although the bridge length is longer, the embankments are slightly reduced in height and more options for traffic management, therefore the overall impact is considered Neutral compared to the Baseline.

Environment				
Biodiversity	Construction	Increased impact on watercourses. Increased impact on woodland priority habitat. Increased impact on Protected/notable species.	Worse	Designated Sites: No internationally designated sites within 2km of this option. One nationally designated site is located within 2km - Kilmond Scar SSSI located approximately 1.6km to the west. Marginally closer than baseline option. Ancient Woodland and Veteran Trees: Thorsgill Wood located approx. 0.7km north, Mill Wood approx. 1.3km south west, Jack Wood approx. 1.7km east. Neutral. Section 41 . Priority Habitats: Loss of approx. 190m of watercourse - As with the baseline, unnamed tributaries of Tutta beck are impacted by this option. Punder Gill, (2 crossing points) additional to the baseline. Also additional to the baseline option, impacts on Punder Gill due to construction of new road alongside approx. 530m of the watercourse. Additional watercourse Manyfold Back also impacted by this option. Direct loss of approximately 330m of hedgerow. Less than the baseline option. Direct loss of deciduous woodland priority habitat. Other habitats - additional loss of approximately 40m of watercourse at new crossing (NZ04831395) in comparison with the baseline option. Additional losses of woodland and trees in comparison with the baseline option. Protected/notable species - larger impacts associated with impacts on watercourses (otter, water vole, bats, fish, birds, invertebrates, macrophytes) and woodland/hedgerow species (bats, red squirrel, badger, breeding birds). A worsening in comparison with the baseline. Potential for amphibians including great crested newts due to waterbodies located approx. 330m to north. The proposed crossing of Punder Gill is 4km upstream of a known salmon river. A slight improvement on the baseline as the main junction is located upstream in comparison with the baseline, the Moorhouse land south link does however also impact the river. Due to larger footprint, the impact of the Alternative Option is considered worse on watercourses, trees and protected species than the Baseline Option.
	Operation	Increased permanent impacts associated with operation upon designated sites, ancient woodland and veteran trees, Section 41 priority habitats and other habitats. Increased impacts upon watercourses.	Worse	Permanent loss of land and habitat fragmentation, a minor worsening in comparison with the baseline option. Severance of corridors providing commuting routes for species, a minor worsening in comparison with the baseline option. Shading impacts on watercourses as a result of new watercourse crossings, a minor worsening in comparison with the baseline option. Mitigation required to include use of fencing/appropriate design to allow safe crossing and reduce risk of RTAs. All other impacts reflect those included in the baseline option: Anticipated increase in noise and light levels leading to disturbance of species. Increased mortality of some species due to RTAs. Overall minor worsening anticipated due to increased impacts on watercourses.
Road Drainage and Water Environment	Construction	Increased impact on surface water and ground water during construction	Worse	<u>Surface Water and Flood Risk:</u> As with the baseline option, although this option is located within EA Flood Zone 1, this is due to the watercourses crossed having catchments below 3km² and therefore not being included in flood zone modelling. It is likely there is a flood risk in close proximity to watercourses which are crossed (to be confirmed following hydraulic modelling). Watercourse crossings for this option include: - Unnamed Tributary of Punder Gill 8.1 crossed to the north of existing A66 - Unnamed Tributary of Manyfold Beck 8.1 crossed to the north of existing A66 - Punder Gill crossed by proposed cross road junction and embankment and on Rutherford Lane - Crossing of Unnamed Tributary of Tutta Beck 8.1 and Tutta Beck at Tutta Bridge - The Unnamed Tributary of Tutta Beck 8.1 and Unnamed Tributary of Tutta Beck 8.2 are crossed by the side road from Moorhouse Lane A minor worsening in comparison with the baseline option. Watercourse crossings during construction may result in changing surface water flow rates, which may affect flood risk to downstream receptors; predominantly agricultural land and a number of properties for the affected watercourses Construction activities in or in close proximity to watercourses pose a potential risk to water quality. This includes the proposed side road in close proximity, to the south at Tutta Beck Construction impacts associated with the proposed long culvert beneath an offline crossroad at Punder Gill would likely require compensation elsewhere in the form of culvert removal, potentially requiring additions to the development boundary. There may also be adverse impacts as a result of this culvert on biodiversity within the water environment. Due to a larger number of watercourse crossings, this option is considered to pose a greater construction risk to surface water elements than the baseline option. <u>Groundwater:</u> The alternative option has a larger footprint than the baseline option presenting an additional risk to groundwater quality during construction. alternative option lies closer to groundwater seepage approximately 35m northwest of the junction. There is potential for water quality impacts to the seepage during construction.

	Operation	Increased impact on surface water and ground water during operation	Worse	<u>Surface Water and Flood Risk:</u> The alternative option includes the following watercourse crossings: - Unnamed Tributary of Punder Gill 8.1 crossed to the north of existing A66 - Unnamed Tributary of Manyfold Beck 8.1 crossed to the north of existing A66 - Proposed cross road junction and embankment on Punder Gill - Additional crossing of Punder Gill on Rutherford Lane - Proposed side road in close proximity, to the south to Tutta Beck - Crossing of Unnamed Tributary of Tutta Beck 8.1 and Tutta Beck at Tutta Bridge - Side Road from Moorhouse Lane crosses Unnamed Tributary of Tutta Beck 8.1 and Unnamed Tributary of Tutta Beck 8.2 A minor worsening in comparison with the baseline option. Operational impacts associated with this scheme include those associated with the long culvert beneath an offline crossroad at Punder Gill. This would likely require compensation elsewhere in the form of culvert removal, potentially requiring additions to the development boundary. There may also be adverse impacts as a result of this culvert on biodiversity within the water environment. There is a potential that drainage pond locations for this alternative option may directly affect Punder Gill / Tutta Beck (as for the original option). The potential operational flood risk will be informed by hydraulic modelling of affected watercourses and which will inform flow rates and additional storage requirements. The greater increase in impermeable surfaces than for the original option will likely result in greater compensation / storage requirements. This option has a greater area of offline road and would likely therefore require additional treatment measures to be incorporated into the drainage system in order to pass the HEWRAT assessment. This would likely increasing space requirements for the drainage features. Due to additional watercourse crossings and a greater additional requirements for flood and surface water quality mitigation measures, this option is considered less favourable than the baseline option with respect to operational impacts on surface water. Lessening of watercourse crossings would be more favourable. Mitigation would be explored to ensure that environmental effects are acceptable. <u>Groundwater:</u> The alternative option has a larger footprint than the baseline alternative option is likely to have a larger reduction in recharge.
Geology, Soils, Contaminated Land and Groundwater	Construction	Increased loss of agricultural soil resource. Increased impacts upon contaminated land, surface water and groundwater during construction.	Worse	The alternative option does not present any additional contaminant risks during the construction phase. Potential sources highlighted under the baseline alternative option are still present under alternative option. The proposed northeast to southwest running embankment located to the northeast of the current alignment intersects a drainage channel which spurs off from the Manyfold Beck. The overbridge and northeast to southwest embankment located to the south of the current alignment intercepts Tutta Beck. However, as for the baseline option, subject to Environmental Permitting Regulations being followed, there is not considered to be an increase in risk to controlled waters. This option includes a larger road footprint than at baseline, therefore there is a potential for a increase in the loss of agricultural land. If the land required for construction increases over that allowed at baseline, then there is a potential for temporary loss of a greater amount of agricultural land than at baseline.
	Operation	Increased loss of agricultural soil resource. Increased impacts upon contaminated land, surface water and groundwater during operation.	Worse	The alternative option does not present any additional contaminant risks during the construction phase. Potential sources highlighted under baseline are still present under alternative option. The proposed northeast to southwest running embankment located to the northeast of the current alignment intersects a drainage channel which spurs off from the Manyfold Beck. The overbridge and northeast to southwest embankment located to the south of the current alignment intercepts the Tutta Beck. However, as for the baseline option, subject to Environmental Permitting Regulations being followed, there is not considered to be an increase in risk to controlled waters. This option includes a larger road footprint than at baseline, therefore there is a potential for an increase in the permanent loss of agricultural land.
Noise and Vibration	Construction	Increased effects at noise sensitive receptors during construction.	Worse	There is potential for construction noise and vibration impacts to result in significant effects at the same four residential receptors identified for the Baseline option since there are construction works in close proximity to these receptors, although the magnitude may be reduced as there is increased distance between the alternative and the receptors. Additionally, there is one residential receptor named Poundergill on Rutherford Lane and one named Dent House Farm which have the potential to be subject to significant effects as a result of the construction of the alternative. The Cross Lanes Organic Farm shop also has the potential to experience significant effects arising from construction works of the alternative. To the north of the A66, on the west side of the B277 there are approximately 7 Public Rights of Way which may be temporarily impacted by the construction of the alternative. This number is comparable to that identified for the baseline alternative option therefore is not a differentiator. Any potential significant effects will be mitigated and minimised by the use of Best Practicable Means contained within the project Construction Environmental Management Plan or Code of Construction Practice. In conclusion, the operation of alternative option has the potential to impact two more receptors than the baseline. Although impacts are reduced on the other properties noted in the baseline the alternative is considered a minor worsening due to the additional properties impacted.
	Operation	Increased effects at noise sensitive receptors during operation.	Worse	There is potential for the operation of alternative option to result in significant effects at the same receptors identified for the baseline option, although the magnitude of impact is likely to be reduced as the distance from the scheme to the receptor in average is larger. However, alternative option is likely to impact 2 more residential receptor named Punder Gill located on Rutherford Lane and Dent House Farm which the baseline option does not impact. There are approximately seven Public Right of Way to the west side of the B6277 with the potential to be subject to significant affects. This number is comparable to that identified for the baseline alternative option therefore is not a differentiator. With regards to indirect effects identified to the north of the A66 alongside the B6277 towards Barnard Castle, the number of receptors potentially impacted by the operation of the scheme are the same to those identified for the baseline option. In conclusion, the operation of alternative option has the potential to impact two more receptors than the baseline. Although impacts are reduced on the other properties noted in the baseline the alternative is considered a minor worsening due to the additional properties impacted.

Landscape and Visual	Construction	Increased impacts in relation to landscape and visual effects during construction.	Neutral	Landscape effects: Similarly to the baseline scenario this option would have a localised impact on landscape character, very similar to the baseline scenario. The construction will have a temporary, short term and reversible nature of effect. The alteration to the junction will be of small scale and would not change the characteristic of wider landscape character areas. Locally however the option would contribute to the expansion of the A66 corridor through provision of more prominent access links and expansion of road infrastructure pattern and introduction of the overbridge. Overall landscape effects during construction would be very similar to the baseline scenario. Visual effects: These would be very similar to the baseline scenario. Construction would significantly affect residential properties located close to the junction: The Smithy, Cross Lanes, Tutta Bridge, The Cottage and Street Side Farm but also North Butts and Punder Gill. These effects will be temporary, short term and reversible and the change to the views would be of similar scale to the baseline scenario.
	Operation	Increased impacts in relation to landscape and visual effects during operation.	Worse	Landscape effects: This option would retain an existing tree belt along the B6277 and will alter slightly more of the existing landscape pattern in comparison to the baseline option. The introduction of earthworks and overbridge, amount of vegetation loss, severance of lanes and field boundaries is greater than the baseline option. This would widen the projects influence in the area and change the perception of this area in the landscape as the junction would be more prominent than the baseline option. Overall, it is considered that the alternative option is likely to have slightly more significant effects in comparison to the baseline option. Visual effects: Similarly visual receptors located close to the junction will be most significantly affected. In addition, residential receptors at Punder Gill and Dent House will be significantly affected in operation but the effects on Street Side Farm and Cross Lanes Cottage will be less significant in comparison to the baseline scenario. Although some residual significant effects will persist, they will reduce in comparison to the construction through the introduction of environmental design measures. Visually this option would affect the views slightly more than baseline option, affecting overall views from greater number and length of PRoWs.
Population and Human Health	Construction	Increased impacts upon agricultural land holdings, community, business and residential receptors, Public Rights of Way/WCH and human health during construction.	Worse	Agricultural land holdings: Construction will require some agricultural land take (grade unknown) on the northern and southern side of the A66. The amount of land take required is considered to be greater in comparison to the baseline option. Community, Business and Residential Receptors: The alignment runs within close proximity to three residential receptors and one business receptor where land take may be required during construction. No demolitions are likely. This section of the alignment does not intersect any open space, sports/recreational buildings or land, including playing fields. Public Rights of Way/WCH: The alignment intersects two PRoW; one to the north of the A66 and another to the south. Construction impacts on these two routes will be likely during construction.
	Operation	Increased impacts upon agricultural land holdings, community, business and residential receptors, Public Rights of Way/WCH and human health during operation.	Worse	Agricultural land holdings: Potential to sever/divert access to agricultural holdings on northern and southern side of A66 due to new junction. Area of land take from agricultural land and severance is slightly greater than the baseline option. Community, Business and Residential Receptors: No operational impacts on community , business or residential receptors during operation. Public Rights of Way/WCH: The alignment intersects two PRoW; one to the north of the A66 and another to the south. During operation there is potential for both PRoW to be permanently altered /diverted to accommodate the route.
Air Quality	Construction	Similar impact	Neutral	Dust and fine particulate matter (PM10) rising from the construction of Scheme 8 alternative option is unlikely to result in significant adverse effects at the receptors located close to the western side of alternative option at the junction of Rutherford Lane and the A66. Any potential significant effects would be mitigated by the use of Best Practicable Means contained within a Construction Environmental Management Plan.
	Operation	Similar impact	Neutral	The implementation of Scheme 8 alternative option is unlikely to result in a significant adverse effect at the two receptors on the western side of alternative option at the junction of Rutherford Lane and the A66. No change in traffic flow is anticipated.
Material Assets and Waste	Construction	Similar impact	Neutral	Longer bridge proposed in comparison with the baseline. The alternative option is not located in a MSA or a peat resource. The recycled content estimate for alternative option is currently unknown. The project aims to achieve that construction materials will have a recycled content target of at least 31%. The recycled rate estimate for alternative option is currently unknown. It is unlikely a significant effect will be identified as there are currently no major sources of contamination in Scheme 8. The project aims to achieve at least 90% material recovery of non-hazardous CDW. The alternative option has the potential to generate CDW which may affect the capacity of waste management infrastructure in Study Area 2 (comprising waste infrastructure in the regions of the North East). However there is currently adequate waste infrastructure capacity for inert, non-hazardous and hazardous landfill in Study Area 2. The alternative option has the potential to generate CDW which may require disposal outside Study Area 2. However this is unlikely as there is currently adequate waste infrastructure capacity and CDW will not need to be exported outside Study Area 2.
	Operation	Scoped out	Neutral	Material resource use and waste generation is expected to be very small during operation therefore these aspects have been scoped out of the assessment.

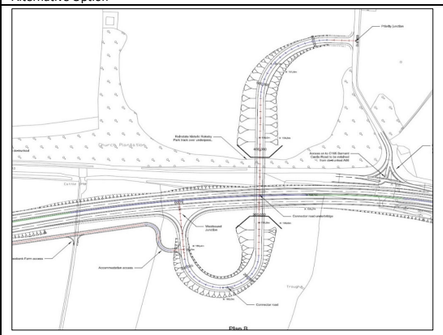
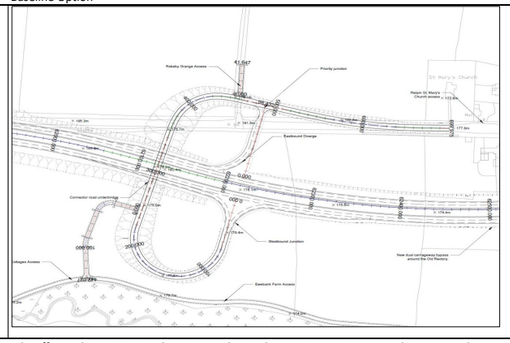
Cultural Heritage	Construction	Increased impacts upon heritage assets including setting and directly. Increased impacts upon buried archaeology during construction.	Worse	The alternative option would require a greater footprint beyond the area of the existing road corridor than the baseline option, resulting in greater impacts to buried archaeological remains (both known and unknown) and impacts resulting from changes to the setting of heritage assets which are more severe than the baseline. Considering impacts to non-designated heritage resources, these would include the removal of areas of medieval and post-medieval ridge and furrow present within the fields to the north and south of the current road, along with other features identified from aerial photography and lidar, mostly of low or negligible value. One key exception to this is a ring ditch, which could represent a prehistoric roundhouse or barrow (burial mound). These archaeological remains would be removed, resulting in a significant adverse effect on the ring ditch and a slight adverse effect on the others. Previously unrecorded archaeological remains could also be affected. The effect on the Grade II listed Dent House Farmhouse would be increased to a moderate adverse effect, as the connecting road would be considerably closer and constitute a more substantial change to views and the surrounding landscape of the farmhouse. The permanent adverse effect on Cross Lanes Farmhouse would be a lower magnitude of impact as the road to the west would be set back from the building and the over bridge would be replaced by a slip-lane junction. However, this would remain as a moderate adverse significance of effect. The impact to the Castle Farmhouse, the Barn 40m east of the Castle Farmhouse and the listed milestone would remain the same.
	Operation	Increased impacts upon heritage assets including setting and directly. Increased impacts upon buried archaeology during operation.	Worse	The alternative option would have the same effects as the baseline on all heritage resources with the exception of Dent House Farmhouse, where there would be an additional slight adverse effect resulting from the increased amount of traffic visible in views from the building.
Climate	Construction	Increased impacts upon greenhouse gas emissions and impacts upon climate change resilience during construction.	Worse	The alternative option presents a significant change in the proposed design, i.e. the revised design significantly increases the footprint of development. Therefore the revised design is anticipated to have an effect on the climate assessment and anticipated climate impacts, when considered against the baseline. The NNNPS sets out that the Secretary of State will consider the effectiveness of such mitigation measures in order to ensure that, in relation to design and construction, the carbon footprint is not unnecessarily high. The proposed changes will increase the carbon footprint significantly on this scheme. It significantly increases the development boundary and increases the scale of damage to soils and vegetation which will lead to further carbon emissions.
	Operation	Increased impacts upon greenhouse gas emissions and impacts upon climate change resilience during operation.	Worse	The proposed changes increase the scale of development against the baseline. This will result in higher maintenance requirements e.g. refurbishment/replacement of pavement. The significant increase in the development boundary is also likely to have an increased effect on ongoing land use, GHG emissions/sequestration each year during the lifetime of the infrastructure, resulting in a greater carbon impact over the lifetime of the project.
Traffic and Economic				
Traffic Volume		Alternative Junction options is located to the west of the existing junction and increases the distance to either or the Rokeby junction options. Neutral impact on the local traffic network compared to baseline (the Preferred route had a detrimental impact on the local road network)	Better	For context; the traffic model shows vehicles travelling eastbound on the A66 tend to leave at the Bowes/A67 junction. By locating the junction to the west of the existing junction, this shows the primary flow of westbound vehicles on the A66 choose to use the Rokeby junction, and not Cross Lanes. The proximity of the baseline junction to Rokeby indues traffic transfer to Cross Lanes/ B6277 Moorhouse Lane, which is not favoured by the Council and local residents. The alternative junction is sited to link Rutherford Lane/ B6277 Moorhouse Lane which carries more local vehicular movements and non-motorised traffic, compared to the baseline option.
Journey Time Savings		Small overall increase in amount of journey time savings.	Better	Traffic travels on a more direct route between A66 East and Barnard Castle. Less potential for delay on Barnard Castle Bridge.
Safety		Neutral safety impact on the A66 Improved safety for walkers, cyclists and horse riders.	Better	Both the baseline and alternative option improve safety on the A66 due to the removal of the existing central reserve gap, replaced by a grade separated junction, stopping traffic turning right across other flows. However the alternative removes two additional direct accesses onto the A66, improving safety for A66 traffic. Therefore, impact considered better. For context for walkers, cyclists and horse riders: - The B6277 Moorhouse Lane is used by cyclists as part of a known local route to/from 'The Stang'. - The C165 Barnard Castle Road is used by cyclists as part of a known local route to/from Greta Bridge, feedback from the walkers, cyclists and horse riding focus group suggests the B6277 Moorhouse Lane route is the greater used route. - There are no official bridleways in the area, however some horse riding is expected on local roads. The eastern location of the baseline option influences a proportion of traffic to switch the Cross Lanes junction. The northern end of the B6277 Moorhouse Lane is surrounded by residential properties and there is a nearby primary school. Due to greater number of potential origins and destinations in the vicinity of the B6277 Moorhouse Lane, it is expected that there will be more walkers, cyclists and horse riders on the route to/from Barnard Castle. The alternative junction reduces this transfer of traffic due to its location, resulting in the primary flow of vehicles to/from Barnard Castle is via the C165 Barnard Castle Road. It is considered that safety is improved for walkers, cyclists and horse riders.
Economy (not modelled with TUBA)		Negligible impact	Neutral	The change in design impacts a relatively low traffic volume, so any impacts would be expected to be negligible.
Accessibility including WCH Opportunities		Direct link from Rutherford Lane to the B6277 Moorhouse Lane via a new overbridge Removal of direct access on the A66	Better	The link from Rutherford Lane to the B6277 provides a more direct, shorter and safer crossing of the A66 which reduces severance created by the A66 and significantly improves connectivity for vulnerable non-motorised users compared to the baseline design. The same movement is not provided in the baseline option as cyclists and horse riders travelling from Rutherford Lane towards the B6277 will need to cross an existing gap in the central reservation, travel eastbound along the A66 and then join the stopped-up B6277 at Cross Lanes. Design year two-way traffic flows are 34,863 AADT. Travelling along a dual carriageway with 70mph traffic will be uncomfortable and dangerous for cyclists and horse riders. There is not a formal crossing provision in the central reserve A link from Rutherford Lane to Moorhouse Lane south of the A66 in the baseline option would result in an additional 700m distance compared to the alternative. Two additional direct accesses onto the A66 are directed to the alternative junction allowing safer access to and from the A66 for these property owners. More opportunity to link with PRoWs

Stakeholder			
Land Take	Increase in land take required	Worse	The alternative option footprint is larger than the baseline and as such has a greater impact on landtake. Footprint can be refined through design development compared to the baseline option.
Residential	New landowners impacted Residential properties at Cross Lanes junction impacted by both options. Residential properties at North Bitts and Punder Gill are impacted by the alternative option.	Neutral	5 new landowners impacted - 3 associated with new PMAs, 2 associated with loss of agricultural land The residential properties at North Bitts and Punder Gill are adjacent to the alternative junction compared to the baseline option (350m away). However safer access to and from the A66 is provided by linking the property accesses to the alternative junction and removing direct accesses on the A66. No blight impacts compared to baseline option (Carter property) The impact on new landowners is considered balanced against improvements to accesses and reducing impact on properties at Cross Lanes.
Commercial	Access impact on local business Cross Lanes Farm shop Impact on farm businesses	Neutral	Feedback from the owners of Cross Lanes Farm Shop suggest the alternative is preferred, with the exception that the access road to Moorhouse Lane be placed to the north of the shop adjacent to the A66. This would be an improvement to them as the current layout of the alternative option has a greater visual impact on views to the south from the premises. The alternative option is considered to be better as it has the potential to capture westbound passing trade compared to the baseline option. This is due to the perception that the cafe will be hidden by the baseline structure. Impact on arable land is reduced for the impacted landowner in the baseline option. However new landowners are now impacted by the alternative. The impact on new landowners is considered to balance out any reduced impact on the landowner affected by the baseline option and any potential improvement for the farm shop. Therefore the overall impact is considered to be neutral.
Wider Community Issues	Feedback received from Durham County Council, Local Councillors, Community Liaison Group and local residents	Better	Alternative option is preferred by Durham County Council, Local Councillors and the Community Liaison Group on the basis that it minimise impacts on the local road network. Alternative option was preferred by the majority of attendees to the Public Information Event held to update the general public on scheme progress. Notwithstanding the direct impact on affected landowners, the overall impact is considered better to more stakeholders
	Conclusion		
	Engineering The alternative option, situated to the west of Cross Lanes provides a more direct link between Rutherford Lane and the B6277 Moorhouse Lane, which is a busier local route, in comparison with the baseline option that connects Moorhouse Lane north and south. The alternative option removes an existing at-grade right left stagger across the A66 which is the predominant local movement (for both vehicular and non-motorised users) and is inherently unsafe. This is a significant benefit over the baseline option. The design standards for the alternative option are the same as the baseline option. No departures from standard are required. Two additional direct accesses are removed from the A66, re-routing to the alternative junction which improves the standard of the A66. This is a significant benefit over the baseline option. The span of the alternative structure is approximately 55m and on a high skew when compared to the baseline option of 40m on a 90deg crossing. This is a worsening compared to the baseline in the pre-mitigation assessment. The alternative option will result in a larger quantum of earthworks, mostly additional fill (circa 29%), with a similar percentage increase in extent. The additional structure length and larger footprint results in further impacts for drainage, CDM and cost, which is considered worse overall than the baseline The alternative option has the potential to be refined to minimise engineering footprint and extent of earthworks. This will also reduce the structure length and skew which introduces the option of an integral structure, comparable to the baseline option. The design refinements may be achieved by: -shifting the southern link from the proposed junction to Moorhouse lane to the north of Cross Lanes farm shop and parallel to the A66; -refining the horizontal alignment of the link from Rutherford Lane to the B6277 Moorhouse Lane by incorporating desirable minimum horizontal curvature or including the link as part of the compact junction; -minimising tie in lengths to existing roads: -drainage basins to utilise land sterilised by the layout. By incorporating the design refinements above, the drainage impact, extent of earthworks (not necessarily the quantum and the amount of fill required as there are more road connections to tie in compared to the baseline), cost and CDM impacts are considered comparable to the baseline option. The baseline junction is as compact a footprint as it can be and offers little scope for further refinement. Although the bridge length is longer in the alternative option, the embankments are slightly lower in height and there is more flexibility for traffic management, therefore buildability impacts are considered similar to the baseline. However, considering the design refinements that can be made to the structure length, buildability would be considered comparable to the baseline option. Environment Air quality and Materials (construction) are similar for both the baseline and alternative option. In terms of biodiversity, impacts would remain upon a larger number of watercourses in in the alternative option compared with the baseline (two more) which would be considered worse, however with appropriate mitigation impacts through ecological design at the watercourse crossings, the impacts would be considered neutral compared to the baseline. The larger footprint associated with the alternative has a worse impact on Road Drainage and Water, Geology, Soils and Contaminated Land and Population and Human Health compared to the baseline. This is reflected in a larger number of water courses impacted, larger impact on agricultural holdings and increased carbon and climate impacts associated with longer structure, and increased extent of earthworks. However, there is potential that these impacts can be reduced by a refined footprint (refinements detailed above). In terms of cultural heritage, the impact on buried archaeological remains would be increased compared to the baseline due to the larger footprint. The Grade II listed Dent House Farmhouse would be increased to a moderate adverse effect, as the connecting road would be considerably closer and constitute a more substantial change to views and the surrounding landscape of the farmhouse. The permanent adverse effect on Cross Lanes Farmhouse would be a lower magnitude of impact as the road to the west would be set back from the building and the over bridge would be replaced by a slip-lane junction. Overall, the alternative option is worse for cultural heritage. Amendment to the Moorhouse lane south link would lessen impacts upon buried archaeology, Dent House Farm and Cross Lanes, and the reduction of the proposed footprint would lessen impacts upon the non-designated heritage assets.		

