highways england

European Union
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A30 Chiverton to Carland Cross
Environmental Statement

Volume 6 Document Ref 6.4 ES Appendix 15.2 In-combination climate change impacts

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Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)
APFP Regulation 5(2)(a)

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15.2 ICCI assessment summary

15.2.1 This section presents the summary of the in-combination climate change impacts assessment. The assessment methodology is described in **Consideration of cumulative effects** (Volume 6 Document Ref 6.2 ES Chapter 15). Results for each assessed environmental topic are presented are presented as follows:

- Table 3: Air quality
- Table 4: Cultural heritage
- Table 5: Biodiversity
- Table 6: Landscape and visual effects
- Table 7: Geology and soils
- Table 8: Materials
- Table 9: Noise and vibration
- Table 10: People and communities
- Table 11: Road drainage and the water environment.

15.2.2 Significance of the in-combination climate change impacts is assessed based the impact's likelihood and consequence, as shown in the ICCI significance matrix in Table 15-1.

Table 15-1 In-Combination Climate Change Impacts Matrix

Consequence	**High**	Medium	High	High
	Medium	Low	Medium	High
	Low	Low	Low	Medium
		Low	**Medium**	**High**
		Likelihood		

15.2.3 Table 15-2 is an explanatory table, providing some background information on how each of the presented assessment tables has been structured and completed.

Table 15-2 In-Combination Climate Change Assessment Results: Explanatory table

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures (High/Medium/Low)	Consequence of in-combination climate change impacts given existing/embedded mitigation measures (High/ Medium/ Low)	Significance of in-combination climate change impacts given existing/ embedded mitigation measures (High/ Medium/ Low)	Additional mitigation and allowances for future monitoring
Each resource/receptor is identified in a new row.	*The effects of the Proposed scheme on each receptor/resource are numbered in brackets to allow for identification in later columns in the table.*	*Each mitigation measure shows the number (in brackets) of the effect in the previous column that it addresses. Each mitigation measure is given a new letter to allow for identification in later columns in the table.*	*Each climate change impact shows the number of the resources/ receptors that it could impact.*	*The likelihood of each in-combination impact is assessed, given the existing mitigation measures. The relevant mitigation measures considered are referenced.*	*The consequence of each in-combination impact is assessed, given the existing mitigation measures. The relevant mitigation measures considered are referenced.*	*The significance of each in-combination impact is assessed qualitatively, based on the combined assessment of likelihood and consequence*	*Additional mitigation measures are identified for significant in-combination CC effects, and reference made to the existing mitigation measure that should/could be improved.*

Table 15-3 In-Combination Climate Change Assessment Results: Air Quality

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
People; children and elderly are most vulnerable Health effects: Respiratory problems. This is particularly dangerous for young children as increased exposure to soot and particulate matter may have damaging health impacts.	**During construction:** (1) Dust and particulate emissions during earthworks construction (2) Vehicle exhaust emissions associated with construction related traffic **During operation:** (3) Changes in vehicle emissions on the local road network as a result of changes to traffic flow, speeds, composition and route alignment (4) Pollutants	(1,2) Compliance with outline CEMP to implement best practice mitigation methods for dust suppression and control of on-site emissions. (3) No mitigation required as no significant impacts are predicted. (4) No mitigation required as no significant impacts are predicted.	(1,2,3,4) Changes in wind patterns may affect the spread of pollutants. However, consequences of this are very uncertain.	Low - No conclusive projections relating to wind patterns available; however, it is unlikely that there will be major changes to the spread of pollutants.	Low - The consequences are uncertain; however, it is unlikely that the effects on air quality will be substantial	Low	none
			(1) Drier weather in the summer months may exacerbate the spread of dust. Furthermore, droughts may impair our ability to mitigate this risk (by dampening the site), if there are water shortages	Medium – considering the short timescales relevant to construction, this impact is considered to be of medium likelihood, despite the projected decrease in future summer precipitation.	Low – dust during construction is not considered to be a significant effect by the air quality assessment, including when potential effects of climate change have been taken into account.	Low	none
			(1) Increased levels of precipitation during winter months may reduce spread of dust	Medium - Increased precipitation is likely but dust is not normally an issue in winter due to frequent rainfall	Low (Positive) – there is little change from the state of dust currently in winter months compared to the future incorporating climate change.	Low (Positive)	none