	It is acknowledged that some of the environmental topics have indicated that the impact of the alternative option is worse than the baseline option. However, under some of the topic headings, these impacts are marginally worse than the baseline option and there is a high probability that these impacts can be reduced through refinement of the design footprint, resulting in a comparable impact with the baseline. There are no environmental impacts highlighted that are felt to be prohibitive or outside the normal scope of a typical highway project. Traffic The alternative option is considered better than the baseline from a traffic assessment perspective. This is due to: -locating the junction to the west of the existing junction results in more westbound vehicles on the A66 choosing to use the Rokeby junction, and not Cross Lanes. The proximity of the baseline junction to Rokeby indues traffic transfer to Cross Lanes/ B6277 Moorhouse Lane, which is not favoured by Durham County Council and local residents. -The alternative junction is sited to link Rutherford Lane/ B6277 Moorhouse lane which carries more local vehicular movements and non-motorised traffic, compared to the baseline option. -The link from Rutherford Land to the B6277 provides a more direct, shorter and safer crossing of the A66 which reduces severance created by the A66 and significantly improves connectivity for vulnerable non-motorised users compared to the baseline design. Stakeholder Five new landowners are impacted with the alternative option - three associated with new PMAs, and two associated with loss of agricultural land. The residential properties at North Bitts and Punder Gill are adjacent to the alternative junction compared to the baseline option (350m away). However safer access to and from the A66 is provided by linking the property accesses to the alternative junction and removing direct accesses on the A66. There are no blight impacts compared to baseline option. Feedback from the owners of Cross Lanes Farm Shop suggest the alternative is preferred, with the exception that the access road to Moorhouse Lane be placed to the north of the shop adjacent to the A66. This would be an improvement to them in terms of visual impact on views to the south from the premises. The Farm Shop owner perception is that the alternative option has the potential to capture westbound passing trade compared to the baseline option, as views of the cafe from the dual carriageway will be obstructed by the baseline structure. Other landowners have commented on the potential loss of arable land. The impact on new landowners is considered balanced against improvements to accesses and reducing impact on properties at Cross Lanes. Design refinement may potentially reduce the footprint of the alternative option, but the number of landowners impacts will be similar, therefore the overall impacts still considered neutral, compared to the baseline. The alternative option is preferred by Durham County Council, Local Councillors, and representatives of the Community Liaison Group on the basis that it minimise impacts on the local road network and increases WCH provision. Notwithstanding the direct impact on affected landowners, the overall impact is considered better in the wider community as it has the potential to benefit more stakeholders. In summary, the alternative option is favoured for traffic, safety and NMU improvements, whilst acknowledging that engineering and environmental impacts can be reduced through further refinement of the layout and environmental mitigation. The alternative complies more favourably with Highways England Imperatives of Safety, Customer Service and delivering the Road Investment Strategy.

Note: policy considerations are covered as part of the Route Development Report.

A.6 Rokeby Junction sifting matrix

Alternative Option Name	**Rokeby Alternative Layout (Option D)**
Description	Compact grade separated junction located further east when compared to the Baseline Option. The compact connector road directly impacts the Registered Park and Garden (RP&G), crossing at its narrowest point. The compact connector road passes beneath the proposed alignment of the A66, the de-trunked A66 and the RP&G to minimise impact.
Drawing (name and link)	HE565627-AMY-HML-S08-SK-CH-000016.pdf
Drawing Image	Alternative Option  Baseline Option 
Reason for option consideration	Local stakeholder concerns (residents, Councillors and Durham County Council) about potential for increased traffic on the B6277 Moorhouse Lane due to the junction positioning – this perceived increase in traffic was then validated by the traffic models. Some landowner and local stakeholder preference for a junction closer to the location of the existing junction between the A66 and the C165 Barnard Castle Road, due to a 2km diversion of the Baseline Option. Receipt of a formal report from a landowner who had objections to the Baseline Option.
Assessment outcome (State the result of the assessment)	The alternative option is not considered to comply with national planning policy due to its impact on the Registered Park and Garden (RPG). The RPG is granted significant importance and protection in planning policy and any negative impacts will only be accepted in exceptional circumstances where sufficient evidence can be provided to demonstrate that the negative impacts of the works are outweighed by the positives and that no viable alternative solutions are viable. Although strong stakeholder and community support has been shown for the alternative option, at this stage it is not considered that there is sufficiently robust evidence to justify the impacts on the RPG and therefore there is a significant risk that the alternative option would be deemed not comply with national policy by the Planning Inspectorate.
Suggested improvements (State any possible improvements or variations of the option that may have resulted from the assessment)	Design development to introduce an environmental bund to screen the connector road from view and a green bridge to reconnect the RP&G. Refinement of the connector road alignment to avoid cutting down a mature tree alongside C165 Barnard Castle Road and to achieve a greater planting depth for a 'green bridge' allowing more planting options.

Discipline	Impacts	Comparison with base option	Justification
Engineering			
Highways - Standards Compliance	Similar requirements for Departures from Standard and/or relaxations.	Neutral	The eastbound merge design includes Departures from Standard. However, the junction layout and departures are consistent for the Baseline Option and the Alternative Option. The Alternative Option westbound diverge (inc. taper) is located on the inside of the curve (CD123 5.17). It is important to note, at the location of the westbound diverge the curve radii is 2040m. This is considered a near straight with less impact on visibility than smaller radii. Where the minor road is on the inside of a curve, the diverging lane can adversely affect visibility for drivers emerging from the minor road. The Alternative Option eastbound diverge layout is non-standard. Although not considered a departure, the slip road ties-in to the proposed de-trunked A66 and does not terminate with a junction as per standard layouts demonstrated in DMRB. The parallel arrangement of the slip road may promote higher speeds for vehicles exiting the A66 due to the long straight and emission of a terminating junction. Careful consideration of the final layout is required where the slip road meets the de-trunked A66 (slip road cross-section to single two lane carriageway) and how this interacts with existing private accesses. This risk could be mitigated subject to further design development. The Baseline Option eastbound diverge is also located on the inside of the curve. Technically a departure from standard, however the eastbound merge is displaced and visibility of merging traffic is not impacted by the taper and auxiliary lane of diverging traffic. The Baseline Option eastbound diverge layout is more inline with conventional diverge arrangements. However, the length of connector road from the eastbound diverge to the priority junction is less than typically found, this may result in queuing back to the mainline during peak traffic flows. Positives and negatives are present for both options, overall the options are considered balanced. Therefore a neutral score has been submitted.
Utilities	Reduced number of diversions or protective works	Better	The majority of utility diversions are a result of the A66 mainline diversion, which remains consistent for both options. There are some additional openreach cables impacted by the north section of the Baseline Option (serving Rokeby Grange). Some of which could potentially be retained for the Alternative Option.
Geotechnics and Earthworks	Increase in bulk earthworks Favourable/unfavourable ground conditions at structures unresolved	Better	There is a general increase in bulk earthworks, however the increase is of cut. This scheme has a earthworks deficit and therefore increased cut material will result in a cost saving. Therefore it is considered to be better. (See figures below). Baseline Option (with western alternative junction at Cross Lanes) Cut: 66,105m³ Fill: 196,529m³ Net: *130,424m³ imported fill required Alternative Option (with western alternative junction at Cross Lanes) Cut: 99,262m³ Fill: 193,205m³ Net: *93,942m³ imported fill required - this saves circa. 36,000m³ *presuming all cut is suitable Limited information on the Baseline Option is available due to accessibility issues during Preliminary Ground Investigation (GI). Therefore, GI information considered to be the same for both options. 2021 preliminary ground investigation provides very limited information at the eastern junction location. - No historical records available on British Geological Survey (BGS) website. - Depth to rockhead unknown. - Additional ground investigation requirements for the Alternative Option likely to be marginally greater than the Baseline option. - Potential for seepage through cuttings at underbridge if shallow groundwater present; however common in both options. Due to the overall increase in cut volume helping the scheme cut/fill balance, the impact is considered to be better.

Structures		Increased structure length Increased durability issues due to increased structure length Neutral structure complexity	Worse	The length (approx. 80m) of the Alternative Option underbridge means that it is in effect a short tunnel, therefore increased construction and cost. Potential durability issues with buried joints - twice as many as baseline due to increased length over the Baseline Option. Simple box structure likely to be most efficient structural form, same as Baseline Option. Standard structural solution, same as Baseline Option. Due to the length, lighting will be required. Drainage will need to control water pressures and risk of inundation - same as Baseline Option. North section will require excavation through historic park which might limit construction flexibility. Due to increased overall length, cost, potential durability issues, additional lighting and potentially limited construction flexibility, the Alternative Option is considered to be worse than the Baseline Option.
Drainage and Hydrology		Increase in attenuation required Neutral impact for watercourse realignment Increase in number of culverts Increase in cut off drains	Better	<u>Outfall Location:</u> The Alternative Option requires one additional outfall to the two already required for the Baseline Option, this is to the North of the A66, discharging into a tributary of the River Tees. <u>Surface Water Storage/Attenuation:</u> The Alternative Option will require an additional attenuation basin located within the agricultural field adjacent to the River Tees, one more basin than the Baseline Option. Therefore impact considered to be worse. <u>Watercourse realignment:</u> Neither option require watercourse realignment - impact considered to be neutral. <u>Culverts:</u> A greater number of culverts are required for the Baseline Option to convey overland drainage from the North of the A66 to the South and discharge into Tutta Beck. The Baseline Option underpass will increase depths of pipes. This will likely impact on the outfall into Tutta Beck, and may require construction works within the Ancient Woodland. Deep culverts will introduce H&S risks. The Alternative Option requires a min. of two culverts under Barnard Castle Road. Due to the greater number of culverts, depths of pipes, impacts on the Ancient Woodland at Tutta Beck; the impact is considered to be better. <u>Cut off drains:</u> The Alternative Option has additional length of cut off ditches when compared to the Baseline Option. This is considered to be worse. <u>Flooding impacts:</u> Government Flood Maps For Planning suggest minimal design impact for both options. In the event of drainage collection units failing, the vertical alignment of the Alternative Option facilitates overland flows. The Baseline Option has a risk of potential flooding in the underpass due to presence of a low point. Impact considered to be better. Although the Alternative Option requires an additional attenuation basin and outfall compared to the Baseline Option; the resilience created by the vertical alignment of the Alternative Option creating overland flows, and the removal of deep construction within the Ancient Woodland at Tutta Beck, the impact is considered better.
Construction Design Management (CDM)		Increase in Construction Risk Increase in Operation/ Maintenance Risk	Worse	Increased construction risk relating to the additional cut required to construct the Alternative Option when compared to the Baseline Option. The structure (underbridge) required to pass beneath the proposed A66 alignment, existing A66 corridor and church plantation area is of greater length when compared to the Baseline Option, this increases construction risk. The compact connector road for the Alternative Option has a continuous fall from the westbound priority junction to the intersection with Barnard Castle Road. This creates overland drainage route in the event the proposed drainage collection units fail during operation. Due to the increased construction risks associated with increased cut and structure length, the overall impact is considered worse.
Construction Cost		Similar cost	Neutral	The additional structure length and total excavation would have a negative impact on costs. The scheme wide, together with the Baseline Option, cut/fill balance indicates a large deficit of fill material. Material won due to increased cut of the Alternative Option would be a benefit to the other areas of the scheme and reduce material import and the associated cost.
Buildability		Less complex construction Increased phasing Less Traffic Management Reduced imported fill	Neutral	The Alternative Option looks the most straightforward to build with easy material movement routes established. Underpass construction can take place partially offline. Remaining elements will need to be phased once traffic is diverted. Potential for Temporary Works to enable underpass to be completed and maintain A66. No significant increase in level for new road, thus a large fill import is not required. The Alternative Option increases cut, helping to rebalance the earthworks deficit on the scheme, saving costs. Reduced Traffic Management to undertake connections with existing A66. Positives and negatives are present for both options, overall the options are considered balanced. Therefore a neutral score has been submitted.
Environment				
Biodiversity	Construction	Similar impacts during construction upon designated sites, mature trees, Section 41 priority habitats and other habitats. Small improvement on impacts to watercourse	Neutral	<u>Terrestrial:</u> Compared to the Baseline Option, the Alternative Option is considered neutral since similar impacts are anticipated on woodland/arable related habitats and species. A section of the woodland located within the Registered Park and Garden immediately to the north of the proposed underbridge which may include mature trees. The design of the underpass could be of benefit if suitable for use for safe passage of species under the A66, i.e. appropriate lighting design and greening of the underpass. There are also opportunities of creating habitat linkages/connectivity between Church Plantation to the north and Jack Wood to the south (e.g. via additional hedgerow/woodland planting) which is of benefit (Minor Improvement). <u>Freshwater:</u> No watercourse crossings are proposed in this section of the scheme under this option. This option is considered neutral (compared to baseline) from a freshwater ecology perspective. Construction activities in or in close proximity to watercourses pose a potential risk to water quality. The Alternative Option poses lower risk (from a freshwater ecology perspective) compared to the Baseline Option as risk of water quality impacts is reduced to due to the earthworks being further north of the Tutta Beck. However, both options would be constructed in accordance with appropriate construction methods, therefore the impact is considered negligible. Overall impacts in comparison with the Baseline Option are considered to be neutral.
	Operation	Similar impacts during construction upon designated sites, mature trees, section 41 priority habitats and other habitats. Small improvement on impacts to watercourse	Neutral	<u>Terrestrial:</u> Similar disturbance impacts and mitigation requirements for adjacent terrestrial habitats compared to baseline. This option is therefore considered neutral in comparison to the Baseline Option. The opportunity to create connectivity/habitat linkage between Church Plantation to the north and Jack Wood to the south once in operation is considered as a minor benefit in comparison to the Baseline Option. <u>Freshwater:</u> This option is considered neutral (compared to the Baseline Option) from a freshwater ecology perspective. No watercourse crossings are proposed in this section of Scheme 8 under the baseline scenario. Assuming that operational water quality risks will be managed through incorporation of treatment measures within the drainage system (in accordance with LA113), there should be no operations-phase pathway for impact for freshwater habitats (Tutta Beck). Overall impacts in comparison with the Baseline Option are considered to be neutral.

Road Drainage and Water Environment	Construction	Reduced impact on surface water during construction. Similar impact on ground water during construction.	Better	<u>Surface water:</u> Similar to the Baseline Option, the Alternative Option is located within EA Flood Zone 1 for fluvial flooding, however due to the granularity of the flood modelling it is most likely that both options extends into EA Flood Zone 2. No watercourse crossings are proposed. Construction activities in or in close proximity to watercourses pose a potential risk to water quality. In relation to the Baseline Option, the Alternative Option is considered to be a lower risk of water quality impacts to surface watercourses due to the earthworks being further north from the Tutta Beck. Climate change flows (to be determined by modelling) may require compensatory storage being included within the design. <u>Groundwater:</u> Similar to the Baseline, the Alternative Option is located on the Great Limestone Member (Alston Formation), which is a Secondary A aquifer with potential for conduit flow (karst). Similar to the Baseline, the Alternative Option includes an underbridge that will require excavation and this may locally lower groundwater levels during construction, potentially impacting on groundwater quantity and quality. Potential groundwater quality impacts are possible from earthworks. Like the Baseline Option, the Alternative Option includes similar potential for both groundwater quantity and quality impacts. Due to the lower risk to water quality during construction, the Alternative Option is considered to be a minor improvement.
	Operation	Similar impact on surface water and ground water during operation	Neutral	<u>Surface water:</u> Similar to the Baseline Option, the potential operational risk to water quality will be managed through incorporation of treatment measures within the drainage system in accordance with LA113. The potential operational flood risk will be informed by hydraulic modelling of affected watercourses which will inform flow rates and additional storage requirements. <u>Groundwater:</u> Similar to the Baseline, the potential operational risk to water quality will be managed through incorporation of treatment measures within the drainage system in accordance with LA113. The inclusion of an underbridge may locally lower groundwater levels, which will require either groundwater management or sealing for groundwater ingress. There is a similar potential for localised permanent groundwater lowering at the underbridge. Operational effects are considered to be neutral in comparison with the baseline.
Geology, Soils, Contaminated Land and Groundwater	Construction	Slight increase in loss of agricultural soil resource. Neutral impacts upon contaminated land, surface water and groundwater during construction.	Neutral	The Alternative Option has a slightly larger footprint area compared to the Baseline Option, although the difference is small (approx. 3% increase in area). This option could result in a slight increase in the loss of agricultural soils compared to the baseline. No potential contamination sources have been identified within the footprint of the proposed Alternative Option underpass. The underpass may require dewatering during construction which could result in a temporary worsening of groundwater quality locally, although no potential contamination sources have been identified close to the proposed junction location. This is similar to the Baseline Option, where no contamination sources were identified close to the proposed junction. This scheme is located close to a surface water body (Tutta Beck) to the south and there is a risk of pollution caused by runoff/accidental spillage during construction, this risk is smaller than the baseline option. These risks should be managed through good construction practices. Considering the increase in land take and the smaller risk to Tutta Beck the impact is considered neutral in comparison with the baseline.
	Operation	Slight increase in loss of agricultural soil resource during operation	Worse	The Alternative Option has a slightly larger footprint area compared to the Baseline Option, although the difference is small (approx. 3% increase in area). This option could result in a slight increase in the loss of agricultural soils compared to the baseline. No permanent effects relating to contaminated land, surface or groundwater quality have been identified, assuming no permanent dewatering required for the underbridge. Minor worsening in comparison with the baseline due to increased land take.
Noise and Vibration	Construction	Increased effects at noise sensitive receptors during construction.	Worse	As with the Baseline Option Construction noise and vibration impacts associated with the Alternative Option have the potential to result in significant effects at the noise sensitive receptors closest to the scheme. These receptors include The Old Rectory, Tutta Beck Cottage, Keepers house, Tack Room Cottage and the Grove. The new underpass within the Alternative Option will also extend closer to West Lodge, Garden House, Stable Yard Cottage and the Dovecote in the north and Ewebank in the south. Any potential significant effects will be mitigated and minimised by the use of Best Practicable Means contained within the project Construction Environmental Management Plan or Code of Construction Practice. The Alternative Option is considered a minor worsening in comparison with the Baseline option as it is closer to the properties of West Lodge, Garden House, Stable Yard Cottage, Dovecote and Ewebank.
	Operation	Increased effects at noise sensitive receptors during operation.	Worse	Potential significant effects are anticipated both north and south of the A66 carriageway for the Alternative Option, including receptors to the north (The Old Rectory), south (Tutta Beck Cottage and Keepers house) and east (the Grove and Tack Room Cottage). Some beneficial effects are anticipated from the Alternative Option at Schoolhouse, St Mary's Church, and The Old School due to the movement of the junction to the east. The addition of the underpass will result in operational traffic moving closer to the noise sensitive receptors at Ewebank Farm in the south and noise receptors in the north including West Lodge, Garden House, Stable Yard Cottage and the Dovecote. There is the potential for a significant adverse effect at these receptors. The Alternative Option is considered a minor worsening in comparison with the baseline option due to the increase in number of affected receptors. As the design is developed further, noise barriers will be investigated in line with LA 111 which will potentially minimise any identified significant adverse effects.
Landscape and Visual	Construction	Similar impacts in relation to landscape and visual effects during construction.	Worse	<u>Landscape:</u> The majority of the route being constructed off line with the integration of farmers accommodation tracks will result in construction that will require earthworks of a similar scale in comparison to the baseline and the construction works will be in closer proximity to Rokeby Grove and Tack Room Cottage. There would be permanent loss of woodland at Rokeby RPG and permanent alteration of the RPG, topography and land use in the field to the north of the underpass. As with the baseline, there would be additional loss of mature trees in field boundaries to the north of 'Ewebank'. However, the Alternative Option would avoid the loss of mature sycamore trees at Rokeby Grange Farm associated with the Baseline Option, a minor improvement on the Baseline Option. <u>Visual:</u> Construction works will concentrate close to the underbridge location. However the eastward shift of the junction will result in loss of trees and woodland. As with the Baseline Option, construction of the underbridge would require the use of cranes and these would be prominent in views. The construction in this area is likely to be slightly less noticeable in views from footpath adjacent to the church and 'The Rectory' due to screening by vegetation and landform. Construction will affect PRoW 13 that crosses the field in which the northern part of the junction will be located. It will also affect views from the entrance gates to Rokeby Park RPG which is a visitor attraction. Further design development would look to reduce the above impacts through the potential use of environmental bunds to screen the junction from sensitive receptors.
	Operation	Increased impacts in relation to landscape and visual effects during operation.	Worse	<u>Landscape:</u> The Alternative Option will permanently alter landscape in the setting of the RPG and this will result in greater impact on landscape character than the Baseline Option. <u>Visual:</u> While the Alternative Option will result in noticeable change and will affect different receptors to the Baseline Option, it is considered that opportunities for mitigation such as alteration of landform in the field to the north of Church Plantation and additional planting alongside Barnard Castle Road and at the underpass will reduce impacts to a degree by year 15. This option is considered to be a minor worsening in comparison with the Baseline Option.

Population and Human Health	Construction	Similar impacts upon agricultural land holdings, community, business and residential receptors, Public Rights of Way/WCH and human health during construction.	Worse	Agricultural land holdings: The Alternative Option has a slightly larger footprint area compared to the Baseline Option, although the difference is small (approx. 3% increase in area) this does increase agricultural land take (grade unknown). Individual fields will be severed during construction, however this is a smaller number than the Baseline Option. Community, Business and Residential Receptors: Impacts will not differ from the Baseline Option. At this section of the Baseline Option, there are eight residential properties that lie within close proximity to the scheme and access into these properties (with the exception of Rokeby Grange) will likely be disrupted during construction. Public Rights of Way/WCH: The Alternative Option will intersect two PRoW (footpaths - one more than option A) which will be disrupted during construction. Both these routes are deemed to be of medium value and therefore any diversion over 500m would result in a significant effect. It is noted that there is a desire line from Greta Bridge which would be improved in the Alternative Option. Human Health: The option is located in a sparsely populated area. Due to the low number of people exposed to the impacts of the option, no health effects are identified. (Effects on the wellbeing of the occupants of individual properties are considered through the air quality, noise and visual assessments.) This option will not differ from the baseline. Due to the slightly larger footprint and additional footpath which is affected by the Alternative Option, the impact is considered to be a minor worsening.
	Operation	Similar impacts upon agricultural land holdings, community, business and residential receptors, Public Rights of Way/WCH and human health during operation.	Neutral	Agricultural land holdings: Permanent agricultural land take (grade unknown) will be required on the northern and southern side of the existing A66. The addition of the underbridge will link agricultural land on the northern and southern side of the A66 and so severance between land holdings is unlikely. There will be severance of individual fields, however this is a smaller number than the baseline. Community, Business and Residential Receptors: Impacts will not differ from the Baseline Option. There are no operational impacts on any business receptors at this section of the alignment. There will be permanent amendment to access for numerous residential properties and two community assets. Public Rights of Way/WCH: The Alternative Option intersects two PRoW (footpaths - one more than the Baseline Option) however one will be reinstated via the historic Rokeby Park track. Both routes are deemed to be of medium value and therefore any diversion over 500m would result in a significant effect. It is noted that there is a desire line from Greta Bridge which would be improved. Human Health: The option is located in a sparsely populated area. Due to the low number of people exposed to the impacts of the option, no health effects are identified. (Effects on the wellbeing of the occupants of individual properties are considered through the air quality, noise and visual assessments.) This option will not differ from the baseline. The Alternative Option is considered neutral in comparison with the baseline.
Air Quality	Construction	Similar dust and emissions to air and impacts upon human and ecological receptors during construction	Neutral	Similar impacts from emissions to air at isolated properties and the ancient woodland to the south during the construction of the Alternative Option and the Baseline Option, with the implementation of appropriate mitigation measures contained within an approved Construction Environmental Management Plan, no significant effects are likely to occur at identified human or ecological receptors. Air quality should therefore not be a material consideration with regards to the optioneering process for Rokeby Junction.
	Operation	Similar dust and emissions to air and impacts upon human and ecological receptors during Operation	Neutral	Similar impacts from emissions to air at isolated properties during the operational phases of the Alternative Option and the Baseline Option, no significant effects are likely to occur at identified human or ecological receptors. Air quality should therefore not be a material consideration with regards to the optioneering process for Rokeby Junction.
Material Assets and Waste	Construction	Similar impacts from materials for structures, similar land take and earthworks balance	Neutral	The alternative is not located in a MSA or a peat resource. The alternative has the potential to generate CDW which may affect the capacity of waste management. However, there is currently adequate waste infrastructure capacity for inert, non-hazardous and hazardous landfill.
	Operation	Scoped out	Neutral	Scoped out
Cultural Heritage	Construction	Increased impacts upon heritage assets. Similar impacts for potential buried archaeology during construction.	Worse	This option would result in direct impacts to the Registered Park and Garden and introduce major change to the setting of the most sensitive heritage resources within the Rokeby Park group, including the Hall and its grand gate-piers and railings. The road would be constructed as an underpass approached in cutting from the north and south. During construction this would be a major change to the Registered Park and Garden, temporarily severing the parkland connection between the park and Church of St Mary. While this would be reinstated following construction, the new underpass and connector roads would be a substantial change to the setting of the Registered Park and Garden and would alter the way in which the listed buildings along its west and south-western boundary are experienced and viewed on approach. Further, the northern approach to the underpass beneath Church Plantation would be visible in the important panoramic view from West Lodge (Rokeby Park) towards the church. Even if screened by planting, this would cause a sense of enclosure in that view which would also be undesirable. Signage and lighting may be required close to the park wall, which would also be potentially harmful, depending on location and design. Construction is also likely to result in an adverse effect on the group of Grade II listed buildings at the Grove, although these effects will be limited due to existing screening and the fact that the main aspect of the house is looking south. Potential for buried archaeology reflects that of the baseline. There would be an improvement in terms of impacts upon St Mary's Church due to the movement of the junction further east however in balance the impacts upon the RPG cause this option to be worse than the baseline.
	Operation	Increased impacts upon heritage assets.	Worse	This option would result in reduced traffic passing within the vicinity of St Mary's Church due to the movement of the junction further to the east, leading to a potential improvement to the setting of the church, in comparison with the baseline option. Rokeby Park and Gardens is a Grade II* Registered Park and Garden. This option would result in fragmentation of and introduction of traffic to a nationally designated heritage asset, leading to harm of that asset. As stated in the NNNPS substantial harm to or loss of designated assets of the highest significance, including grade I and II* Registered Parks and Gardens should be wholly exceptional.
Climate	Construction	Similar impact on greenhouse gas emissions and impacts upon climate change resilience during construction	Neutral	Green House Gas: The Alternative Option presents a change in the proposed design. The alternative design is expected to represent a similar scale of development compared to the baseline. The Alternative Option will have a direct impact on the Registered Park and Garden, including the removal of trees, however this effect is anticipated to reflect the baseline and carbon emissions associated with land use change during construction are expected to be similar. The NNNPS sets out that the 'Secretary of State will consider the effectiveness of such mitigation measures in order to ensure that, in relation to design and construction, the carbon footprint is not unnecessarily high'. The proposed changes are expected to be neutral in terms of the carbon footprint on this scheme when compared to the Baseline Option. Climate Change Resilience: Climate Change Resilience Assessment is scoped out for construction. There will be neutral impact when compared to the Baseline Option.
	Operation	Reduced impacts upon greenhouse gas emissions climate change resilience during operation (versus option A)	Better	Green House Gas: It is anticipated that the Alternative Option will have a minimal effect on road user emissions compared against the Baseline Option. Maintenance requirements e.g. refurbishment/replacement of pavement and effects on ongoing land use are anticipated to be similar to option A. Therefore, during operation, Green House Gas is considered to be neutral in comparison to the Baseline Option. Climate Change Resilience: The preliminary Climate Change Resilience assessment identified a potential risk for some underpasses to flood, impacting operation. Both the Baseline Option and the Alternative Option involve the construction of an underpass adjacent to the proposed A66 line of route. The climate resilience risk is likely to be improved for this option due to an increased capability of overland flows. This should be considered in conjunction with the flood risk assessment. The overall climate risk for the Alternative Option is considered to be better compared to the Baseline Option. Considering Green House Gas and Climate Change Resilience together, the Alternative Option is considered to have a slightly better effect on operation compared to the Baseline Option due to increased climate resilience.