Table 15-4 In-Combination Climate Change Assessment Results: Cultural heritage

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
Archaeological/ historic sites	(1)Noise and vibrations during operation may affect historic buildings (2)Potential removal or demolition of historic sites that may be within the scheme's location (3)The scheme may impact the setting of listed sites (e.g. skyline, views, lighting, noise) (4)Permanent removal of archaeological features (e.g. mining features, prehistoric period) (5)Drilling and land excavation may result in damage to buried archaeology	There may be a slight beneficial effect on some assets, as the road would be moved slightly further from them, increasing the sense of tranquillity in the setting.	(2) Increased rainfall during winter months, combined with increased runoff as a result of the scheme – historic rainfall and drainage systems may be unable to handle the increased amount of water, leading to localised flooding.	Low - increased rainfall may affect the drains in winter months, potentially exceeding their capacity. However, localised flooding is unlikely, as the scheme is located in an area of low flood risk. The residual risk to be mitigated through robust drainage design, incorporating climate change considerations.	Medium - as exhausted drainage systems could lead to localised flooding which has consequences for local communities and archaeological sites.	Low	none
			(4,5) Changes in soil moisture may pose a threat to preservation of buried archaeology - exacerbating effects to archaeological sites partially affected by the scheme.	Low - buried archaeology under the scheme is to be excavated and not further affected by climate change. Buried remains may be partially located under the scheme, in which case there would be impacts from the scheme and climate change; the presence of such buried archaeology is unconfirmed	Low - while soil moisture affects the preservation of buried archaeology, the effects of gradual changes in soil moisture are expected to be low.	Low	none
			(2, 5) Increased number of heavy rain events may lead to increased erosion to archaeological sites partially affected by the scheme, e.g. round barrows.	Medium - increased rain in winter is likely; the potential increase in surface water runoff may have some impact on erosion to round barrows. It is unlikely that the public will have access to any round barrows as a result of the scheme, further reducing the likelihood of the in-combination climate change impact.	Low - the increase in erosion rates due to changes in winter rainfall patterns is expected to be small.	Low	none
			(3) Potential increases in wind speed as a result of frequency and severity of storms may impact on setting due to trees lost.	Low – it is difficult to quantify wind increases and the likely impact on the setting. Based on professional judgement likelihood is expected to be low.	Low – based on professional judgement the consequence of trees lost in such a way on the local setting is expected to be low.	Low	none
			(3) Increased frequency and severity of drought events may affect planted screens, which protect views from listed sites of the road.	Medium - drought events can be expected to become more frequent and severe and this may adversely impact flora, fauna and water features. However, projections for extreme weather events are associated with higher uncertainty.	Medium – planted screens play an important role for the setting in the area and impacts as a result of more frequent drought events, in combination with the impacts of the scheme are assessed as being of medium consequence.	Medium	none

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
			(1,2,3) Increase in temperature during summer months may result in an increase in tourist visits to historical sites. The resulting increase in footfall may increase erosion	Low – it is possible that increased summer temperature may lead to an increase in tourist flows in the area, increasing footfall. Furthermore, it is unlikely that the public will have access to any round barrows as a result of the scheme, further reducing the likelihood of the in-combination climate change impact.	Low – the effect of increased footfall on the round barrows is not expected to be large as barrows on private land will not be open to the public.	Low	none
			(6) Increased frequency and severity of drought events may result in loss of hedgerows	Medium - Drought events can be expected to become more frequent and severe and this may adversely impact flora, including hedgerows. However, projections for extreme weather events are associated with higher uncertainty.	Medium - hedgerows play an important role of the setting in the area and impacts as a result of more frequent drought events, in combination with the impacts of the scheme are assessed as being of medium consequence	Medium	none
			(4) Changes in agricultural regime may introduce new crops to the area. Crops used for biofuels may be more damaging to archaeological sites.	Low - likelihood of drastic change in agricultural regime as a result of climate change in combination of the scheme is low	Low - it is unlikely that the new crops will be planted widely and greatly affect archaeological sites, leading to low consequence level being assigned.	Low	none
Hedgerows	(6) Destruction of historic hedgerows	(6) Hedgerows that are considered to relate to the miners smallholdings that are associated with the World Heritage Site should be avoided.	(3,6)Increased temperatures may lead to longer growing season, affecting planted screens	Medium - it is possible that increased summer temperature all year round may lead to longer growing seasons	Medium (Positive) - longer growing seasons may have a positive impact on planted screens, enabling them to grow faster	Medium (Positive)	none

Table 15-5 In-Combination Climate Change Assessment Results: Biodiversity

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
European designated sites Newlyn Downs SAC which is located at its closest 111.5 m to the north of the scheme. (International Significance) Statutorily designated sites Newlyn Downs SSSI, Carrick Heaths SSSI, Carnkief Ponds SSSI and Ventongimps SSSI (National Significance) Priority Habitats Five habitats within the search area potentially qualifying as Priority Habitats under the NERC Act. These are purple moor grass and rush pasture, deciduous woodland, good quality semi-improved grassland, lowland heathland and lowland fen. Species-rich hedgerows and Cornish hedge banks.	Construction (1) Loss or degradation of habitats through: - Permanent and temporary land-take within the proposed scheme footprint; - Permanent manipulation of habitats, e.g. landscaping and 'tidying-up' of areas not within the footprint, felling of trees for Health and Safety reasons (2) Disruption to breeding, feeding and migration patterns of species through: -Temporary storage of construction materials within/adjacent to ecological resources with associated land contamination and compaction - Direct and indirect disturbance from construction. - Habitat fragmentation; Operation (3) Disruption to breeding, feeding and migration patterns of species during operation through: - Displacement, species loss and isolation; - Direct disturbance from operational use visual, noise, vibration and lighting; - Pollution caused	Where possible, the scheme has been designed to avoid, eliminate, or reduce the magnitude of the potential impacts described above, in particular, habitat severance and species mortality. A total of 33 crossings are proposed that will be suitable for badgers, otters, bats and/or reptiles. Mammal fencing will be provided throughout the scheme. The loss of important habitats (such as heathland and woodland) and habitats suitable for protected and notable species (including hedgerows) will be mitigated by habitat creation, reinstatement, and enhancement providing an overall net gain for biodiversity and important habitats; as shown in the Environmental Master Plan (Figure 7.6 Chapter 7 Landscape). Attenuation ponds and associated drainage has been design to direct road surface runoff into the ponds and reduce any pollution effects.	(1, 2, 3) Higher levels of winter precipitation may increase likelihood of flooding, therefore damaging habitats and increasing habitat fragmentation.	Low - Low likelihood of flooding in the local area. Further mitigated through robust drainage design, incorporating climate change considerations.	Low - The effect of any potential flooding and resulting habitat fragmentation is not expected to be large or long-lasting.	Low	none
			(1, 3) Increased risk of drought may have a detrimental effect on habitats and contribute towards habitat degradation.	Medium - Drought events can be expected to become more frequent and severe and this may adversely impact flora, fauna and water features. However, projections for extreme weather events are associated with higher uncertainty.	Low - no large or long-lasting impacts to habitats are expected as a result of the combined effects of increased frequency of drought and the proposed scheme.	Low	none
			(1) Higher frequency of storms would increase risk of felling trees and destroying habitats.	Low - it is not currently possible to provide robust projections for wind speed. Overall it is deemed unlikely that wildlife habitat will be adversely affected.	Low - no large or long-lasting additional impacts to habitats due increased storm frequency are expected.	Low	none
			(1) Changes in winter/summer precipitation patterns may have an impact on aquatic species and burrowing animals.	Low - No major rivers in the area. The majority of animals in the vicinity of the scheme are unlikely to be affected, with the exception of otters, where suitable mitigation is provided.	Low - limited impacts expected, based on the wildlife present in the vicinity of the scheme.	Low	none
			(1) Longer growing seasons due to higher temperatures may have an impact on plant and animal species. Such impacts would not necessarily be beneficial - any changes can be expected to be detrimental.	Medium - it is possible that increased temperatures may lead to longer growing seasons.	Low - the potential impacts to be sufficiently mitigated through measures detailed in the Biodiversity chapter such as planting drought tolerant species.	Low	none