Traffic and Economic			
Traffic Volume	Improved impact on local traffic network	Better	For context; - the traffic model shows vehicles travelling eastbound on the A66 tend to leave at the Bowes/A67 junction. - A Heavy Goods Vehicle (HGV) ban on Barnard Castle Bridge is incorporated into all modelling. The Baseline Option design (Option A/PCF Stage 2) shows the majority of westbound vehicles choosing to use the Cross Lanes junction (B6277 Moorhouse Lane) rather than Rokeby (C165 Barnard Castle Road), due to the increase in journey time resulting from the proposed western location of the junction. This is a switch from the existing scenario where the primary flow is via the Rokeby junction (C165 Barnard Castle Road). This is not favoured by local residents, Councillors and MP's due to the change from the existing situation. Due to the HGV ban the HGV route in either option is via the Rokeby junction and not via Cross Lanes. The Alternative Option shows the primary flow of westbound vehicles on the A66 choosing to use the Rokeby junction, and not Cross Lanes, particularly when paired with the Alternative Option at Cross Lanes. Consequently, This combination of junctions best maintains the current traffic distribution between the C165 Barnard Castle Road and B6277 Moorhouse Lane.
Journey Time Savings	Small Overall increase in amount of journey time savings.	Better	Traffic travels on a more direct route between A66 East and Barnard Castle Less potential for delay on Barnard Castle Bridge
Safety	Neutral safety impact on the A66 Improved safety for walkers, cyclists and horse riders.	Better	Both the Baseline Option and the Alternative Option improve safety on the A66 due to the removal of the existing central reserve gap, replaced by a grade separated junction, stopping traffic turning right across other flows. Therefore, impact considered neutral. For context for walkers, cyclists and horse riders: - The B6277 Moorhouse Lane is used by cyclists as part of a known local route to/from 'The Stang'. - The C165 Barnard Castle Road is used by cyclists as part of a known local route to/from Greta Bridge, feedback from the walkers, cyclists and horse riding focus group suggests the B6277 Moorhouse Lane route is the greater used route. - There are no official bridleways in the area, however some horse riding is expected on local roads. The Alternative Option shows the primary flow of westbound vehicles travelling to/from the A66 choosing to use the Rokeby Junction (C165 Barnard Castle Road), and not Cross Lanes (B6277 Moorhouse Lane) reversing the switch from the PCF Stage 2 design (see Traffic Volume above). The western location of the Baseline Option influences traffic to use the Cross Lanes junction similar to that of the PCF Stage 2 design. The northern end of the B6277 Moorhouse Lane is surrounded by residential properties and there is a nearby primary school. Other than the exception of Rokeby Hall and its group of buildings, there are no residential properties on the C165 Barnard Castle Road. Due to greater number of potential origins and destinations in the vicinity of the B6277 Moorhouse Lane, it is expected that there will be more walkers, cyclists and horse riders on the route to/from Barnard Castle. By ensuring the primary flow of vehicles to/from Barnard Castle is via the C165 Barnard Castle Road, it is considered that safety is improved for walkers, cyclists and horse riders in the Alternative Option.
Economy (not modelled with TUBA)	Negligible Impact	Neutral	The change in design impacts a relatively low traffic volume, so any impacts would be expected to be negligible.
Accessibility including WCH Opportunities	Improvement in connections between communities served by the route	Better	There are multiple PRoWs that currently terminate at the existing A66 highway boundary. It is assumed that users on the PRoWs currently cross the existing single lane carriageway to continue to their destinations. Both options remove at grade crossings and provide safer grade separated crossings. The upgrade to dual carriageway, inclusion of a central reservation and the provision of a grade separated junction in both options will help to prevent future crossings. Therefore, impact considered neutral. Compared to the Baseline Option, the eastern location of the Alternative Option minimises the diversion length for cyclists travelling to/from Greta Bridge but increases the diversion length for walkers using the local footpaths. However, it is considered that there is a greater number of cyclists using the area than walkers. Therefore the location of the Alternative Option is considered better than the baseline as it is best suited to the existing desire lines and flows.
Stakeholder			
Land Take	Marginal increase in land take and overall footprint of the scheme.	Neutral	The engineering land take for both options is similar. Therefore, impact considered neutral.
Residential	Reduced landowner impacts	Better	There is a singular landowner affected by both options, therefore impact considered neutral. Access arrangements to the residents affected by the works in both options are similar, therefore impact considered neutral. In the Alternative Option, the majority of traffic using the junction is to the east, with only a very small volume of traffic using the eastbound diverge and using the proposed de-trunked section of the A66. This change will improve the impact on the residents of the Schoolmasters House at St Mary's Church. Therefore impact considered to be better. Due to the net improvement for the residents of the Schoolmasters House at St Mary's church, the overall impact is considered to be better.
Commercial	Reduced impact on business operation Both options have similar footprints in arable land.	Better	The landowner's view is that the Alternative Option is less commercially damaging and impactful on their tenants than the Baseline Option; primarily due to the complete severance of the agricultural fields south of the Baseline option as a result of its layout and location. Therefore, the Alternative Option is considered to be better.
Wider Community Issues	Feedback received from Durham County Council, Local Councillors, Community Liaison Group and Historic England.	Neutral	The Alternative Option is preferred by Local Councillors and the Community Liaison Group on the basis that it maintains the junction in its existing location and should therefore minimise impacts on the local road network. The Alternative Option was preferred by the majority of attendees to the Public Information Event held to update the general public on scheme progress. The Alternative Option is preferred by Durham County Council. The Baseline Option is preferred by Historic England due to impact on Rokeby Registered Park and Garden. Due to a divided opinion, impact considered neutral.
	Conclusion		
	Engineering The alternative option sites the proposed Rokeby Junction closer to the location of the existing at-grade crossing, which better maintains current traffic distribution between the C165 Barnard Castle Road and B6277 Moorhouse Lane when compared to the baseline option by removing the need for westbound vehicles travelling to/from Barnard Castle to perform a short u-turn, which increases the journey time into Barnard Castle. This reduction in traffic on the B6277 Moorhouse Lane is considered safer for walkers, cyclists and horse riders whilst also providing a more point of crossing for pedestrians and cyclists from Greta Bridge. The alternative option is considered to be neutral for Highways compliance. This is because the design standards for the alternative option are the same as the baseline option and no additional departures from standard are required (both require a departure for the retention of the existing eastbound merge onto the A66). From a Construction Cost and Buildability perspective the alternative option is considered neutral because whilst there is some additional complexity and cost associated with the structure this is counterbalanced by the ability to construct more of the junction offline and the increased cut generated by the alternative option reduces the deficit of fill material. The alternative option is better for Utilities as it affords the option to retain utilities that the baseline option would need to divert. The alternative option is better for Geotechnics as it provides a more favourable earthworks balance. However, the increased work within cut and a longer, more costly structure result in the baseline option being considered better for CDM and Structures. From a Drainage perspective there alternative option is considered better, as whilst it does introduce an additional pond and outfall, it has the significant benefit of not introducing a trapped cutting that is present in the baseline option. The alternative option manages to maintain a fall south to north, which allows water to escape the underpass in the event of any drainage blockages on the local road. Environment The Biodiversity, Air Quality and Waste Topics are assessed as neutral for the alternative option due to having a very similar impact to the baseline option. The Landscape, Visual and Noise impacts are considered to be worse than the Baseline Option. For road drainage the alternative option is considered to be better than the baseline option during the construction phase due to the works being undertaken further away from Tutta Beck and the resultant reduction in risk of negatively impacting water quality. The alternative option is worse for Geology impacts due to the increased land take, although it should be noted that this increase is very minor at 3%. The alternative option has a worse noise impact during both construction and operation due to the increased number of properties impacted by the alternative option when compared to the base line. The Alternative Option will negatively impact upon the setting of the RPG during both construction and operation and therefore has a greater impact on landscape character than the baseline option. There would also be a worse impact on Population and Human Health during construction of the alternative option as it intersects an additional footpath which is considered to be of medium value, during operation it is considered the alternative option would have a neutral impact when compared to the baseline as both would provide an alternative and safer means of crossing the A66. Rokeby Park and Gardens is a Grade II* registered park and garden. The alternative option would result in fragmentation of the RPG and introduce traffic to a nationally designated heritage asset, leading to harm of that asset. Consequently the alternative option is assessed as worse during both construction and operation when compared to the baseline option. It is also noted that that the NNNPS states that substantial harm to, or loss of, designated assets is of the highest significance, and should be wholly exceptional. The operationally impact on Climate Change is considered better for the alternative due the ability for the junction to flow freely, therefore avoiding the risk of the underpass flooding which is present in the baseline option. It should also be noted that through further design development it is considered that the landscape could be reduced in operation when compared to the baseline option through use of earthworks to screen the road when viewing the junction from the north. Planting could also be used across the new structure to reinstate the existing treeline as far as possible. Traffic Regarding Traffic, the Alternative Option is considered better than the Baseline Option due to the primary flow remaining on the C165 Barnard Castle Road, which improves journey times, negates possible issues at The Sills and Barnard Castle Bridge resulting from increased traffic flows, and is safer for walkers and cyclists on the B6277 Moorhouse Lane. It should be noted that these benefits are largely based on anecdotal evidence from stakeholders and consequently are difficult to quantify. The location of the Alternative Option is considered better for walkers and cyclists travelling to/from Greta Bridge when compared to the Baseline Option as it provides a more direct route on the desire line and avoids the diversion present in the baseline option. However, a further diversion for walkers using the PRoW north and west of St Mary's Church. Stakeholder The Alternative Option has a marginally larger area of land take compared to the Baseline Option. However, the singular landowner affected by both options, favours the Alternative Option due to the impact on the number and considered value of the affected land parcels, but also due to the degree of severance created by the Baseline Option on their land between the realigned A66 and the Ancient Woodland adjacent to Tutta Beck. The Alternative Option is favoured by Local Councillors, Durham County Council and the General Public who attended the Public Information Event primarily for the reasons cited in the traffic section above. However, Historic England consider the Alternative Option to be their least favourable option due to the significant impacts on the Registered Park and Garden.		

	Policy Compliance The alternative option is not considered to comply with national planning policy due to it's impact on the Registered Park and Garde. The RPG is granted significant importance and protection in planning policy and any negative impacts will only be accepted in exceptional circumstances where sufficient evidence can be provided to demonstrate that the negative impacts of the works are outweighed by the positives and that no viable alternative solutions are viable. Although strong stakeholder and community support has been shown for the alternative option, at this stage it is not considered that there is sufficiently robust evidence to justify the impacts on the RPG and therefore there is a significant risk that the alternative option would be deemed not comply with national policy by the Planning Inspectorate.

Note: policy considerations are covered as part of the Route Development Report.

B Temple Sowerby to Appleby initial alternatives and sifting

B.1 Map of initial alternatives

KEY

Constraints Plan Areas of major constraint. These areas include: Ancient woodland, Ancient monuments, Areas of local value, Areas of natural beauty, Buildings (residential and industrial), Existing major structures, Farmhouses and major buildings, Flood zones / floodplains, Wells (gypsum plant), Listed buildings, Major stats equipment, Planned developments, Areas of special conservation, Railway lines.	
Constraints Plan Areas of minor constraint. These areas include: Woodland, scrubland, and copses, Public rights of way, Landfill sites, Minor/remote farm buildings, Access tracks, Wet areas and ponds.	
Watercourse These everything known within the site, from rivers to springs.	
Schools Schools have been highlighted as they are considered to be the most sensitive of the buildings in the affected villages/towns.	
Gypsum Mines The abandoned gypsum mines (also known as the longriggs mines) have been separated out from the other major constraints as they could be backfilled to reduce the risks involved and so require more consideration than other constraints.	
Existing A66 Lengths of the A66 that are already dual carriageway.	
Existing Roads Local highway authority roads. These include some more substantial b roads, but mostly are unclassified country lanes.	
Stage 2 Prefered Route	
Route Options	

NOTES

1. Options 6a to 6h were developed at PCF stage 2. Options 6i to 6k were developed at PCF stage 3, based on the need to reduce the impact on the floodplain and SAC of the Trout Beck.
2. Floodplain. The design team is not aware of any detailed modeling that is available at this stage for this assessment. The flood extent is based on EA flood maps (flood zone 2).
3. Option 6B1 needs alterations - it needs threading through the built up areas to minimise the demolition (not achieved/considered at stage 2).
4. The alignments have been designed using a single string, rather than separate strings for each carriageway. Where 510m radii have been used (2no. steps relaxations) the alignment may not be achievable. After accounting for the visibility splay in the central reserve it may not be possible to achieve a 510m radius on both carriageways - the inside carriageway radius will have to be greater than 510m, or the outside carriageway radius will have to be less. Alignments with 510m radii are:
   - 61C (east end tie-in to existing A66)
   - 6IC (southernmost point)
   - 6J (650m radius used after first river crossing)

Revision	Revision details				
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P01.1					
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	Created	Checked	Reviewed	Approved	Authorised
	dd/mm/yy	dd/mm/yy	dd/mm/yy	dd/mm/yy	dd/mm/yy

Designer
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A66 NTP Integrated Project Team

Client
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highways england

Project Name
A66 Northern Trans-Pennine

Drawing Title
Optioneering -
Alignment Options 6a to 6k
For Reassessment at PCF Stage 3
Various Viewports

Project Ref. No.	Stage	Scale : NTS @ A0
---	PCF3	Dimensions : M

Drawing Number
Project | Originator | Volume
HE565627 - AMY - HML
S0405 -DR-CH-300023
Location | Type | Role | Number

Suitability	Suitability Description	Revision
S0	Initial non-contractual code	P01.1

B.2 Map of refined alternatives

DRAFT

[Provided as an appendix to the Route Development Report for information only]

A

B

A66 0405

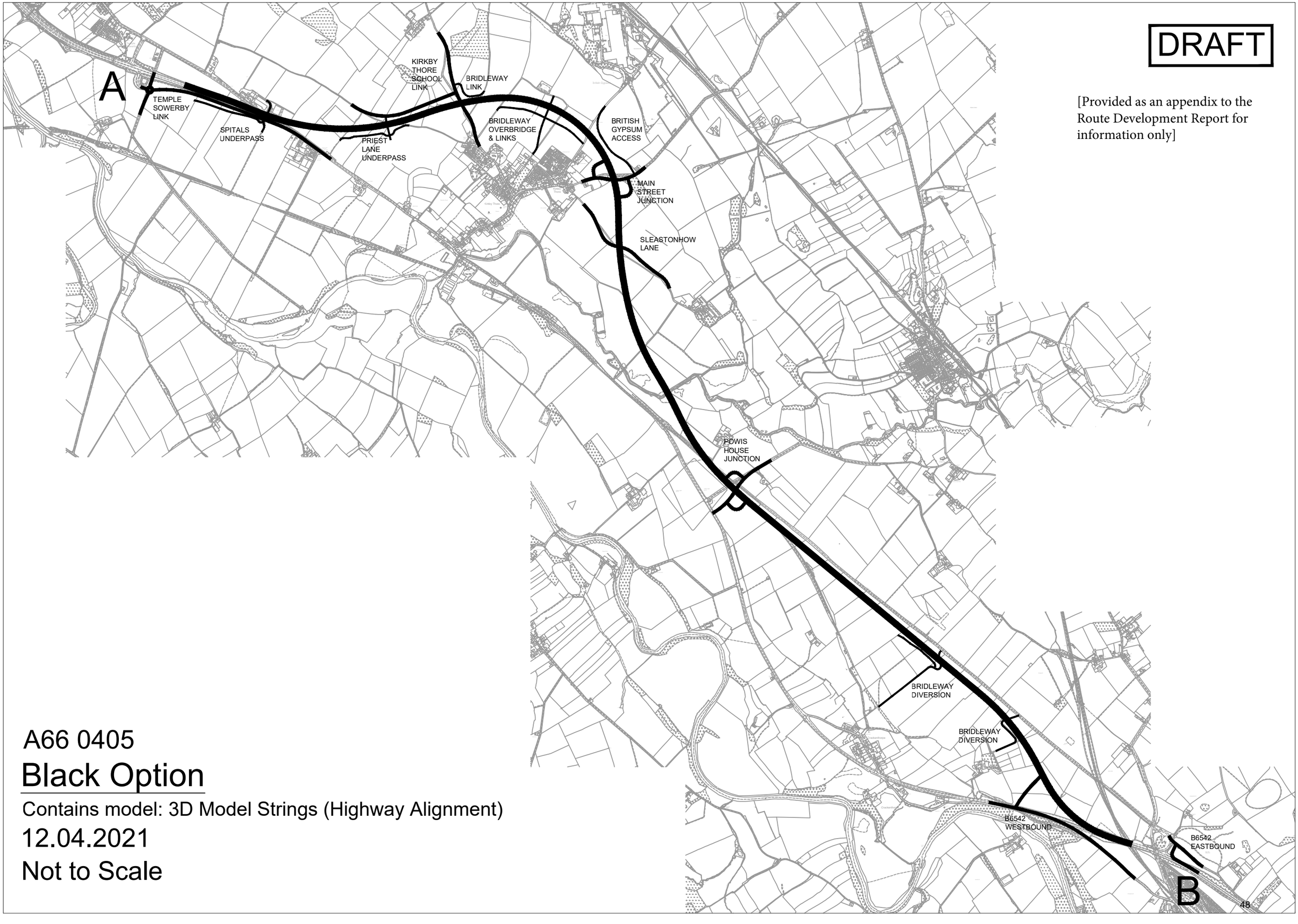
Mainline Options

22.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



A66 0405

Black Option

Contains model: 3D Model Strings (Highway Alignment)

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]

A

TEMPLE SOWERBY LINK

SPITALS UNDERPASS

PRIEST LANE UNDERPASS

KIRKBY THORE SCHOOL LINK

BRIDLEWAY LINK

BRIDLEWAY OVERBRIDGE & LINKS

BRITISH GYPSUM ACCESS

MAIN STREET JUNCTION

SLEASTONHOW LANE

Difference between the Black and blue option. Model shows this area only, for full extent see Black option model.

POWIS HOUSE JUNCTION

BRIDLEWAY DIVERSION

BRIDLEWAY DIVERSION

B6542 WESTBOUND

B6542 EASTBOUND

B

A66 0405

Blue Option

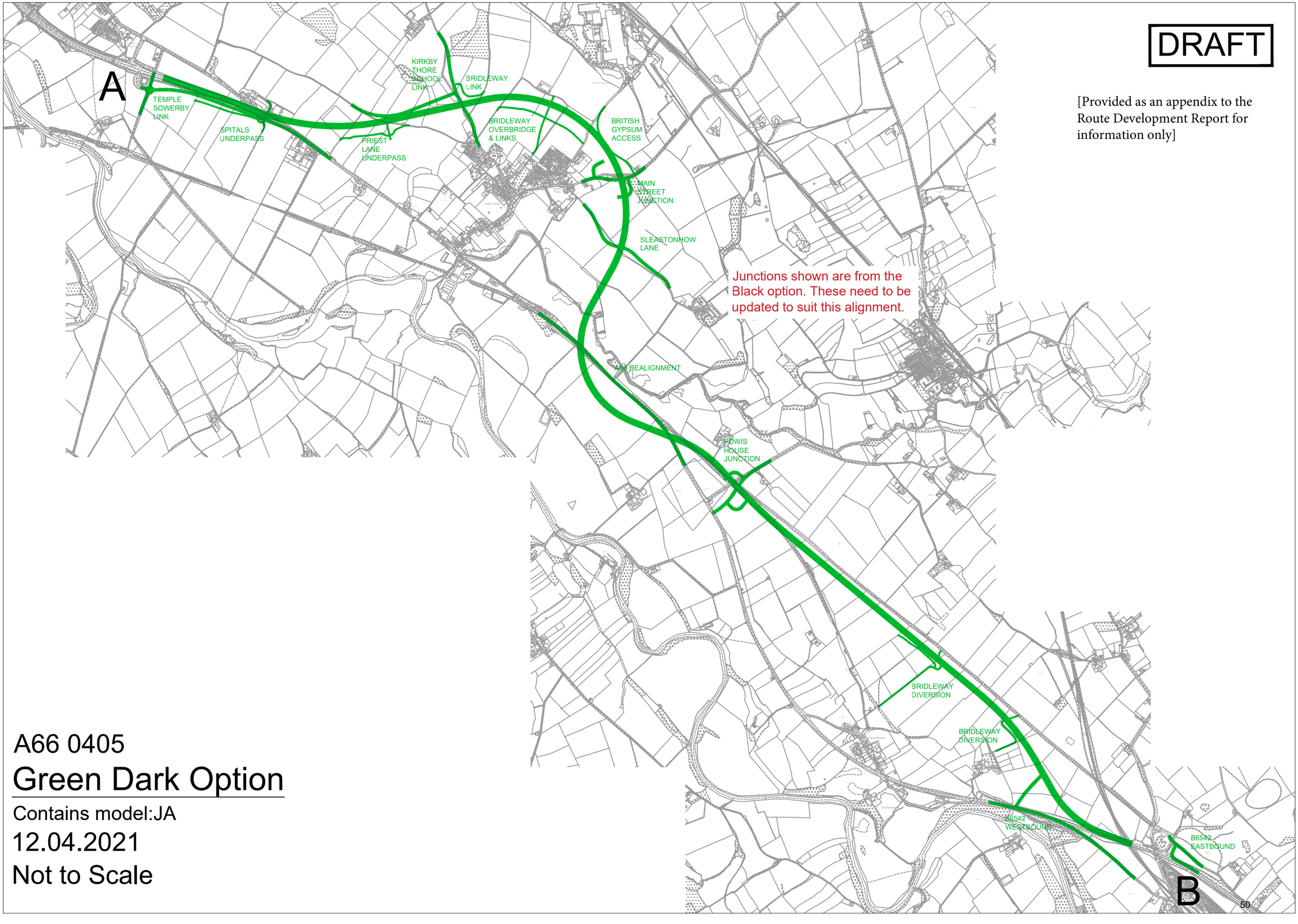
Contains model: Alternative Trout Beck Alignment 3D Model Strings

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



A66 0405

Green Dark Option

Contains model:JA

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]

A

TEMPLE SOWERBY LINK

SPITALS UNDERPASS

PRIEST LANE UNDERPASS

KIRKBY THORE SCHOOL LINK

BRIDLEWAY LINK

BRIDLEWAY OVERBRIDGE & LINKS

BRITISH GYPSUM ACCESS

MAIN STREET JUNCTION

SLEASTONHOW LANE

Junctions shown are from the Black option. These need to be updated to suit this alignment.