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
	by runoff and air deposition. - Direct species mortality through vehicle collision.						
	Additional possible considerations arising from interaction with other topics:		(3) Increased winter rainfall combined with increase airborne pollutants may result in increased acid rain. Damage to wildlife: Acid rain- damage to trees, soils, water bodies, coral (in the Cornwall region)	Low – This relationship is associated with high uncertainty, but the potential increase in the frequency of occurrence of acid rain is likely to be small.	Low - the additional pollution as a result of the scheme is expected to be relatively small.	Low	none
			(3) Increased winter rainfall may have an effect on pollution caused by runoff.	Low – The relationship between increased winter rainfall and changes in harmful leakage patterns are not well understood, but it is unlikely that the climate change impact will be substantial.	Low - The effects of increased rainfall on the spread of contaminants are expected to be small, compared to current rainfall levels, as the contaminants may travel faster to rivers but they will be more diluted.	Low	none

Table 15-6 In-Combination Climate Change Assessment Results: Landscape and Visual Effects

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional Mitigation and Allowances for future monitoring
Natural Landscapes	(1) Environmental: Loss of features; Cornish hedges and land mark trees; Disruption of field pattern. (2) Character: Changes to local landscape character The busy A30 exerts an influence over the landscape, tending to reduce tranquillity within adjacent areas. (3) Views: Changes impacting on the composition of views.	(1) Firstly, retain and protect as much of the existing vegetation as possible. Secondly, carry out new planting for landscape and+ visual mitigation and to replace any vegetation lost to construction of the preferred option. Include construction of new Cornish hedges for landscape integration. Planting will be in locally characteristic patterns, not on a regular grid. (2) Design would include construction of new Cornish hedges for landscape integration and to maintain local character and heritage. Landscape integration would include natural regeneration and recreation of lowland heath.	(1) Increased frequency and severity of drought events may adversely affect flora, fauna and water features.	Medium - Drought events can be expected to become more frequent and severe and this may adversely impact flora, fauna and water features. However, projections for extreme weather events are associated with higher uncertainty.	Low - the effects of drought on landscape are not expected to be long lasting, due to mitigation embedded in the design. Drought-tolerant plant species to be selected where appropriate when designing landscape mitigation.	Low	none
			(2, 3) Increased temperature and frequency and severity of heat waves may lead to increased frequency of forest/grass fires. This may result in a loss of trees, biodiversity and aesthetically change the landscape.	Low - Projected are increases in temperature and reduced summer precipitation; in extreme cases these may lead to forest/grass fires, although this is expected to occur during only very extreme events.	Medium - potential fires could have an adverse effect on the landscape over a relatively long period of time, while vegetation is regenerated.	Low	none

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional Mitigation and Allowances for future monitoring
		The construction scheme would respect, maintain, and enhance local landscape character and distinctiveness. Design proposals will reflect local design characteristics and use local materials. (3) Cornish hedges would also provide a screening function and higher hedges (approximately 1.8m high) also used for noise attenuation.	(2) Areas of high elevation may experience land slippage, partly due to increased rainfall. This could result in a change in landscape and loss of embankments.	Low - risk mitigated through a robust drainage and geotechnical design on the scheme, incorporating climate change considerations.	Medium - land slippage would cause a change in the landscape.	Low	none
Designed landscapes	(5) Historical heritage landscapes: The scheme may change the setting of these areas. (6) The road scheme may encourage greater access and visits to landscape	(5) Refer to: The Cultural Heritage chapter will cover the setting and significance of the WHS and other heritage assets.	(1, 3, 5) Higher temperatures may lead to longer growing seasons.	Medium - longer growing seasons will help increase the speed that designed landscapes grow.	Medium (positive) - this could increase the speed of growth and affect the landscape.	Medium (Positive)	none
			(6) Warmer summers may increase tourist flows to Cornwall.	Medium - An increase of summer temperatures can be expected, which may lead to an increased number of tourists travelling to the area.	Low - The consequence on landscape of increased tourist flows due to climate change is expected to be low.	Low	none

Table 15-7 In-Combination Climate Change Assessment Results: Geology and soils

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/ embedded mitigation measures	Additional mitigation and allowances for future monitoring
Land Stability	(1) Soil compaction and de-vegetation, leading to a reduction in infiltration and an increase in surface water runoff, affecting stability (2) Soil erosion as a result of new road cuttings. (3) Potential risk of collapse settlement if mine working or mine entrances are present beneath the scheme - to be confirmed.	Ground risk managed through working in accordance with HD22/08, which ensures a consistent approach to planning and reporting of ground investigations and the planning, design and construction of geotechnical works. Geotechnical certification is used to ensure that ground risk is correctly identified, reported and managed through the lifetime of a scheme.	(1, 2, 3) Changes in rainfall levels during summer and winter could affect soil moisture, groundwater levels and hence pore water pressures within slopes leading to a increased rainfall-induced slope instability.	Low – there is no evidence of significant landslides or instability. Slopes are designed in accordance with Eurocode 7, which is deemed to provide sufficient mitigation. There is insufficient knowledge to justify a departure from current standards. With respect to mining features: there is no evidence of features that would indicate the presence of shallow mining voids within the vicinity of the alignment, except for two shafts (moderate adverse effect). Further studies are required to investigate the stability around shafts, as described in the Geology and soils chapter.	High - Slope instability may have high safety, reputational and economic consequences for the scheme and may cause significant disruption.	Medium	None
			Frost action related to freeze-thaw cycles is expected to damage engineered slopes.	Low – average number of frost days is expected to decrease. The precise effects on freeze-thaw cycles and the effect this may have on engineered slopes are associated with uncertainty.	Low – any damage to engineered slopes will be superficial (i.e. ravelling of bedrock) and not expected to affect the global stability	Low	None
			(1, 2, 3) Reduced infiltration capacity of the ground due to increased waterlogging and groundwater flooding near springs in winters with higher levels of precipitation. Exacerbated by increased runoff from the scheme.	Low - generally the scheme is situated in an area of low flood risk, however there are areas with a higher risk of groundwater flooding. Drainage design to incorporate sufficient climate change allowances to minimise the likelihood of this impact.	High - Large ground movements may have high safety, reputational and economic consequences for the scheme and may cause significant disruption.	Medium	none