A66 REALIGNMENT

BRIDLEWAY DIVERSION

BRIDLEWAY DIVERSION

B6542 WESTBOUND

B6542 EASTBOUND

B

A66 0405

Green Light Option

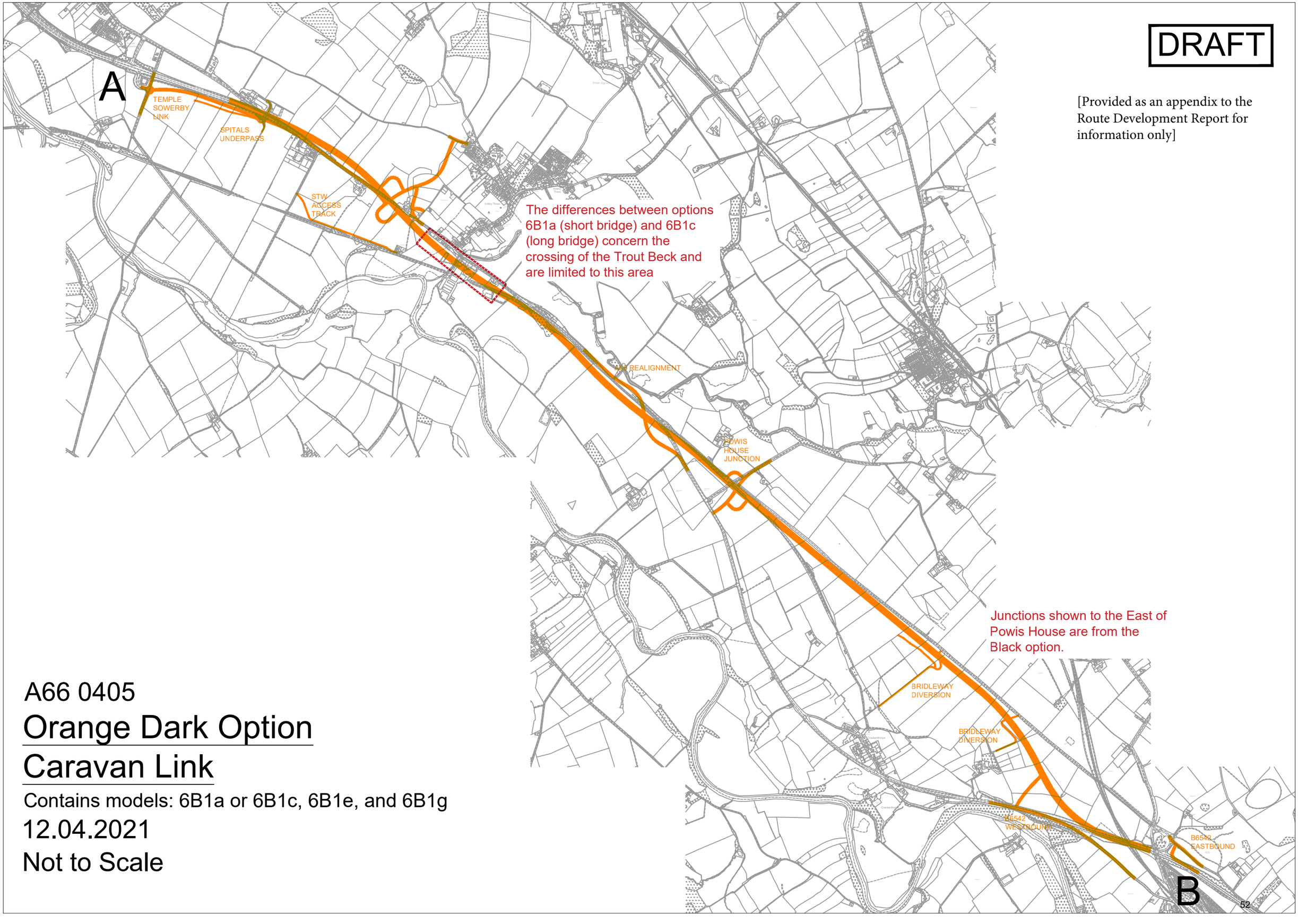
Contains model: JB

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



A66 0405

Orange Dark Option

Caravan Link

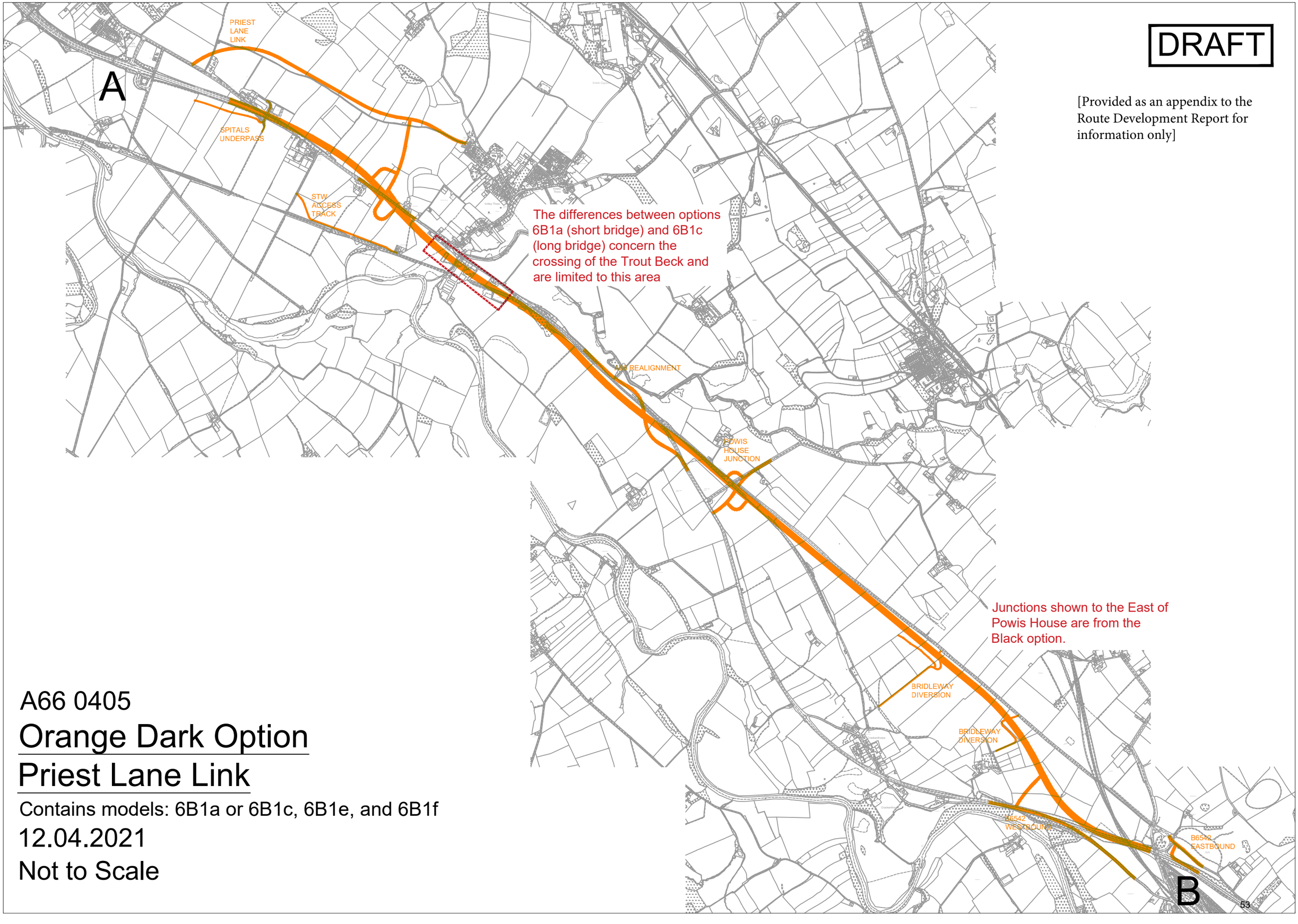
Contains models: 6B1a or 6B1c, 6B1e, and 6B1g

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



A66 0405

Orange Dark Option

Priest Lane Link

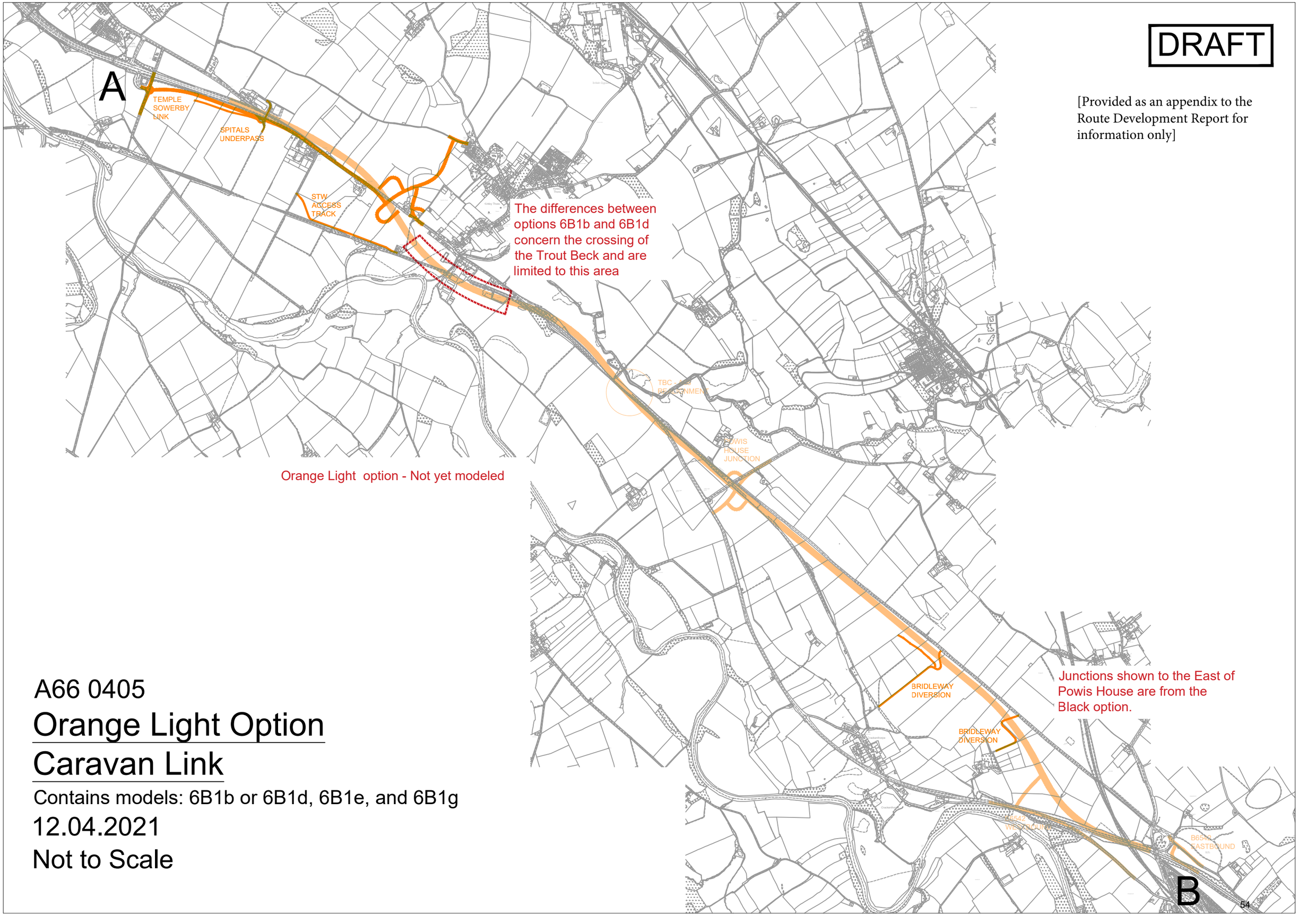
Contains models: 6B1a or 6B1c, 6B1e, and 6B1f

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



Orange Light option - Not yet modeled

A66 0405

Orange Light Option

Caravan Link

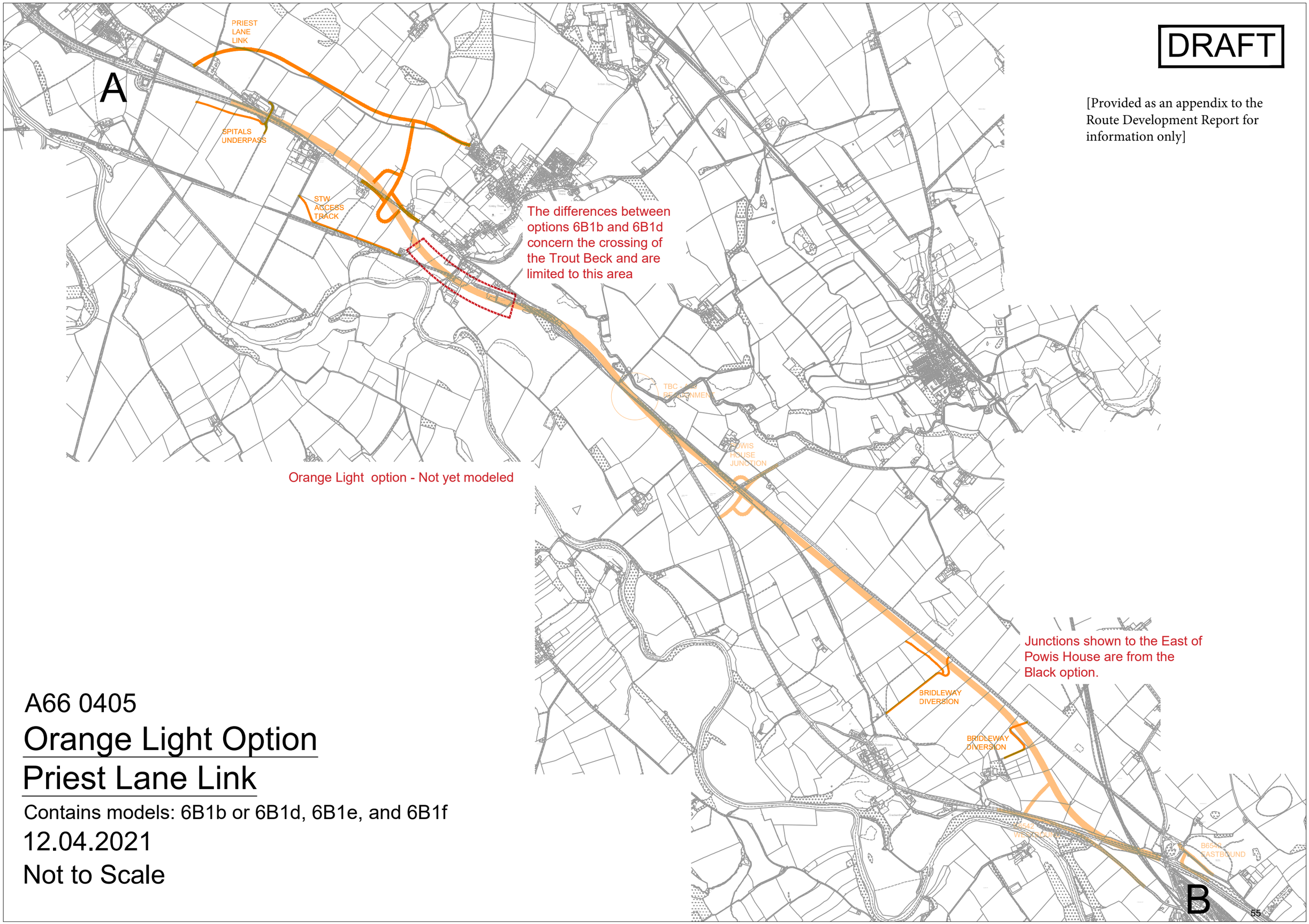
Contains models: 6B1b or 6B1d, 6B1e, and 6B1g

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



A66 0405

Orange Light Option

Priest Lane Link

Contains models: 6B1b or 6B1d, 6B1e, and 6B1f

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]

A

TEMPLE SOWERBY LINK

SPITALS UNDERPASS

PRIEST LANE UNDERPASS

KIRKBY THORE SCHOOL LINK

BRIDLEWAY LINK

BRIDLEWAY OVERBRIDGE & LINKS

BRITISH GYPSUM ACCESS

MAIN STREET JUNCTION

SLEASTONHOW LANE

TBC - LONG MARTON JUNCTION

BRIDLEWAY DIVERSION

BRIDLEWAY DIVERSION

B6542 WESTBOUND

B6542 EASTBOUND

B

Red option - Not yet modeled

A66 0405

Red Option

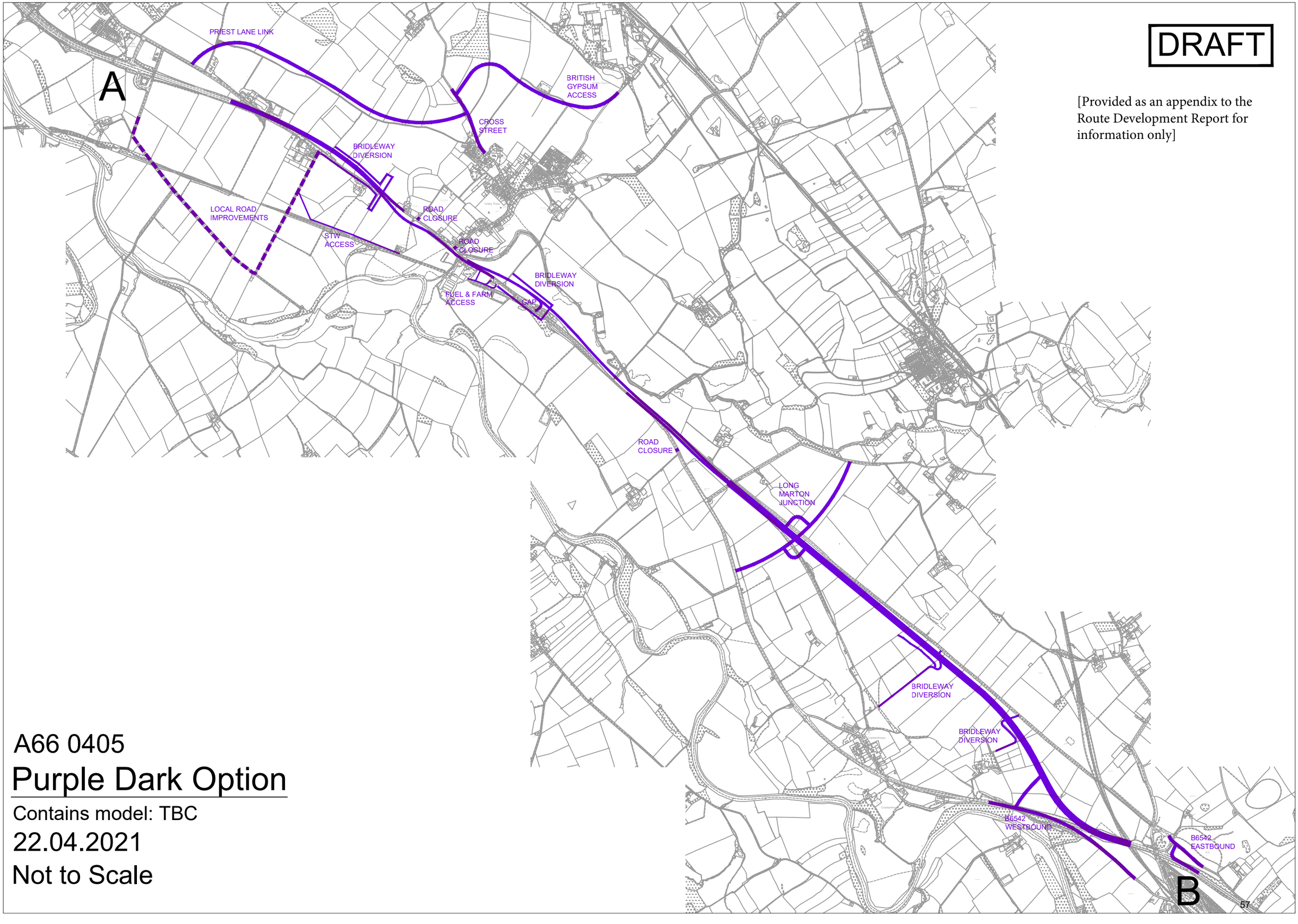
Contains model: TBC

12.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



A66 0405

Purple Dark Option

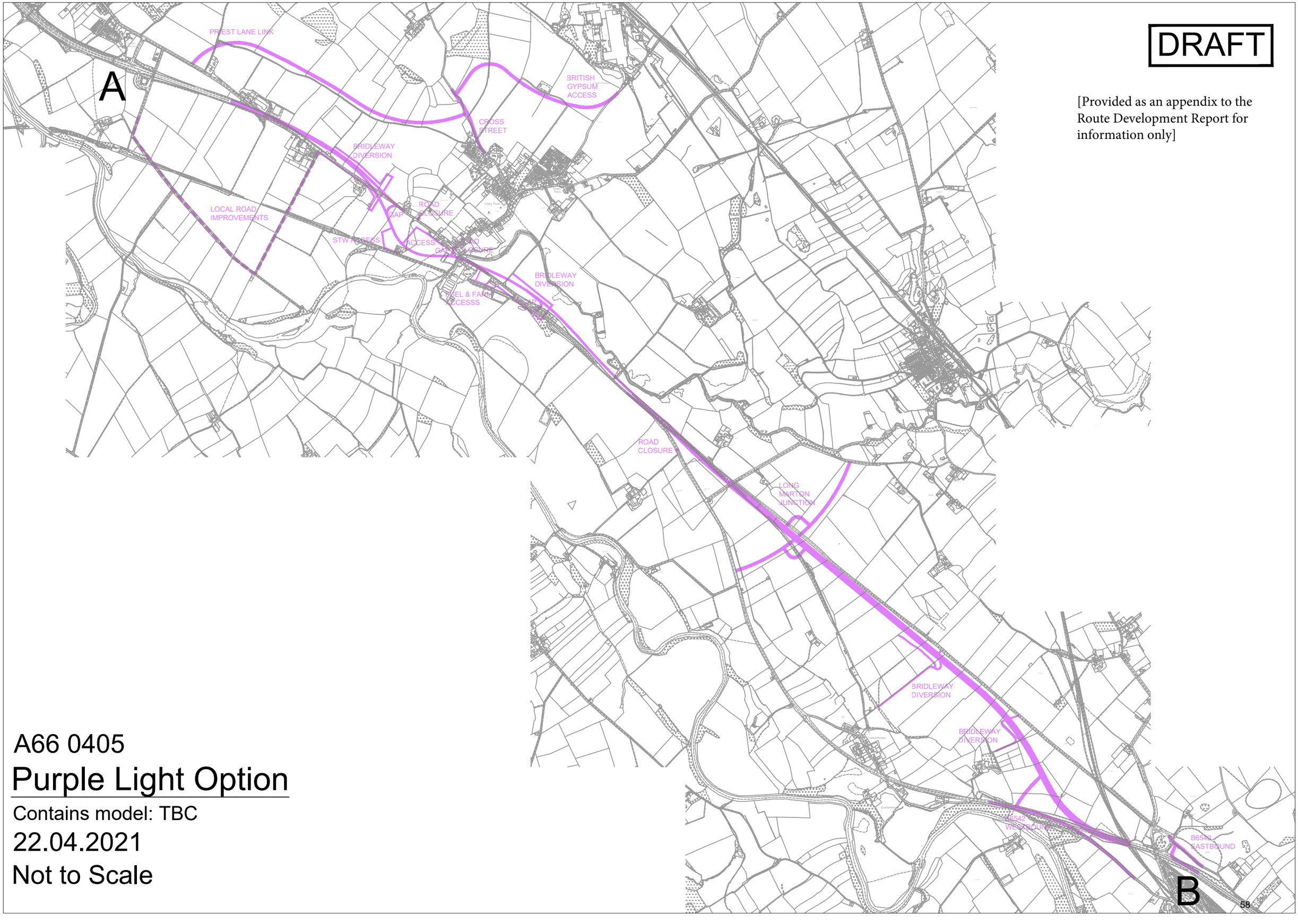
Contains model: TBC

22.04.2021

Not to Scale

DRAFT

[Provided as an appendix to the Route Development Report for information only]



A66 0405

Purple Light Option

Contains model: TBC

22.04.2021

Not to Scale

B.3 Initial sifting matrix summary

Overall	Black (Preferred Route)	Blue	Greeen Dark	Green Light	Red	Orange Dark	Orange Light	Purple	Standard Deviation	Average Score Northern Routes	Average Score Southern Routes
Total Score	-19	-11	-20	-22	-12	-20	-19	-32	6.46	-16.8	-23.7
Rank	3	1	5	7	2	5	3	8		3.6	5.3
Based on Confidence	-5	-2	-6	-7	0	0	-1	-13	4.47	-3.8	-4.9
Rank	5	4	6	7	1	2	3	8		4.6	4.3
Average Score	-0.50	-0.29	-0.53	-0.58	-0.32	-0.53	-0.50	-0.84	0.17	-0.4	-0.6
Rank	3	1	5	7	2	5	3	8		3.6	5.3
Avg Score based on confidence	-0.12	-0.04	-0.17	-0.18	0.00	-0.01	-0.03	-0.35	0.12	-0.1	-0.1
Rank	5	4	6	7	1	2	3	8		4.6	4.3
Quantum of scores											
-3	6	3	4	6	5	6	5	4		4.8	5.0
-2	9	9	11	7	7	6	7	11		8.6	8.0
-1	7	8	9	12	9	10	9	10		9.0	9.7
0	3	5	2	2	3	4	6	5		3.0	5.0
1	4	4	4	3	5	6	5	4		4.0	5.0
2	7	7	5	5	6	4	4	4		6.0	4.0
3	2	2	3	3	3	2	2	0		2.6	1.3

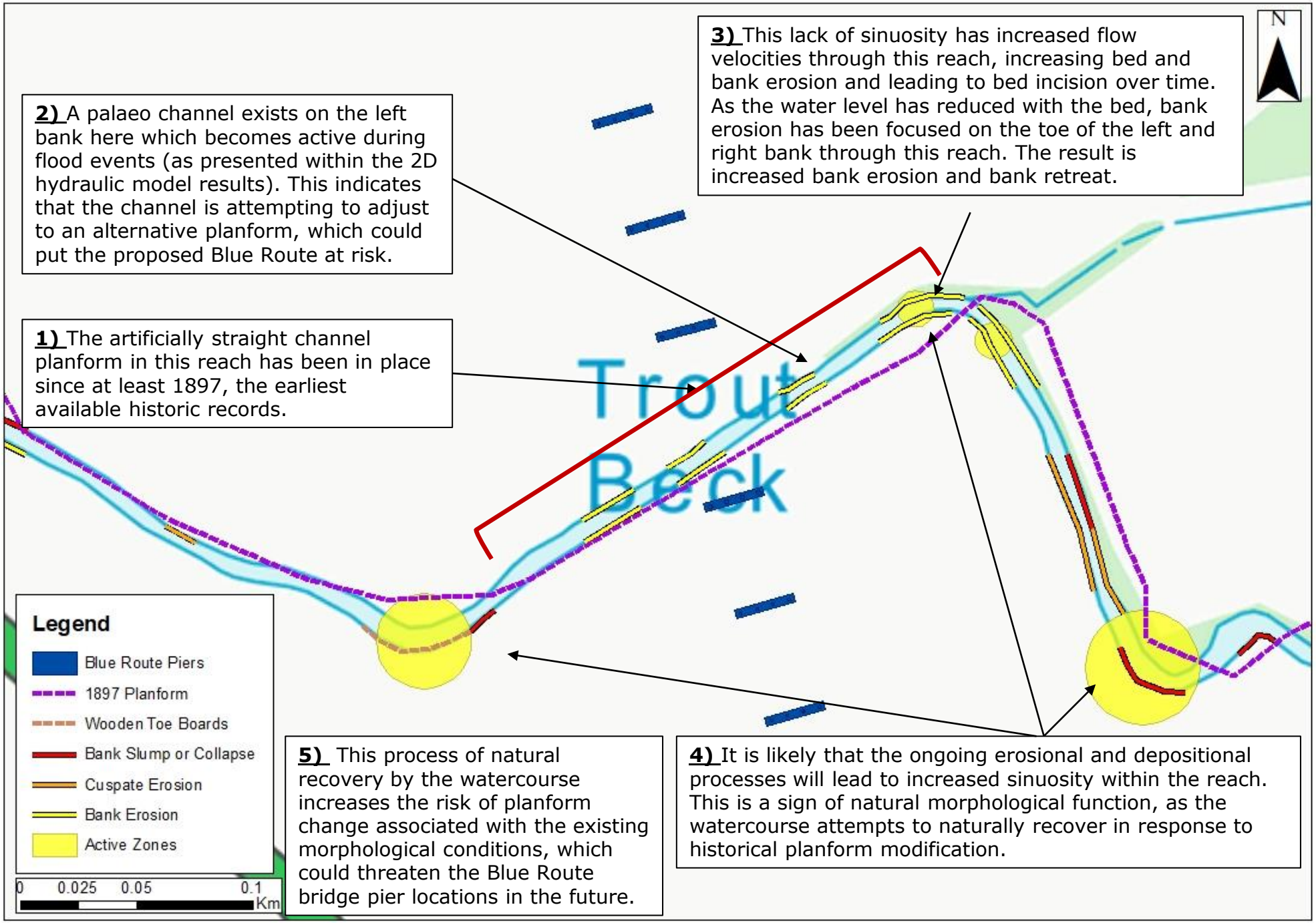
Northern Routes	Black (Preferred Route)	Blue	Greeen Dark	Green Light	Red	Standard Deviation
Total Score	-19	-11	-20	-22	-12	4.97
Rank	3	1	4	5	2	
Based on Confidence	-5	-2	-6	-7	0	2.88
Rank	3	2	4	5	1	
Average Score	-0.50	-0.29	-0.53	-0.58	-0.32	0.13
Rank	3	1	4	5	2	
Avg Score based on confidence	-0.12	-0.04	-0.17	-0.18	0.00	0.08
Rank	3	2	4	5	1	
-3	6	3	4	6	5	
-2	9	9	11	7	7	
-1	7	8	9	12	9	
0	3	5	2	2	3	
1	4	4	4	3	5	
2	7	7	5	5	6	
3	2	2	3	3	3	

Southern Routes	Orange Dark	Orange Light	Purple	Standard Deviation
Total Score	-20	-19	-32	7.23
Rank	2	1	3	
Based on Confidence	0	-1	-13	7.24
Rank	1	2	3	
Average Score	-0.87	-0.83	-1.39	0.31
Rank	2	1	3	
Avg Score based on confidence	-0.02	-0.04	-0.57	0.31
Rank	1	2	3	
Quantum of scores				
-3	6	5	4	
-2	6	7	11	
-1	10	9	10	
0	4	6	5	
1	6	5	4	
2	4	4	4	
3	2	2	0	

C Temple Sowerby flood modelling and geomorphological analysis

Geomorphological Analysis of 1D and 2D Hydraulic Model Results for the A66 Scheme 4 Blue Route and Orange Alternative Route

Analysis of Blue Route Results



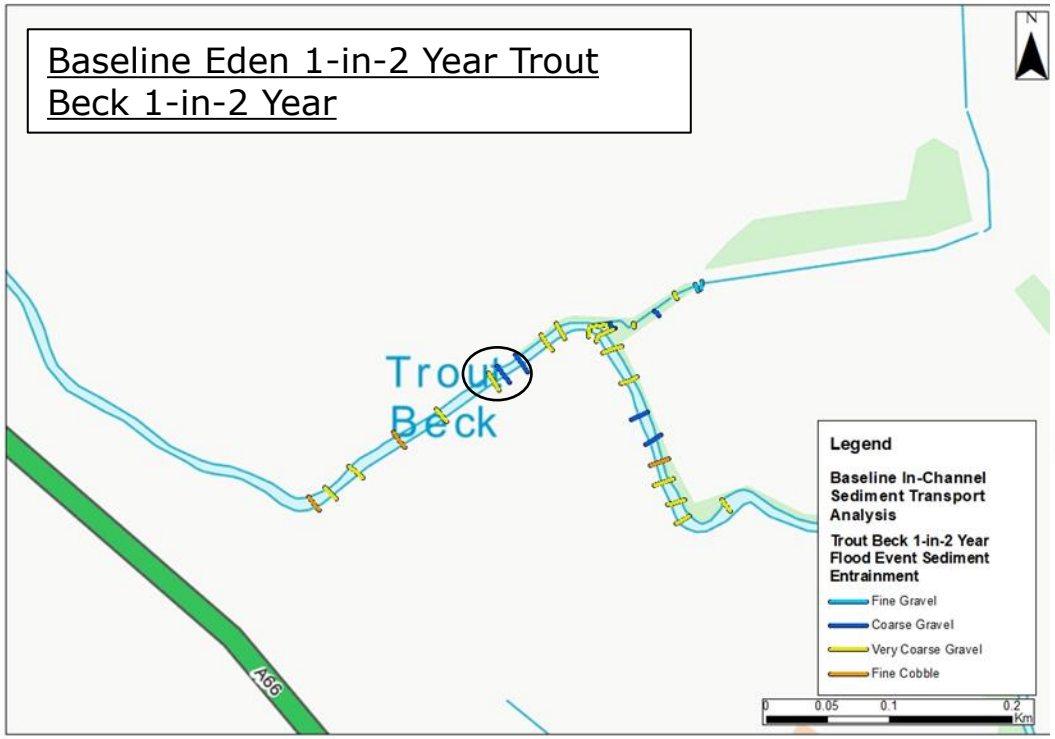
JBA consulting

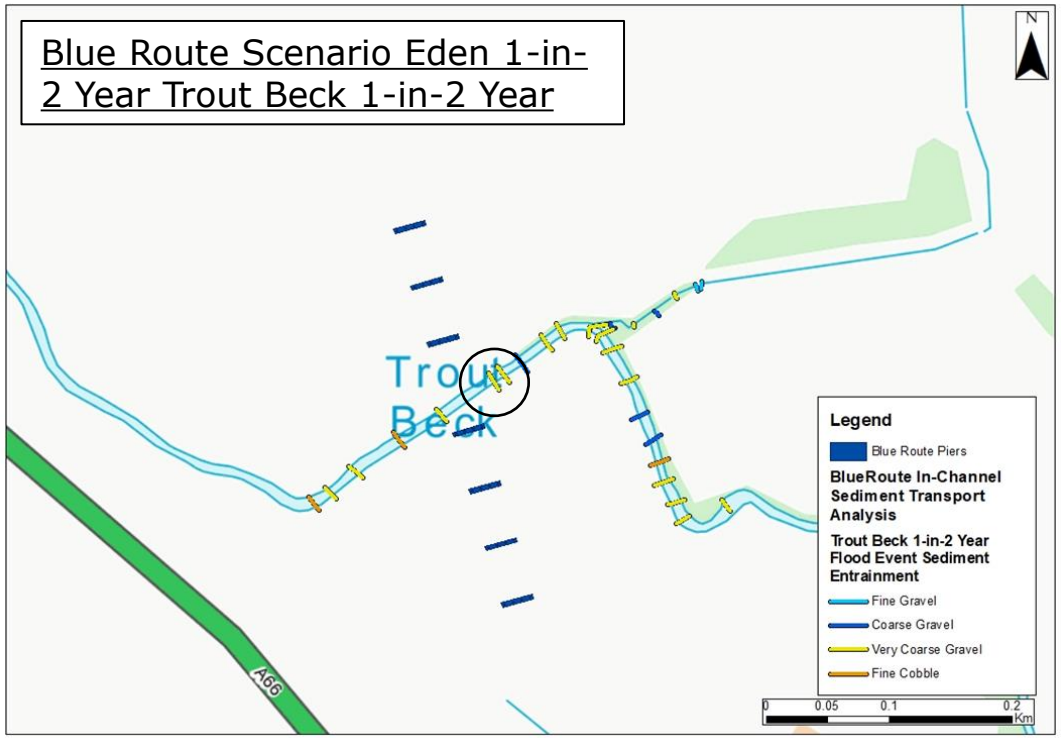
Potential risk posed to the Blue Route due to observed natural channel migration

The impact that the existing geomorphological conditions of the Trout Beck will have on the proposed Blue Route are presented within this figure.

Revision Ref/Date	Amendments
Draft 19/08/2021	
Interim 15/09/2021	

Drawn: Adam Church
Checked: Matt Hemsworth
Approved: Matt Hemsworth
Project Reference: 2021s0769





Key Changes in Blue Route Scenario Compared to the Baseline

- Increase in the maximum size of sediment that can be entrained (from coarse gravel to very coarse gravel) upstream of the proposed route.

Implications for Riverbed Substrate Composition

- Site observations revealed that the typical bed substrate within the vicinity of the Blue Route piers ranges from gravels to cobbles. The hydraulic model results for this reach indicate that the maximum sediment size that can be entrained ranges between coarse gravels to fine cobbles. Apart from immediately upstream of the proposed route, there is unlikely to be a change to the bed substrate composition within the vicinity of the Blue Route.

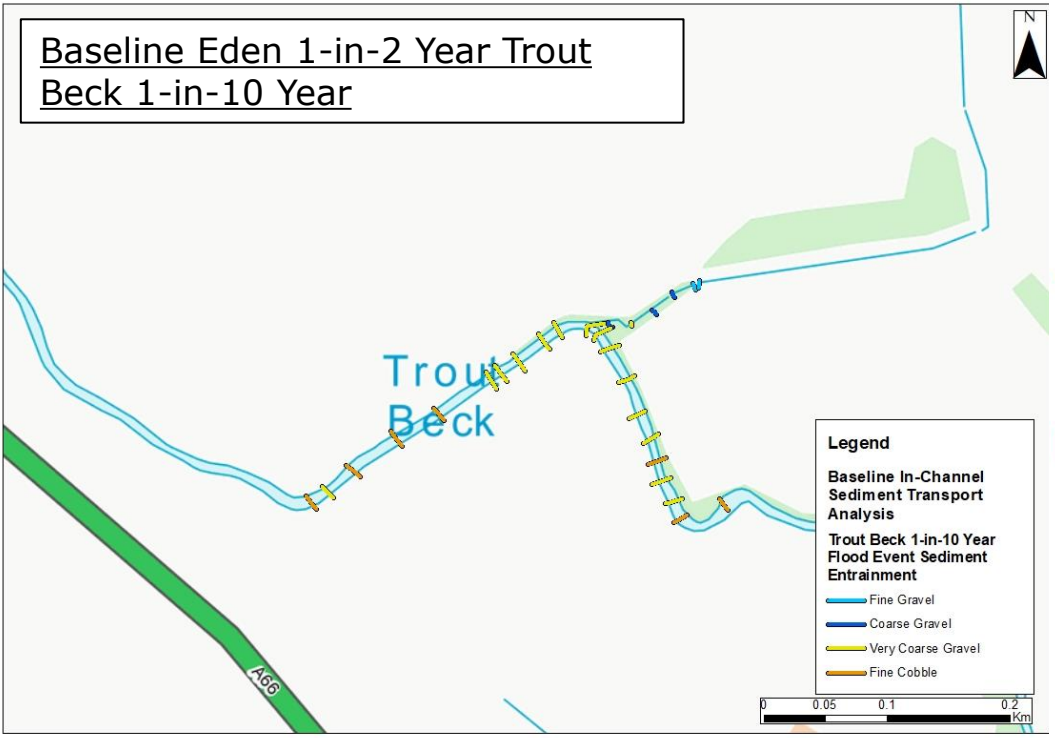
JBA consulting

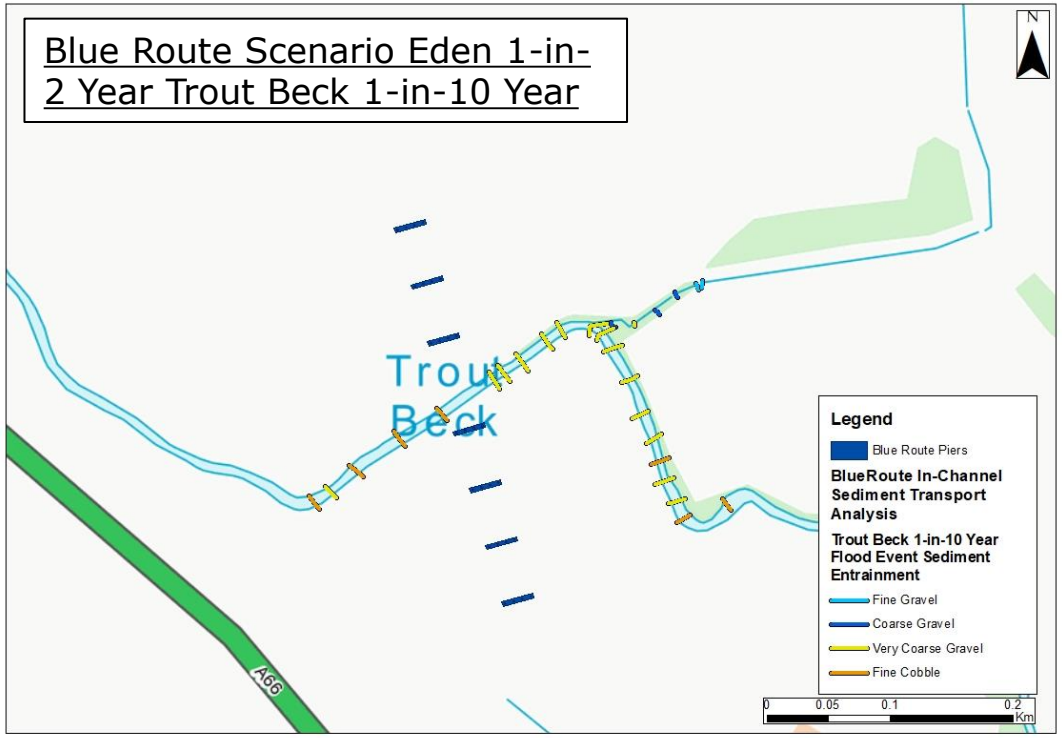
Blue Route: Comparison of hydraulically modelled sediment entrainment size for the Eden 1-in-2 Year and Trout Beck 1-in-2 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the riverbed substrate, for existing baseline conditions and predicted future change.

Revision Ref/Date	Amendments
Draft 19/08/2021	
Interim 15/09/2021	

Drawn: Adam Church
Checked: Matt Hemsworth
Approved: Matt Hemsworth
Project Reference: 2021s0769





Key Changes in Blue Route Scenario Compared to the Baseline

- Negligible.

Implications for Riverbed Substrate Composition

- Site observations revealed that the typical bed substrate within the vicinity of the Blue Route piers ranges from gravels to cobbles. The hydraulic model results for this reach indicate that the maximum sediment size that can be entrained ranges between coarse gravels to fine cobbles. There is negligible change to the maximum sediment size that can be entrained in the Blue Route Scenario compared to the Baseline Scenario. The channel energy increases upstream of the Blue Route, however the change in energy is not significant enough to cause changes to the size of sediment moved on the riverbed. Therefore, there is unlikely to be any change to the bed substrate composition within the vicinity of the Blue Route.

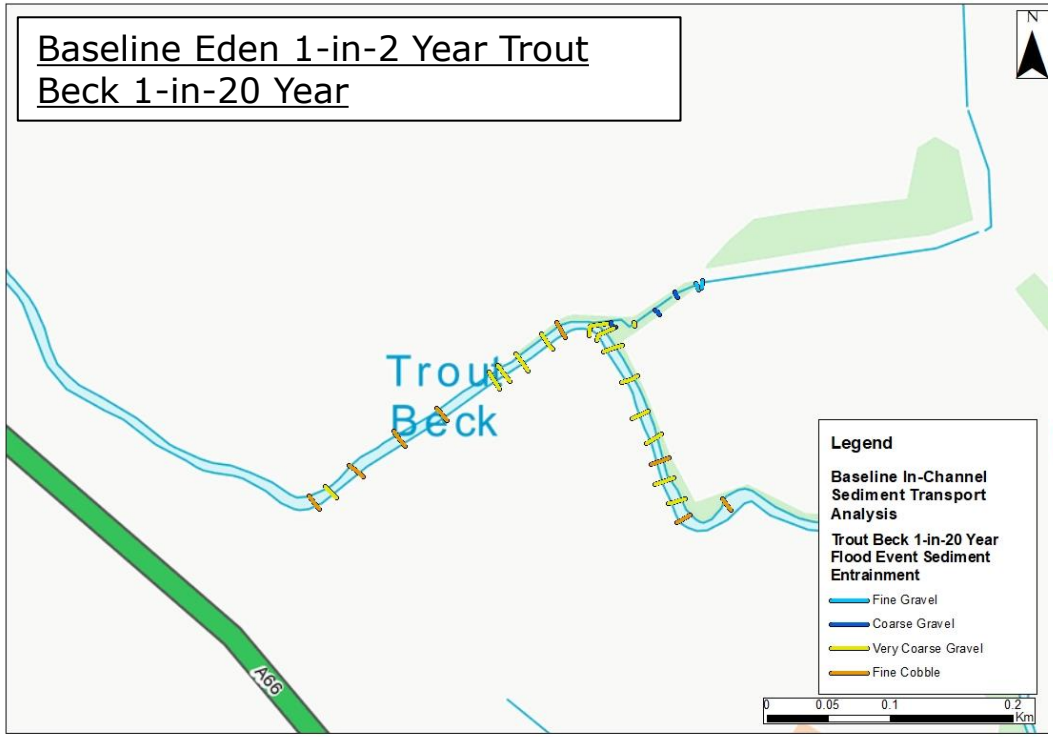
JBA consulting

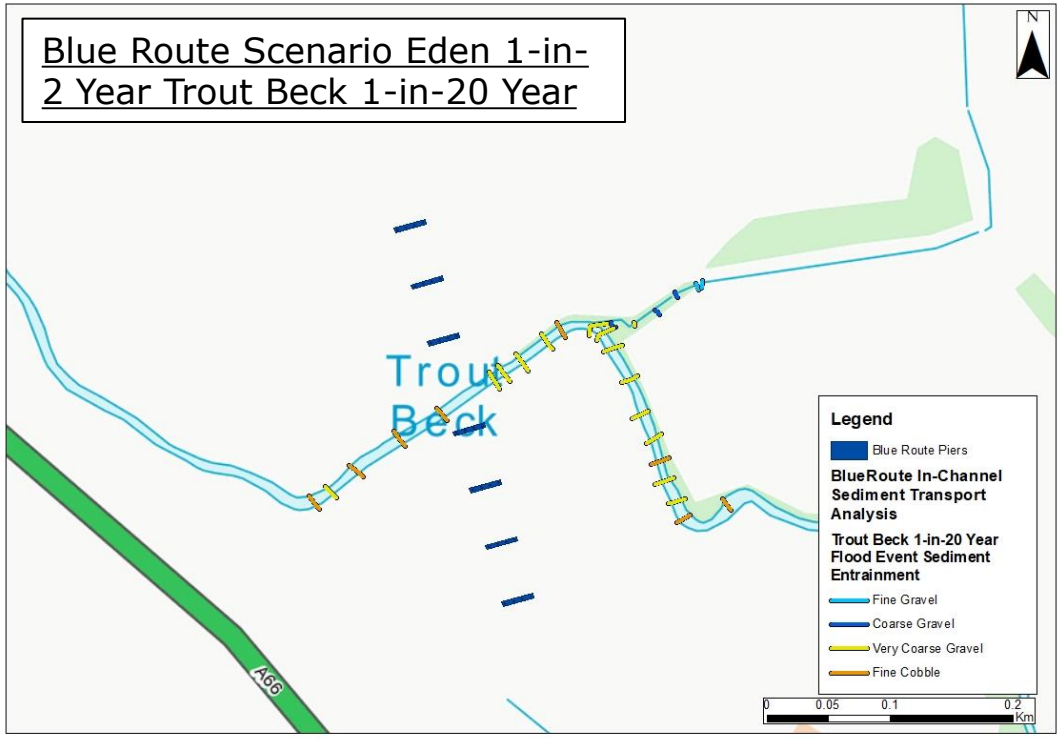
Blue Route: In Channel Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-10 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the riverbed substrate, for existing baseline conditions and predicted future change.

Revision Ref/Date	Amendments
Draft 19/08/2021	
Interim 15/09/2021	

Drawn: Adam Church
Checked: Matt Hemsworth
Approved: Matt Hemsworth
Project Reference: 2021s0769





Key Changes in Blue Route Scenario Compared to the Baseline

- Negligible.

Implications for Riverbed Substrate Composition

- Site observations revealed that the typical bed substrate within the vicinity of the Blue Route piers ranges from gravels to cobbles. The hydraulic model results for this reach indicate that the maximum sediment size that can be entrained ranges between coarse gravels to fine cobbles. As there is negligible change to the maximum sediment size that can be entrained in the Blue Route Scenario compared to the Baseline Scenario. The channel energy increases upstream of the Blue Route, however the change in energy is not significant enough to cause changes to the size of sediment moved on the riverbed. Therefore, there is unlikely to be any change to the bed substrate composition within the vicinity of the Blue Route.

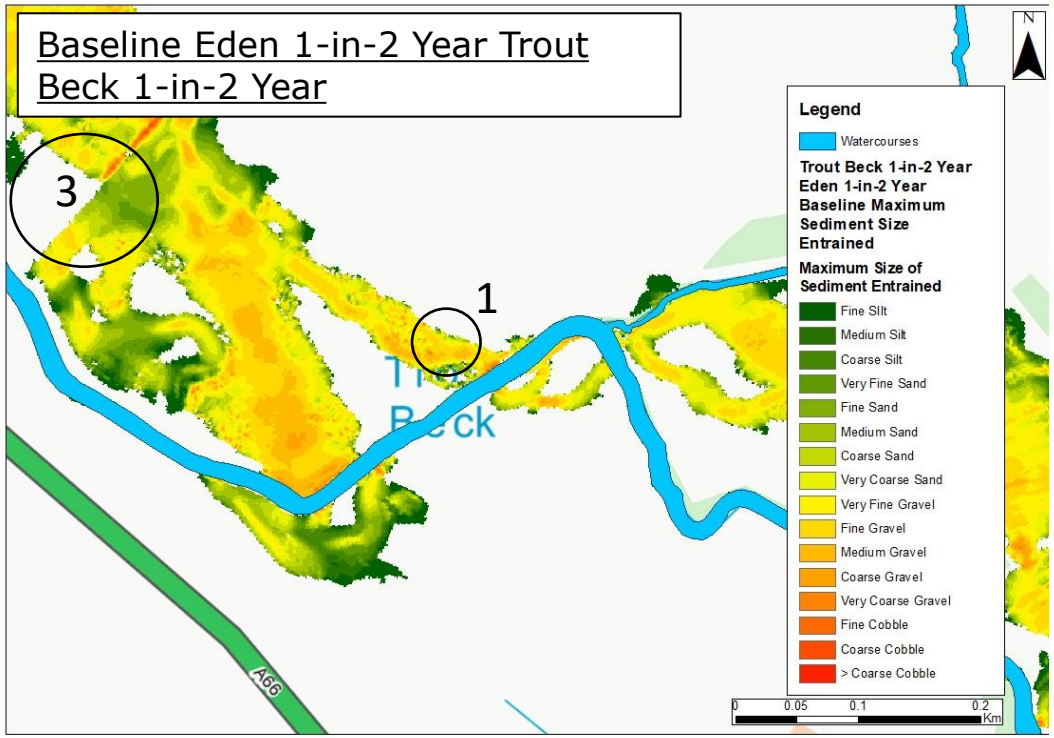
JBA consulting

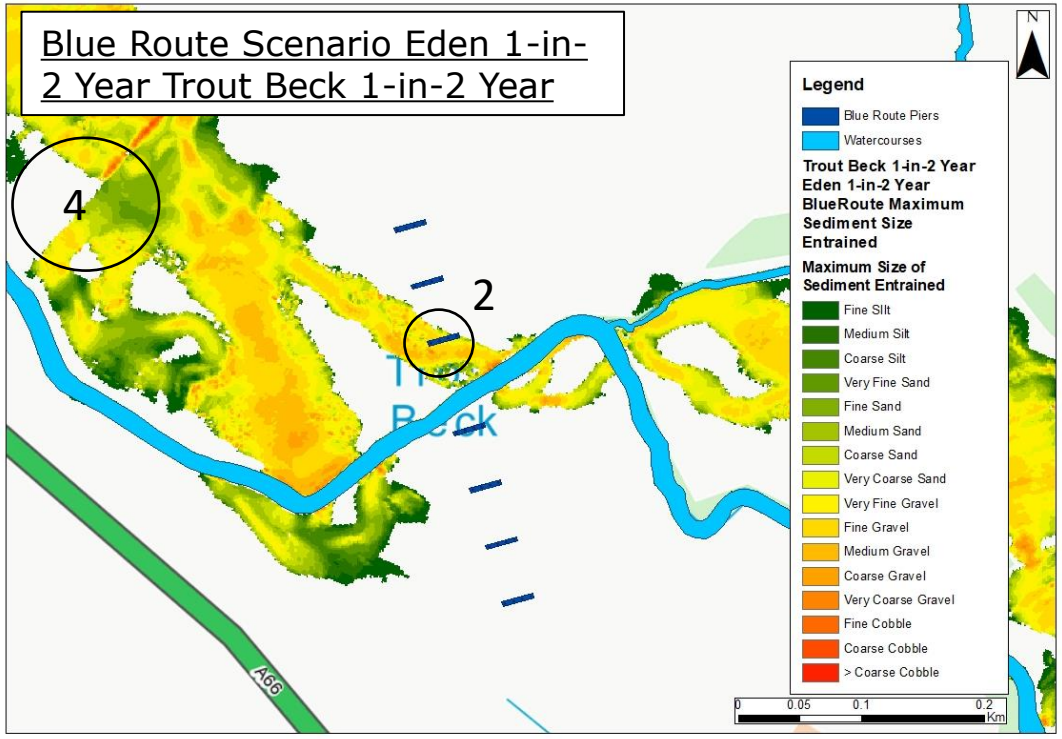
Blue Route: In Channel Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-20 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the riverbed substrate, for existing baseline conditions and predicted future change.