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/ embedded mitigation measures	Additional mitigation and allowances for future monitoring
			(2) Increased frequency and severity of drought events may lead to increases in soil erosion in drier summers.	Low - Types of soils on site are not dispersive/at significant risk of erosion.	Low - No significant loss of soils expected, may affect production of dust (covered under the Air quality assessment and assessed as insignificant).	Low	none
			(1, 2) Increased frequency and intensity of rainfall events, combined with increased surface runoff, may lead to increased soil erosion.	Medium - Increased winter rainfall is likely to lead to increased volume and velocity of surface water runoff. Due to uncertainty in the relationship between changes in rainfall patterns and soil erosion this is classed as Medium likelihood.	Low - no significant loss of soils expected, Consequences mitigated through a robust drainage design.	Low	none
Land Contamination	(4) Potential for a diffuse presence of contaminative substances such as agricultural fertilisers, pesticides and herbicides. (5) Hydrocarbon based contamination (e.g. fuels and lubricants) associated with leaks or spills from vehicles. (6) Creation of new migratory pathways between potentially contaminated soils and underlying aquifers through ground disturbance such as piling activities;		(4, 5, 6) Increased winter rainfall may spread contaminants faster, leading to a wider range of land affected.	Low – The relationship between increased winter rainfall and changes in harmful leakage patterns are not well understood, but it is unlikely that the climate change impact will be substantial.	Low - The effects of increased rainfall on the spread of contaminants are expected to be small, compared to current rainfall levels, as the contaminants may travel faster to rivers but they will be more diluted.	Low	none
Groundwater resources	(7) Different activities associated with the construction of the scheme could potentially affect water table and if	Ground risk managed through working in accordance with HD22/08, which ensures a consistent approach to	(7) Increased rainfall could lead to increase in leaching of chemicals into groundwater.	Low - Likelihood reduced to low, through the following of the Contaminated land guidance within Geology and soils topic.	Low - Increased winter precipitation is not expected to have a major effect on the spread of chemicals to the ground water.	Low	none

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/ embedded mitigation measures	Additional mitigation and allowances for future monitoring
	land becomes contaminated this will have long lasting effect on the aquifer. (8) Groundwater features may be disrupted due to the construction of road drainage systems	planning and reporting of ground investigations and the planning, design and construction of geotechnical works. Geotechnical certification is used to ensure that ground risk is correctly identified, reported and managed through the lifetime of a scheme.	(1,3,8) Projected increases in seasonal fluctuation in rainfall may lead to increased seasonal fluctuation of groundwater levels, exacerbating effects of the scheme.	Medium – It is likely that the projected increases in seasonal variation in rainfall would result in further seasonal variation in groundwater. However, the exact relationship is currently not well understood.	Low - The consequences to be reduced to low through the implementation of robust drainage design.	Low	none

Table 15-8 In-Combination Climate Change Assessment Results: Materials

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
Surplus/ Waste Materials From: 7.10.2.1 Some vegetation clearance and limited demolition 7.10.2.1 Construction materials brought on to the site but not used for its intended purpose. 7.10.2.1 Existing site materials for example, excavation of material from earthworks	(1) The scheme will require landfill space for waste material to be disposed of. (2) The scheme will result in large quantities of material consumption.	(1) Compliance with the Site Waste Management Plan (SWMP) and Duty of Care Provisions in the Environmental Protection Act 1990. (1,2) Before the project identify: The types and quantities of materials required for the project; Waste that requires storage on site prior to re-use, recycling or disposal; Waste to be pre-treated on site for re-use within the project.	(1) Due to increased winter rainfall toxic substances could leak out of waste materials faster and lead to toxins in rivers.	Low – The relationship between increased winter rainfall and changes in harmful leakage patterns are not well understood, but it is unlikely that the climate change impact will be substantial.	Low - The effects of increased rainfall on the spread of contaminants are expected to be small, compared to current rainfall levels, as the contaminants may travel faster to rivers but they will be more diluted.	Low	none
			(1,2) Changes in temperature and precipitation regimes may accelerate road surface deterioration resulting in increased maintenance and more waste from replacement.	Medium - it is possible that the stripping rate for road surfaces is increased, leading to requirement for more frequent maintenance and replacement.	Low - the expected impact on asphalt deterioration are relatively small from a materials perspective, considering the relatively short design life (40 years) and current resurfacing maintenance plan (resurfacing every ~10 years). The resulting consequence on waste and materials is expected to be low.	Low	none
			(2) Due to high rainfall construction work may not be able to continue and materials could be wasted.	Low - mitigation measures to be taken to ensure that material can be used consistently and waste resulting from wet weather can be minimised or eliminated. Likelihood further decreased by the near-term nature of construction.	Low – consequences mitigated through following procedures in outline CEMP.	Low	none
Transport of Materials to and from site	(3) Noise and air pollution on sensitive receptors from HGVs.	(3) Materials should be sourced from the nearest available and suitable location to keep HGV journey distances to a minimum. Use site-won material	Increased frequency of storms may deteriorate road conditions more widely, leading to longer journeys associated with the transport of materials. This could result in larger impacts on the environment.	Low - it is unlikely that the effect on wider transport and reduced traffic speeds would have a significant impact on environmental impact associated with material transport.	Low – this consideration cannot be readily incorporated in the materials assessment; however, it is expected that the impact would be of low consequence.	Low	none