Revision Ref/Date	Amendments
Preliminary 19/08/2021	
Interim 15/09/2021	

Drawn: Adam Church
Checked: Matt Hemsworth
Approved: Matt Hemsworth
Project Reference: 2021s0769





Key Changes in Blue Route Scenario Compared to the Baseline

- Minor increases in shear stress in the vicinity of the Blue Route piers (identified in circle 1 and 2) have been identified in the Blue Route Scenario compared to the Baseline Scenario, which results in a small increase in the size of material that can be mobilised.
- The out of bank flow route that passes through the Blue Route piers on the right bank of the Trout Beck remains unaffected in the Blue Route Scenario compared to the Baseline Scenario.
- The out of bank flow route on the right bank of the Trout Beck is disrupted by a farm access track (identified in circle 3 and 4). This remains in place in both the baseline and Blue Route Scenario.

Predicted Geomorphological Change

- These changes in the size of sediment that can be entrained are not significant enough to cause changes to the floodplain such as scour.

JBA consulting

Blue Route: Floodplain Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-2 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the material on the floodplain, for existing baseline conditions and predicted future change.

Revision Ref/Date	Amendments
Draft 19/08/2021	
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Drawn: Adam Church
Checked: Matt Hemsworth
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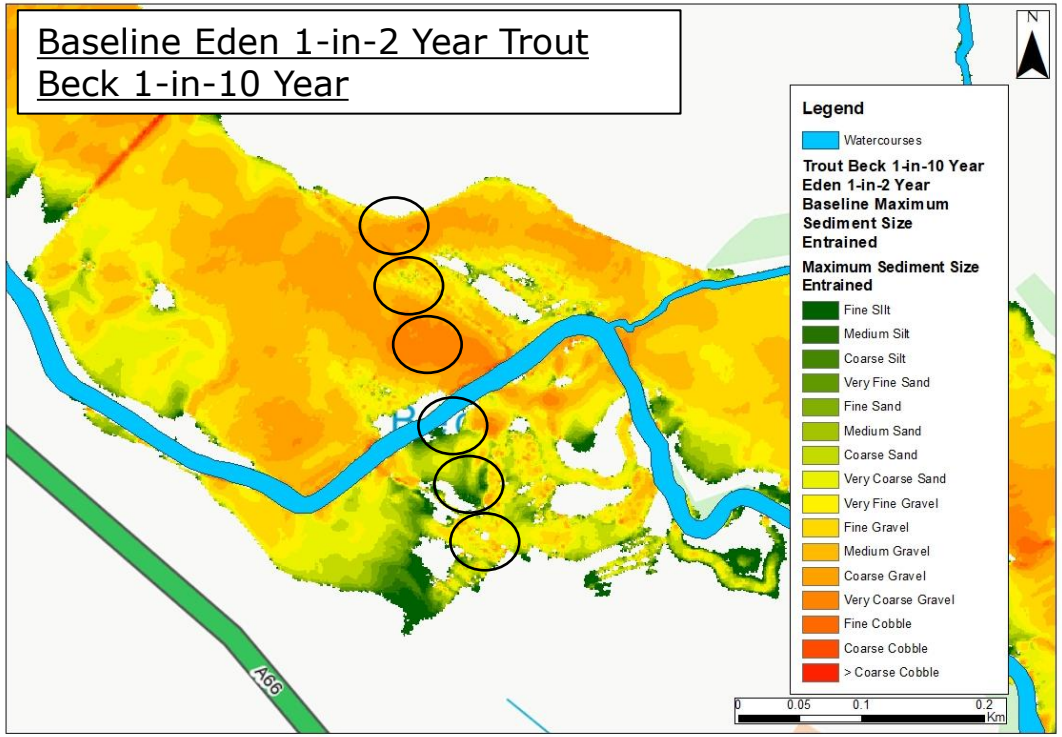

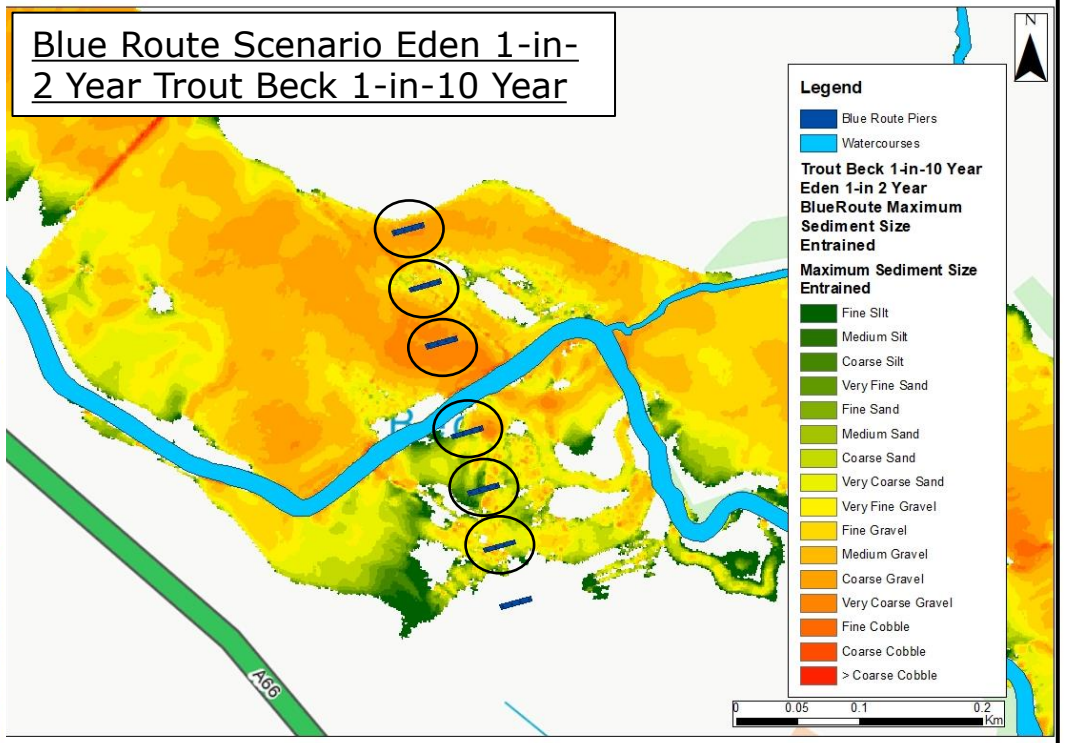

Key Changes in Blue Route Scenario Compared to the Baseline

- Minor increases in shear stress in the vicinity of the Blue Route piers (identified in the black circles) have been identified in the Blue Route Scenario compared to the Baseline Scenario, which results in a small increase in the size of material that can be mobilised.

Predicted Geomorphological Change

- These changes in the size of sediment that can be entrained are not significant enough to cause changes to the floodplain such as scour.

JBA consulting

Blue Route: Floodplain Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-10 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the material on the floodplain, for existing baseline conditions and predicted future change.

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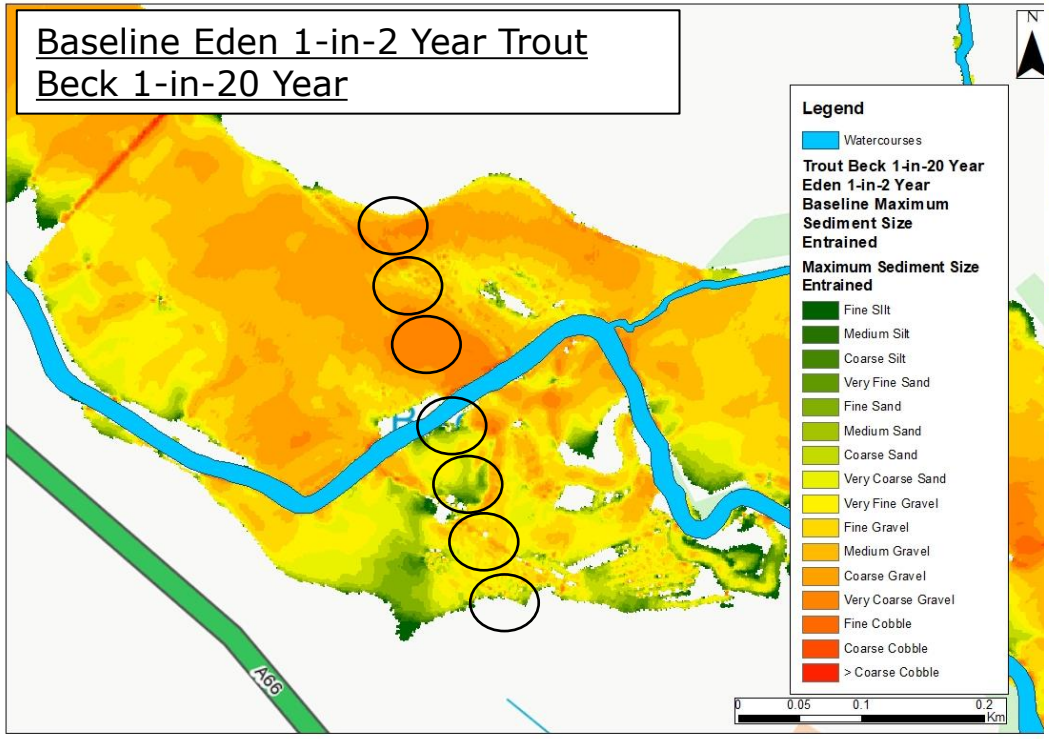

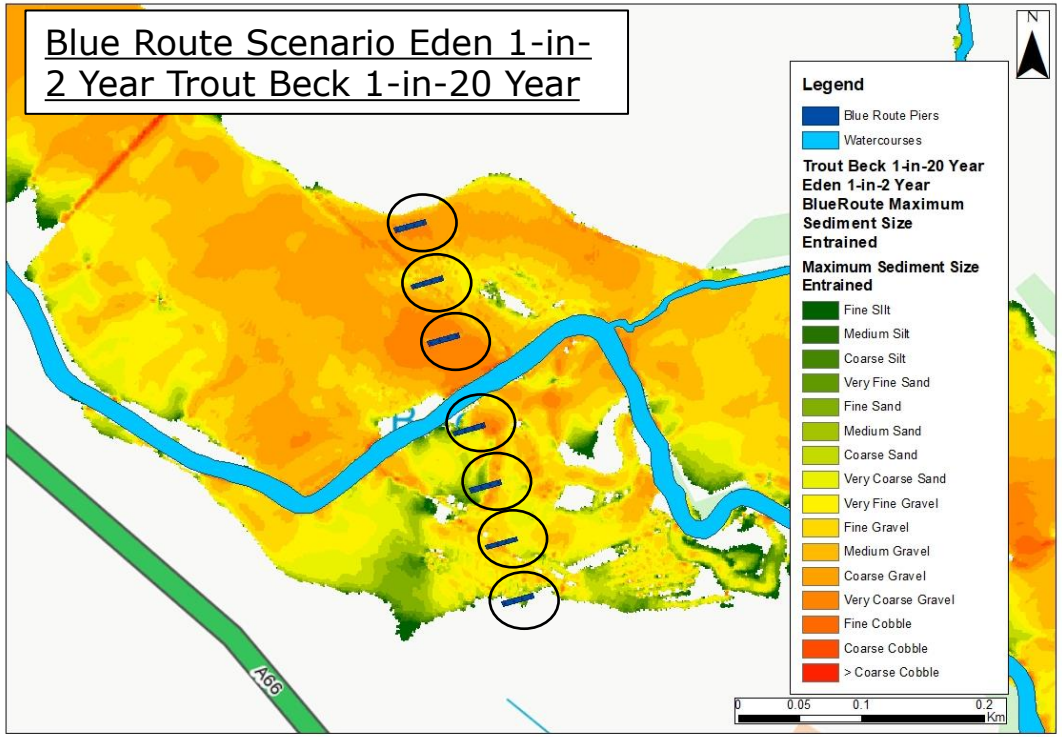

Key Changes in Blue Route Scenario Compared to the Baseline

- Minor increases in shear stress in the vicinity of the Blue Route piers (identified in the black circles) have been identified in the Blue Route Scenario compared to the Baseline Scenario, which results in a small increase in the size of material that can be mobilised.

Predicted Geomorphological Change

- These changes in the size of sediment that can be entrained are not significant enough to cause changes to the floodplain such as scour.

Blue Route: Floodplain Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-20 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the material on the floodplain, for existing baseline conditions and predicted future change.

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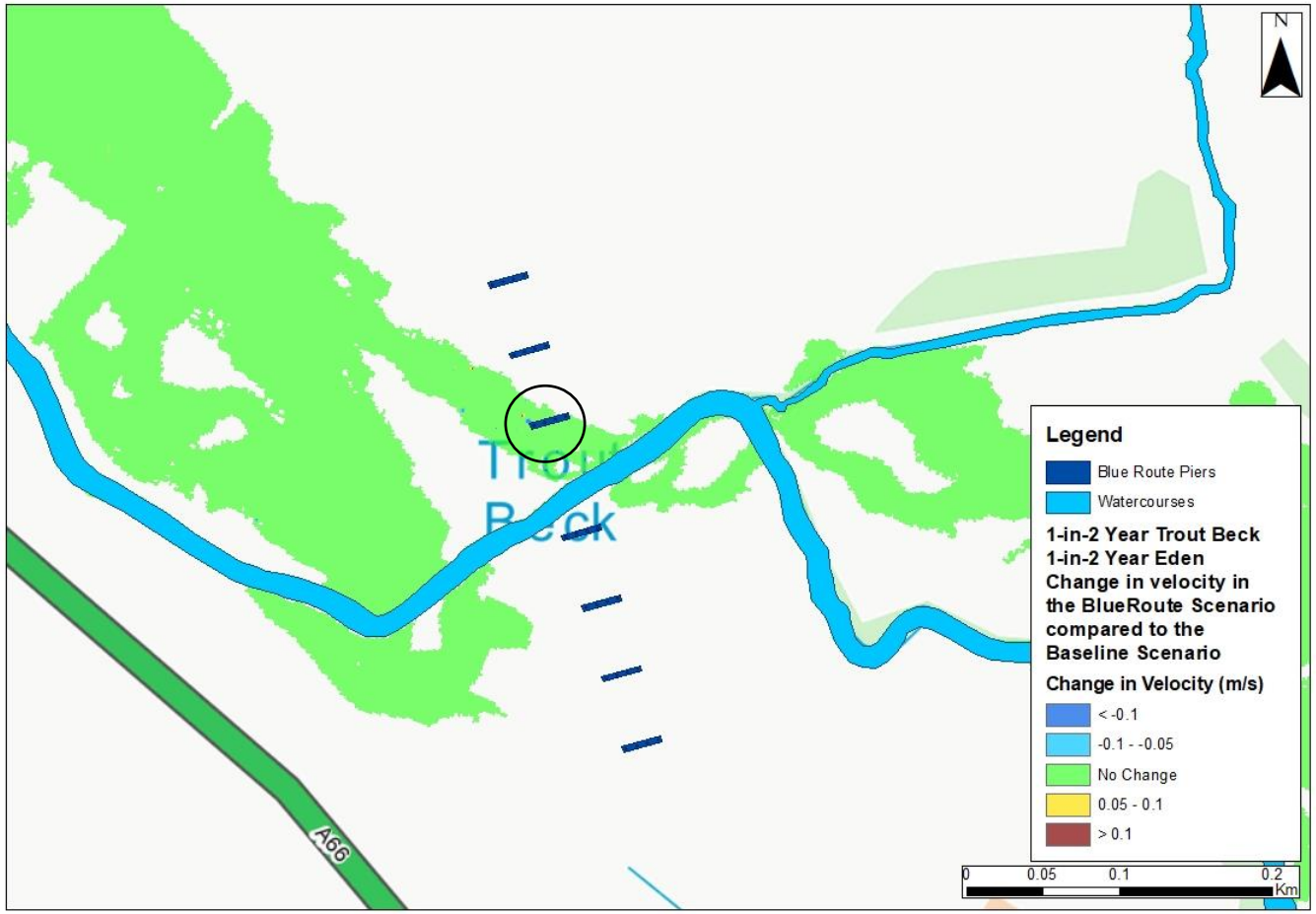

Key Changes in Blue Route Scenario Compared to the Baseline

- Localised minor changes in the flow velocities on the floodplain in the vicinity of the Blue Route pier closest to the right bank of the Trout Beck (indicated by the black circle). The flow is deflected off of the pier, which increases velocity as the flow passes around the pier.
- There are no other changes in flow velocities on the floodplain in this reach of the Trout Beck.

Predicted Geomorphological Change

- The changes to the flow velocities are not significant enough to cause scour in the vicinity of the pier. As such there is unlikely to be changes to the floodplain.
- In the areas of the floodplain that see no changes to flow velocities sediment transport dynamics are expected to remain the same.

JBA consulting

Blue Route: Difference in floodplain velocities for the Eden 1-in-2 Year Trout Beck 1-in-2 Year Flood Event

A comparison of hydraulically modelled velocities to assess the potential impact erosion and scour on the floodplain, for existing baseline conditions and predicted future change.

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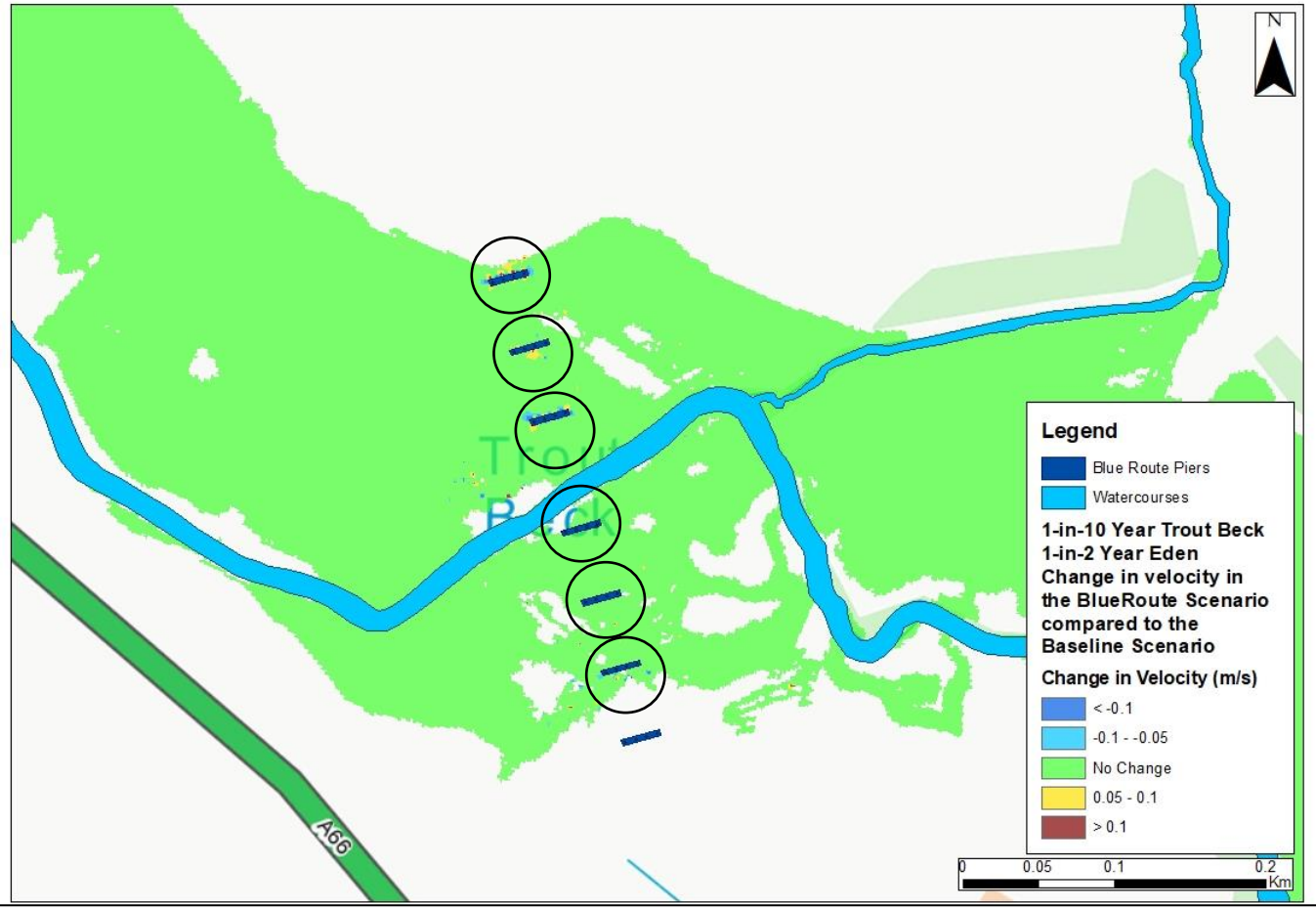

Key Changes in Blue Route Scenario Compared to the Baseline

- Localised minor changes in the flow velocities on the floodplain in the vicinity of most of the Blue Route piers (indicated by the black circles). The flow is deflected off each of the of the piers, which increases velocity as the flow passes around the pier.
- There are no other changes in flow velocities on the floodplain in this reach of the Trout Beck.

Predicted Geomorphological Change

- The changes to the flow velocities are not significant enough to cause scour in the vicinity of each of the piers. As such there is unlikely to be changes to the floodplain.
- In the areas of the floodplain that see no changes to flow elocities sediment transport dynamics are expected to remain the same.

JBA consulting

Blue Route: Difference in floodplain velocities for the Eden 1-in-2 Year Trout Beck 1-in-10 Year Flood Event

A comparison of hydraulically modelled velocities to assess the potential impact erosion and scour on the floodplain, for existing baseline conditions and predicted future change.

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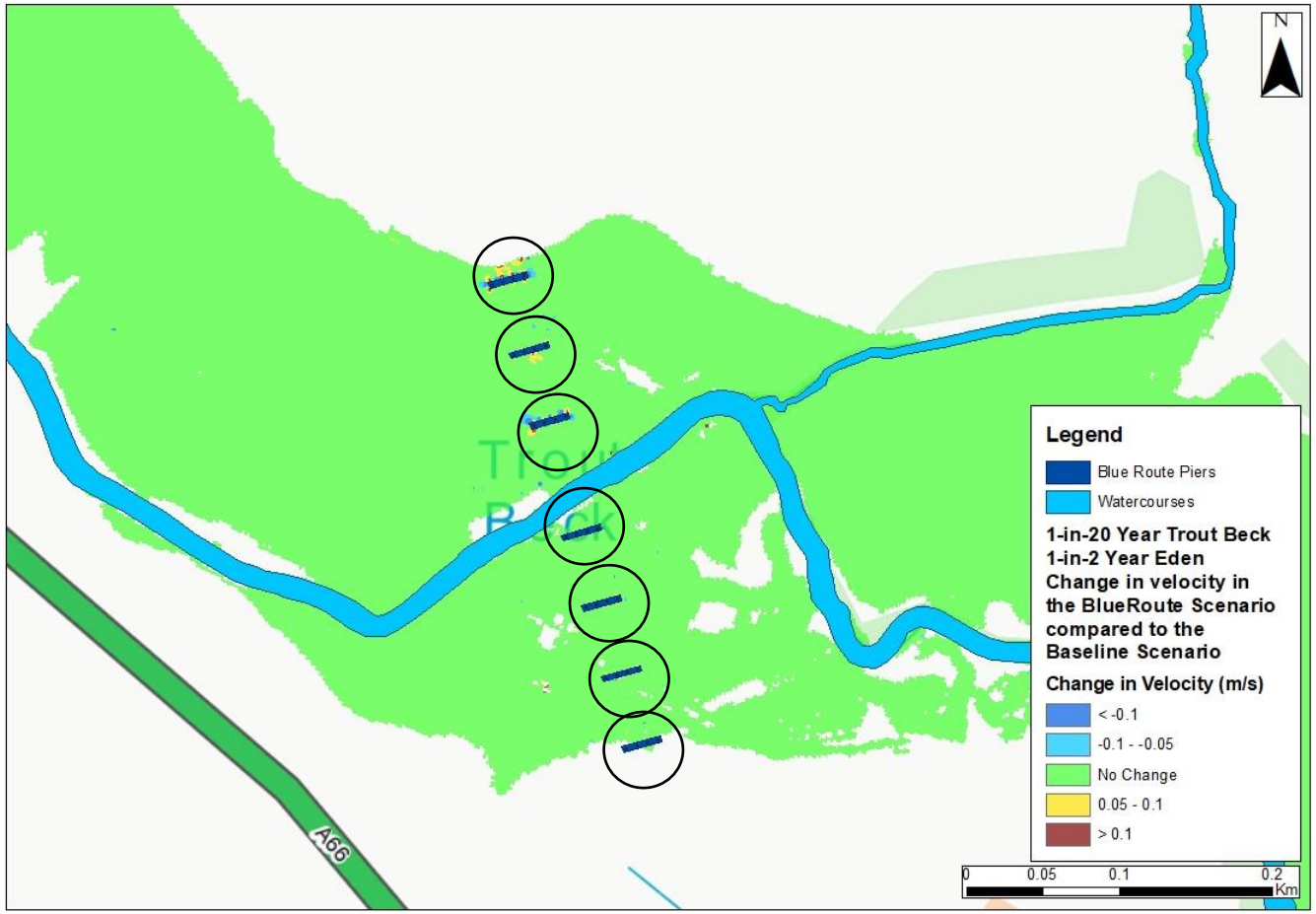

Key Changes in Blue Route Scenario Compared to the Baseline

- Localised minor changes in the flow velocities on the floodplain in the vicinity of all the Blue Route piers (indicated by the black circles). The flow is deflected off each of the of the piers, which increases velocity as the flow passes around the pier.
- There are no other changes in flow velocities on the floodplain in this reach of the Trout Beck.

Predicted Geomorphological Change

- The changes to the flow velocities are not significant enough to cause scour in the vicinity of each of the piers. As such there is unlikely to be changes to the floodplain.
- In the areas of the floodplain that see no changes to flow velocities sediment transport dynamics are expected to remain the same.

JBA consulting

Blue Route: Difference in floodplain velocities for the Eden 1-in-2 Year Trout Beck 1-in-20 Year Flood Event

A comparison of hydraulically modelled velocities to assess the potential impact erosion and scour on the floodplain, for existing baseline conditions and predicted future change.

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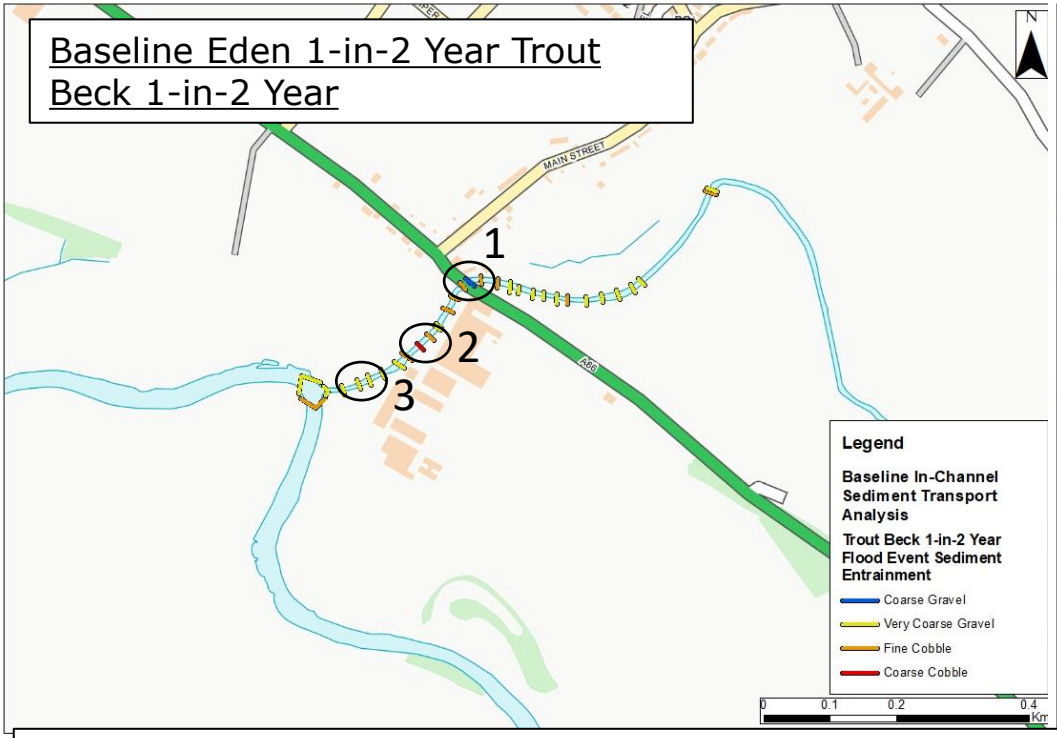
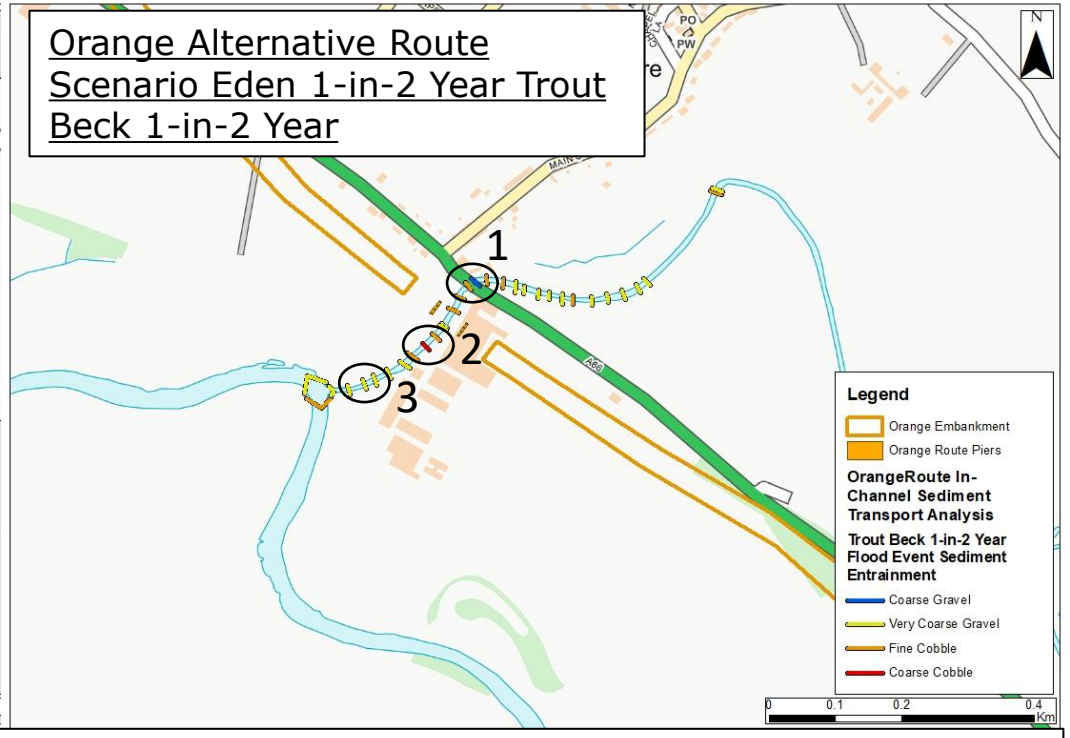
Analysis of Orange Alternative Route Results





Key Changes in Orange Alternative Route Scenario Compared to the Baseline

- Negligible.
- In-channel shear stress decreases upstream of the existing road bridge as the structure controls the flow and water level immediately upstream (black circle 1). This causes a decrease in the maximum size of sediment that can be mobilised (coarse gravel) compared to very coarse gravel and cobbles elsewhere.
- In-channel shear stress increases in the vicinity of black circle 2, as the channel gradient increases significantly in this area. This provides the watercourse with sufficient energy to mobilise coarse cobbles.
- In-channel energy reduces upstream of the confluence with the Eden (black circle 3), as the Eden water level impounds water levels in the Trout Beck and reduces velocities. This causes a drop in the maximum size of sediment that can be mobilised (very coarse gravel) compared to cobbles upstream of this impoundment.

Implications for Riverbed Substrate Composition

- Site observations revealed that the typical bed substrate within the vicinity of the Orange Alternative Route ranges from gravels to cobbles. The hydraulic model results indicate that the maximum sediment size that can be entrained ranges between coarse gravels to fine cobbles. Whilst there are in-channel shear stress increases in the vicinity of the Orange Alternative Route, the change is not significant enough to impact the size of sediment entrained. Therefore, there is unlikely to be any change to the bed substrate composition.

JBA consulting

Orange Alternative Route: Comparison of hydraulically modelled sediment entrainment size for the Eden 1-in-2 Year and Trout Beck 1-in-2 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the riverbed substrate, for existing baseline conditions and predicted future change.

Revision Ref/Date	Amendments
Preliminary 19/08/2021	
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Drawn: Adam Church
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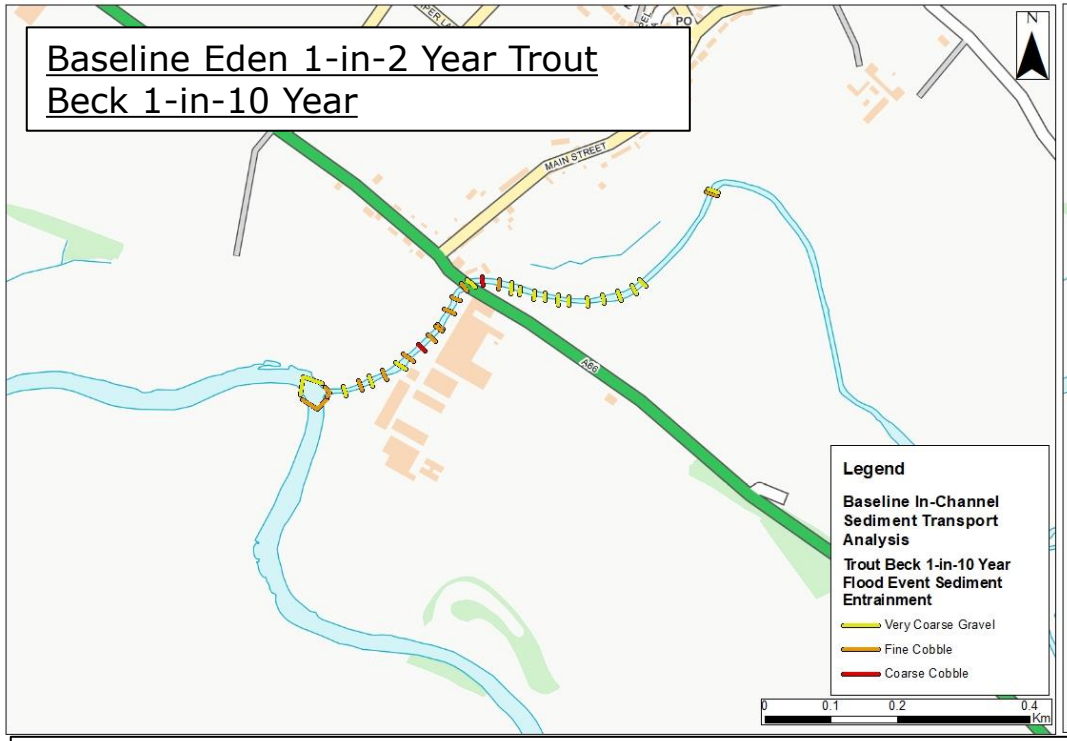

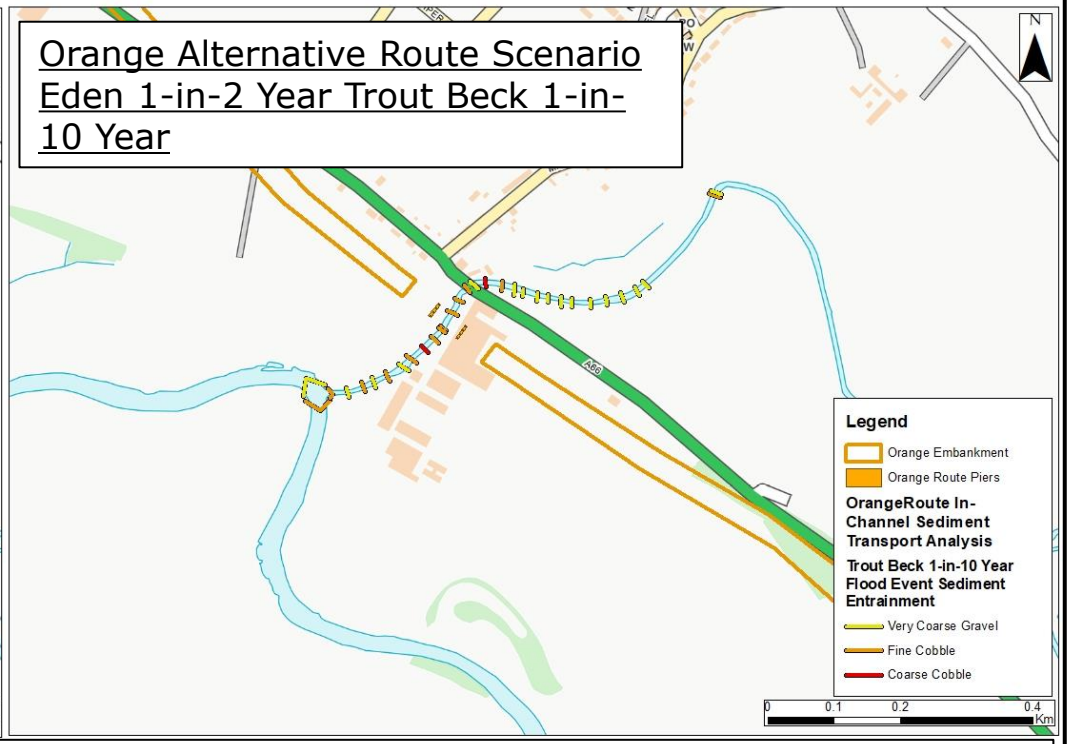

Key Changes in Orange Alternative Route Scenario Compared to the Baseline

- Negligible.

Implications for Riverbed Substrate Composition

- Site observations revealed that the typical bed substrate within the vicinity of the Orange Alternative Route ranges from gravels to cobbles. The hydraulic model results for this reach indicate that the maximum sediment size that can be entrained ranges between coarse gravels to fine cobbles. Whilst there are in-channel shear stress increases in the vicinity of the Orange Alternative Route, the change is not significant enough to impact the size of sediment moved on the riverbed. Therefore, there is unlikely to be any change to the bed substrate composition.

Orange Alternative Route: Comparison of hydraulically modelled sediment entrainment size for the Eden 1-in-2 Year and Trout Beck 1-in-10 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the riverbed substrate, for existing baseline conditions and predicted future change.

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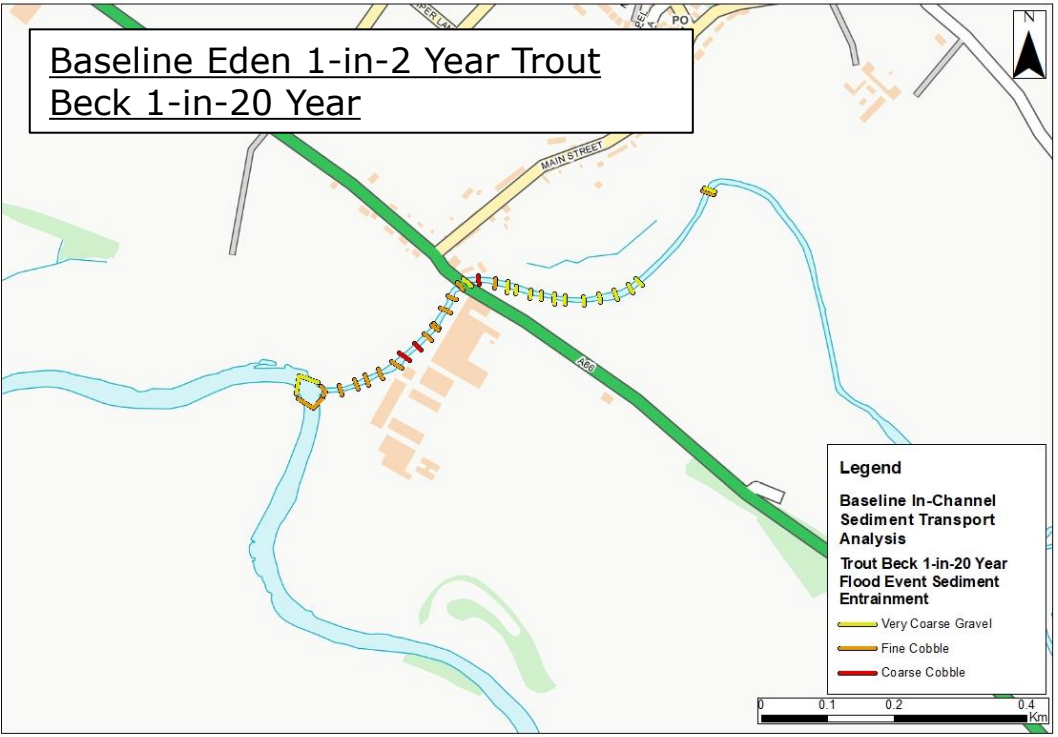

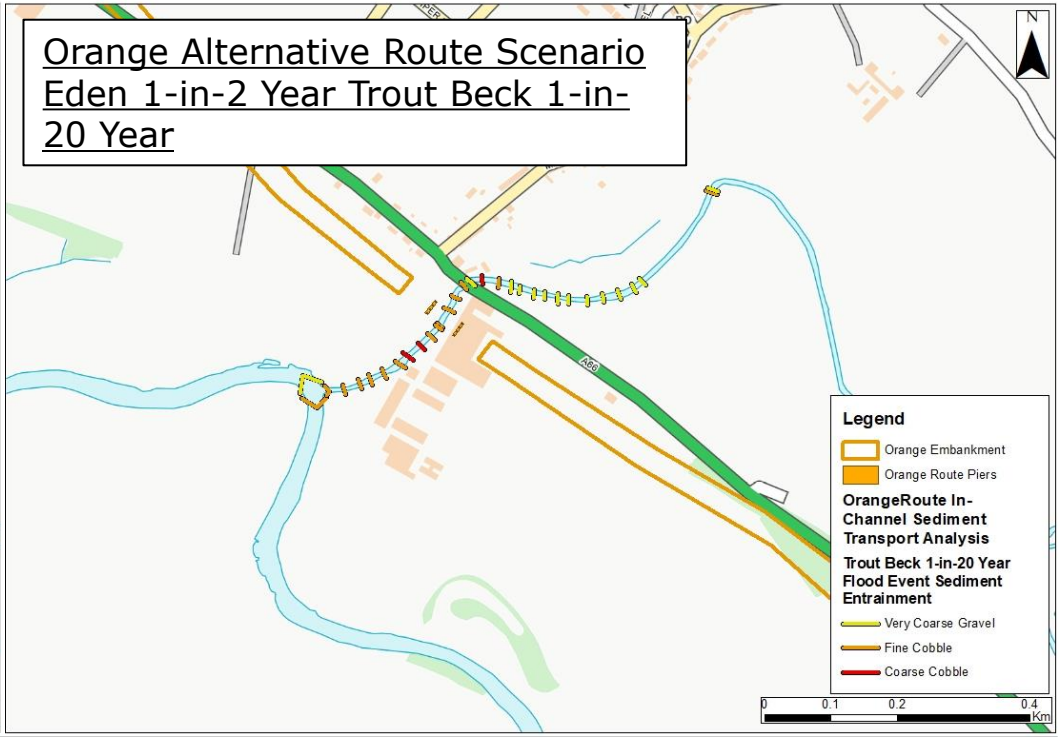

Key Changes in Orange Alternative Route Scenario Compared to the Baseline

- Negligible.

Implications for Riverbed Substrate Composition

- Site observations revealed that the typical bed substrate within the vicinity of the Orange Alternative Route ranges from gravels to cobbles. The hydraulic model results for this reach indicate that the maximum sediment size that can be entrained ranges between coarse gravels to fine cobbles. Whilst there are in-channel shear stress increases in the vicinity of the Orange Alternative Route, the change is not significant enough to impact the size of sediment moved on the riverbed. Therefore, there is unlikely to be any change to the bed substrate composition.

Orange Alternative Route: Comparison of hydraulically modelled sediment entrainment size for the Eden 1-in-2 Year and Trout Beck 1-in-20 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the riverbed substrate, for existing baseline conditions and predicted future change.

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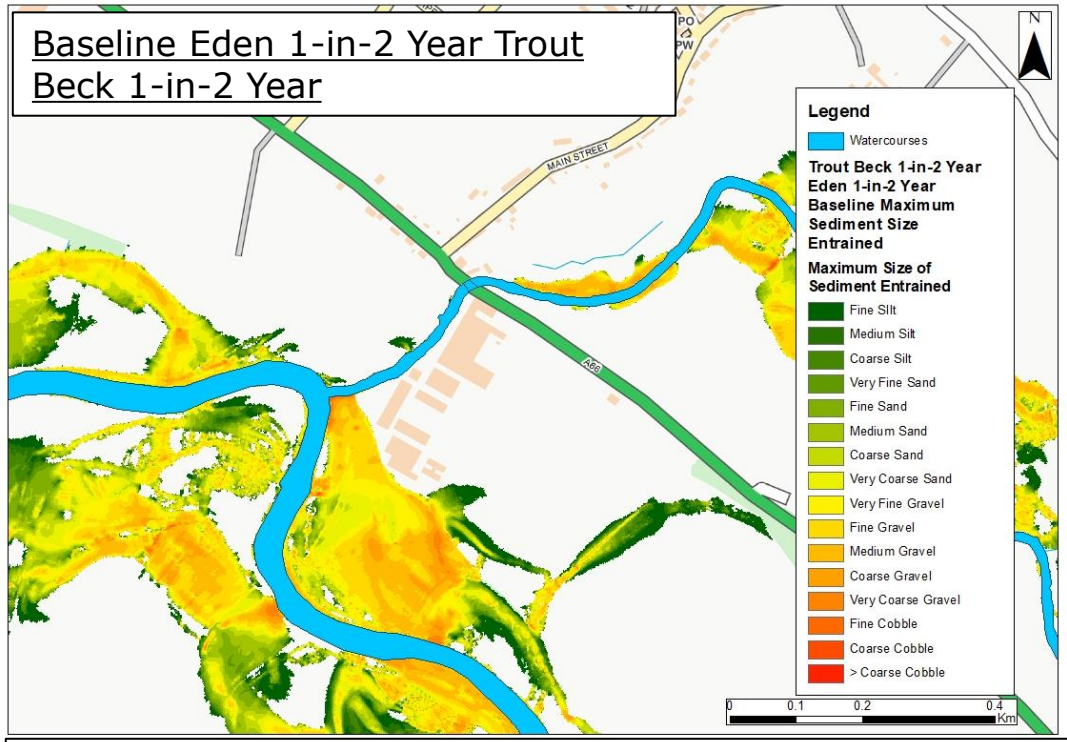
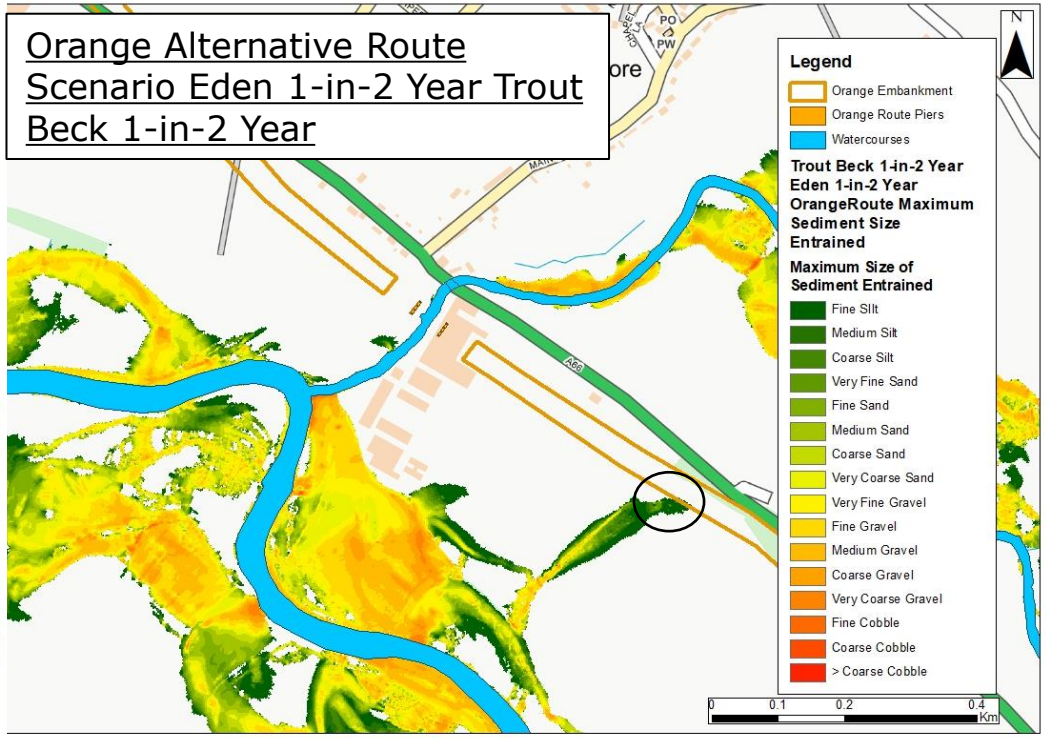
Baseline Eden 1-in-2 Year Trout Beck 1-in-2 Year



Orange Alternative Route Scenario Eden 1-in-2 Year Trout Beck 1-in-2 Year



Key Changes in Orange Alternative Route Scenario Compared to the Baseline

- There are minor changes associated with the Orange Alternative Route embankment reducing the extent of flooding on the left bank floodplain of the Trout Beck (indicated with the black circle)
- In all other areas, the Orange Alternative Route has no impact on the modelled shear stress and therefore no impact on the size of material that can be mobilised on the floodplain.

Predicted Geomorphological Change

- The Orange Alternative Route will have no impact on the composition of the floodplain in this flood event.

Orange Alternative Route: Floodplain Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-2 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the material on the floodplain, for existing baseline conditions and predicted future change.

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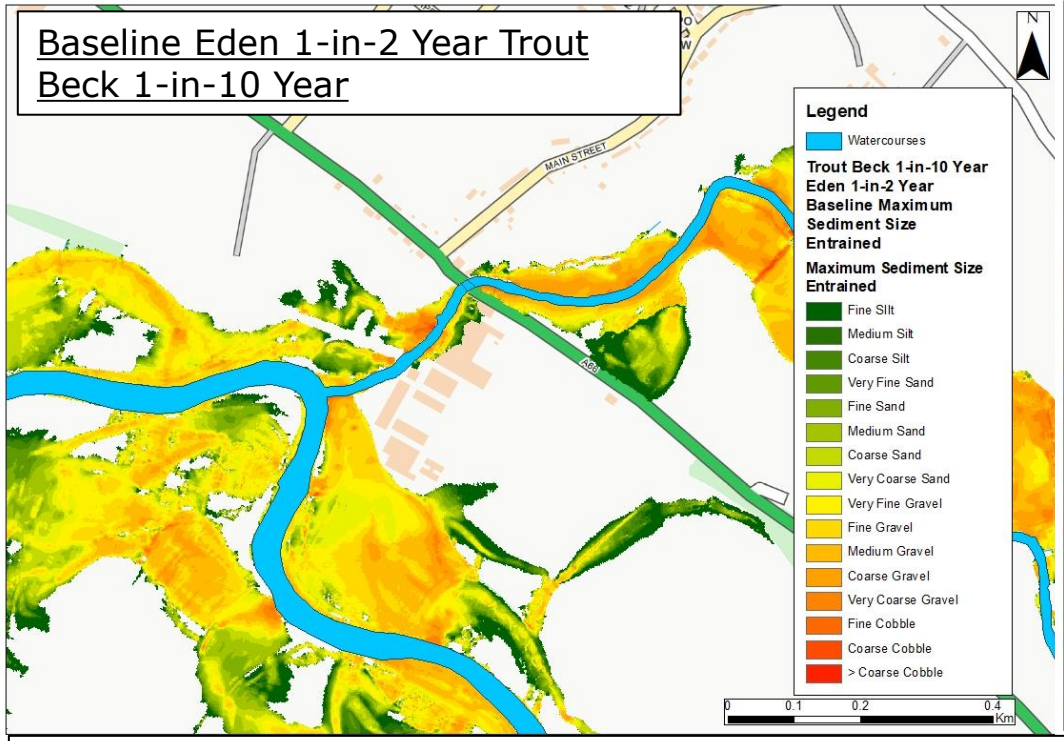

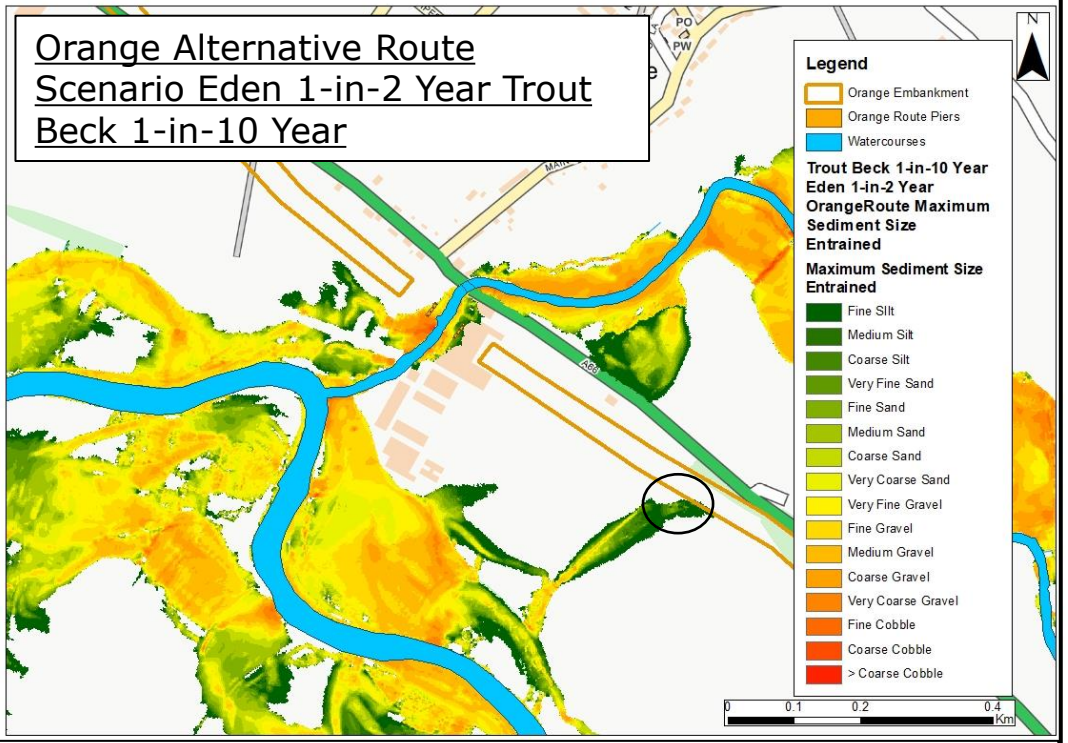

Key Changes in Orange Alternative Route Scenario Compared to the Baseline

- There are minor changes associated with the Orange Alternative Route embankment reducing the extent of flooding on the left bank floodplain of the Trout Beck (indicated with the black circle)
- In all other areas, the Orange Alternative Route has no impact on the modelled shear stress and therefore no impact on the size of material that can be mobilised on the floodplain.

Predicted Geomorphological Change

- The Orange Alternative Route will have no impact on the composition of the floodplain in this flood event.

JBA consulting

Orange Alternative Route: Floodplain Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-10 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the material on the floodplain, for existing baseline conditions and predicted future change.

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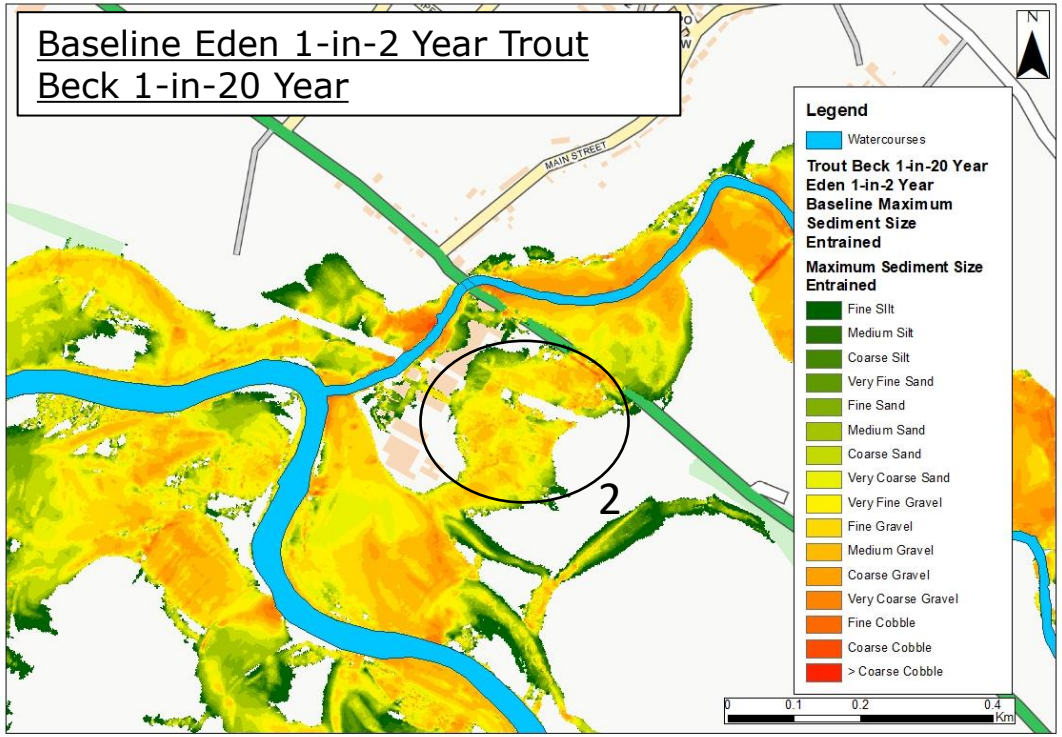

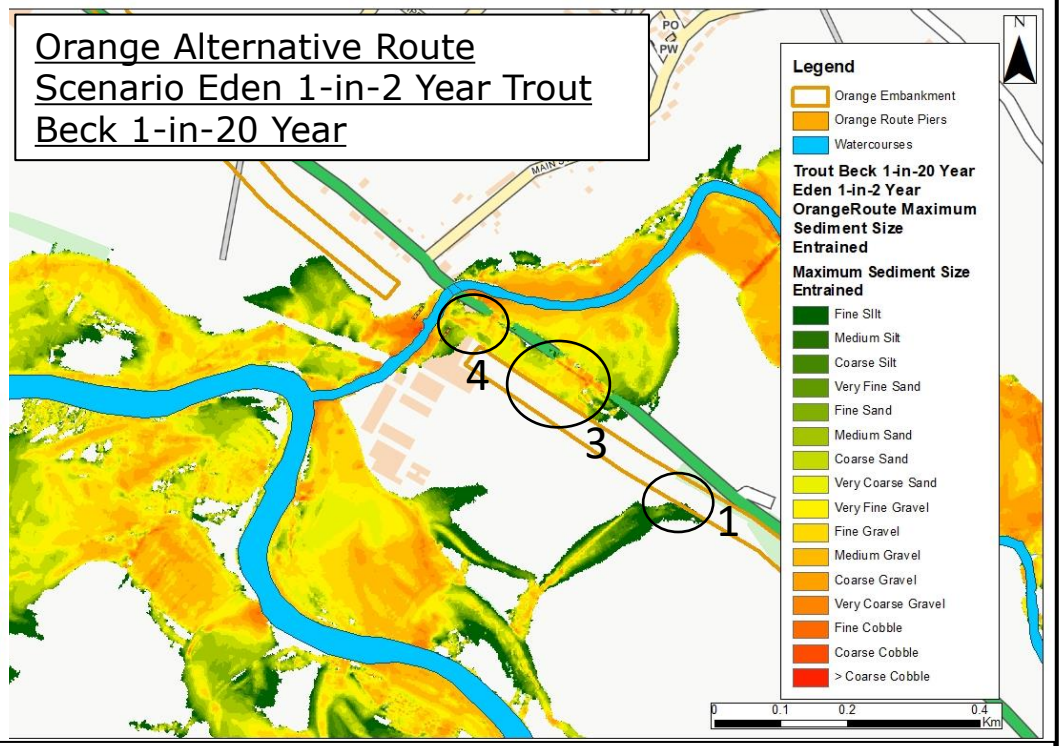

Key Changes in Orange Alternative Route Scenario Compared to the Baseline

- There are minor changes associated with the Orange Alternative Route embankment reducing the extent of flooding on the left bank floodplain of the Trout Beck (indicated black circle 1).
- The out of bank flow route on the left bank floodplain of the Trout Beck (indicated by black circle 2) is cut off by the Orange Alternative Route embankment (indicated by black circle 3). This out of bank flow route is then diverted into the Trout Beck at black circle 4. Modelled shear stress on the floodplain immediately upstream of the Orange Alternative Route embankment and on the left bank of the Trout Beck increases as the surface water flow is forced into the Trout Beck. This results in an increase in the size of sediment that can be mobilised (from sands and gravels to gravels and cobbles).
- In all other areas the Orange Alternative Route has no impact on shear stress and therefore no impact on the size of material that can be mobilised on the floodplain.

Predicted Geomorphological Change

- The increase in flow energy immediately upstream of the Orange Alternative Route embankment has the potential to scour floodplain material. The floodplain is occupied by a mixture of arable farmland farm buildings in this area. The increase in flow energy at black circle 2 and 3 will be sufficient to scour the grass and topsoil material, leading to an increase in sediment input into the River Eden and lead to bank stability issues on the Trout Beck.

JBA consulting

Orange Alternative Route: Floodplain Sediment Entrainment Comparison for the Eden 1-in-2 Year Trout Beck 1-in-20 Year Flood Event

A comparison of hydraulically modelled sediment entrainment size, to assess the potential impact to the material on the floodplain, for existing baseline conditions and predicted future change.

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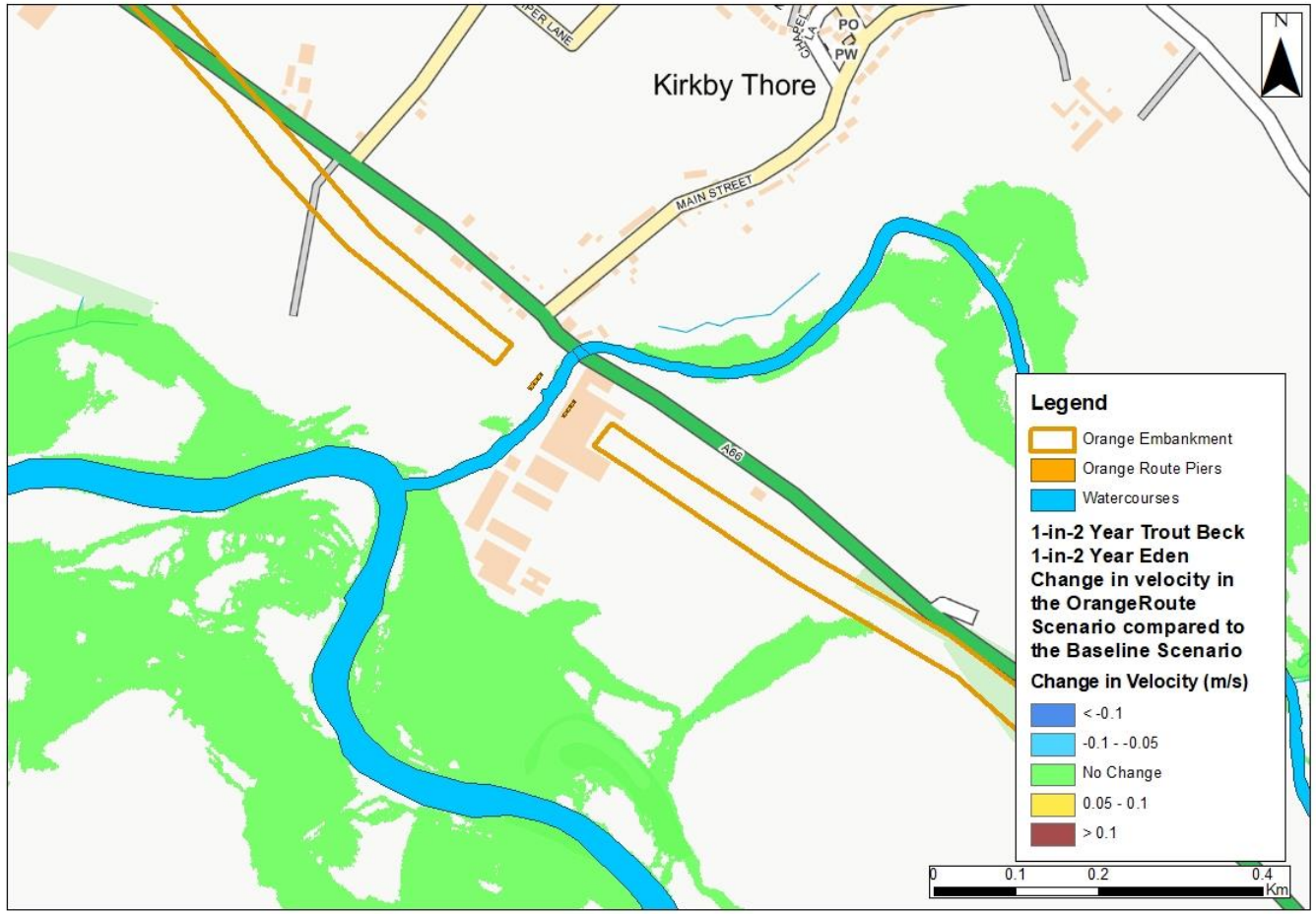

Key Changes in the Orange Alternative Route Scenario Compared to the Baseline

- There are no changes in flow velocities on the floodplain in this reach of the Trout Beck.

Predicted Geomorphological Change

- The condition of the floodplain and sediment transport dynamics are expected to remain the same.

JBA consulting

Orange Alternative Route: Difference in floodplain velocities for the Eden 1-in-2 Year Trout Beck 1-in-2 Year Flood Event

A comparison of hydraulically modelled velocities to assess the potential impact erosion and scour on the floodplain, for existing baseline conditions and predicted future change.

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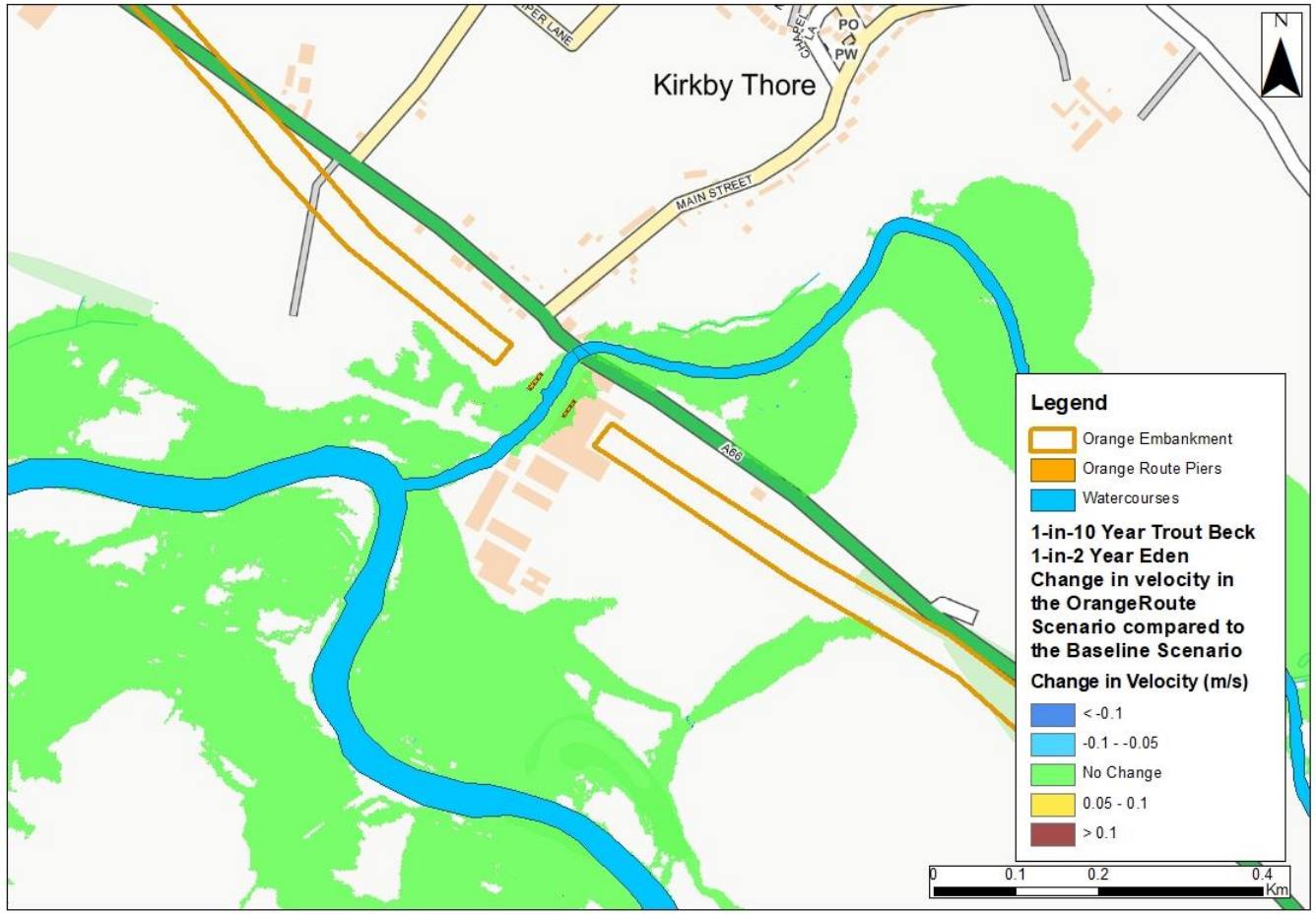

Key Changes in the Orange Alternative Route Scenario Compared to the Baseline

- There are no changes in flow velocities on the floodplain in this reach of the Trout Beck.

Predicted Geomorphological Change

- The condition of the floodplain and sediment transport dynamics are expected to remain the same.

JBA consulting

Orange Alternative Route: Difference in floodplain velocities for the Eden 1-in-2 Year Trout Beck 1-in-10 Year Flood Event

A comparison of hydraulically modelled velocities to assess the potential impact erosion and scour on the floodplain, for existing baseline conditions and predicted future change.

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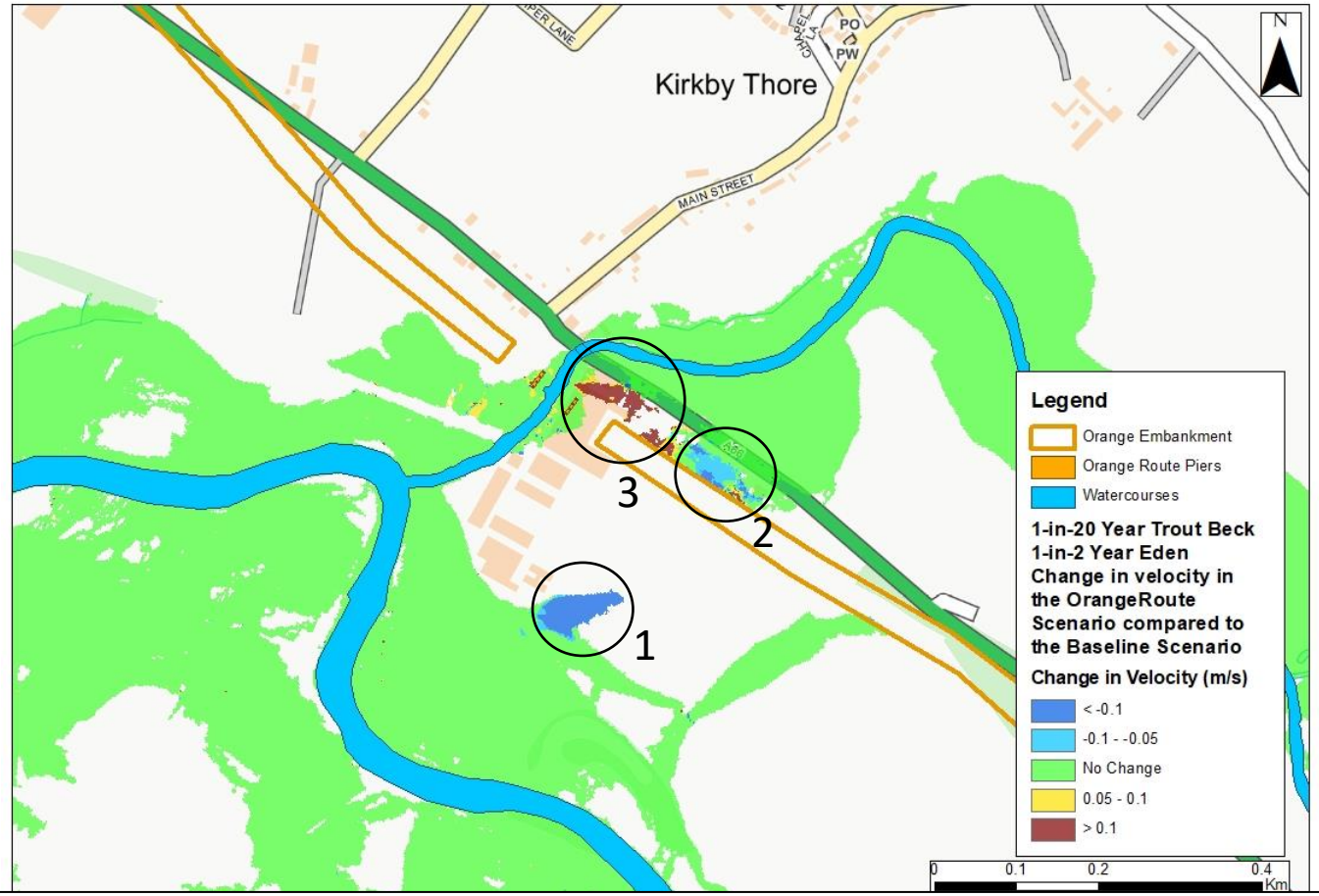

Key Changes in the Orange Alternative Route Scenario Compared to the Baseline

- The out of bank flow route on the left bank floodplain of the Trout Beck (between black circles 1 and 2) is cut off by the Orange Alternative Route embankment. This out of bank flow route is then diverted into the Trout Beck at black circle 3. Flow velocity is reduced immediately upstream of the Orange Alternative Route embankment (indicated by black circle 2) and where the out of bank flow route joins the River Eden flood extent (indicated by black circle 1).
- As the out of bank flow route is diverted into the Trout Beck at black circle 3, the flow velocity increases significantly (velocities increase by as much as 0.4m/s).

Predicted Geomorphological Change

- The reduction in flow velocity at black circles 1 and 2 will increase sediment deposition on the floodplain.
- The increase in velocities at black circle 3 will increase the scour risk on the floodplain and left bank of the Trout Beck. This could lead to increases in sediment input in the River Eden and bank stability issues on the Trout Beck.

JBA consulting

Orange Alternative Route: Difference in floodplain velocities for the Eden 1-in-2 Year Trout Beck 1-in-20 Year Flood Event

A comparison of hydraulically modelled velocities to assess the potential impact erosion and scour on the floodplain, for existing baseline conditions and predicted future change.

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Plans and profiles