Table 15-9 In-Combination Climate Change Assessment Results: Noise and vibration

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
Residential properties and community facilities	(1) Construction Impacts Temporary construction noise and vibration impact (2) Operational Impacts Permanent increases in road traffic noise, resulting from greater free flowing traffic and changes of alignment	(1) Compliance with outline EMP (1) 7.6.4.5 It is anticipated that a combination of BPMs and temporary noise barriers has the potential to achieve a noise attenuation of up to15 decibels (dB) at the closest receptors during construction.	(1, 2) Increased heat during summer months may encourage residents to open windows. This may result in noise propagating more easily through houses.	Low - Open windows already factored into assessment. No increase in effect expected.	Low - Open windows already factored into assessment. No increase in effect expected.	Low	none
		(2)A combination of noise barriers and earth bunds, and low noise road surface will be considered. (2) Compliance with EIA regulations and HEMP (2) Monitoring of the effectiveness of mitigation once the scheme is open to traffic.	(1, 2) Increased precipitation during winter months may cause periods of increased higher frequency noise generation.	Medium - Average winter precipitation is likely to increase. It is possible that this would have a positive effect on noise, reducing the potential impacts of the scheme.	Low - the magnitude of the positive effect is expected to be small and not affecting the significance of noise effects.	Low	none

Table 15-10 In-Combination Climate Change Assessment Results: People and communities

Resources/receptors potentially impacted by the proposed scheme by environmental topic		Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
Travellers	Motorised	Construction: (1) Delays due to slow construction vehicles, closed roads, leading to high driver stress Operation: (2) Problems with a new road layout that drivers are not used to (3) Shorter journey times - due to increased capacity of road (4) Reduced views from the road	(2) Signage and layout to be clear to understand and avoid creating Route Uncertainty. Any diversions or closures undertaken during construction to be clearly advertised. (4) Where overriding landscape or design constraints do not restrict this, the view from the road for MTs would not be further obstructed, and open views of the countryside to be retained. (4) 7.7.4.8. Landscaping that can provide screening of the road where possible and reduce noise level for the wider network of PRoW.	(1, 2) Increased precipitation and higher frequency of storms may lead to worse road conditions and slower journey times. This could increase driver stress and combined with a new road layout, reduce safety of the road.	Low - The risk of water build-up on the road to be mitigated through the implementation of a robust drainage system, incorporating climate change considerations.	Low – does not affect the significance of the effect according to the topic. Potential reduction in road safety due to worse driving conditions. Services at either end of the scheme can be used by drivers in bad weather conditions	Medium	none
				(3) Increased temperature during summer months may lead to an increase in tourist numbers, impacting journey times.	Medium - it is relatively likely that higher temperatures will occur; it is possible that this could lead to an increased number of tourists in the area.	Low - The impact on journey times resulting from increased temperature is expected to be low.	Low	none
				Increased temperature during summers may affect passenger comfort.	Low - increased temperature is likely to occur but it is unlikely it will decrease passenger comfort significantly, due to expected availability of air conditioning systems in vehicles.	Low - effect mitigated through assumed widespread air conditioning availability.	Low	none
	Non-Motorised	(5) Loss of PRoW crossing the scheme (Bridleways, Footpaths and the National Cycle Network)	(5) Existing types of access to PRoW to be retained, for example, by not introducing new barriers such as stiles. Retain or improve the existing access arrangements (e.g. retain footpaths).	(5) Increased frequency and severity of extreme weather (e.g. storms, drought, and heat waves) may impact quality and patterns of use of open spaces.	Low – There is uncertainty in projections for extreme weather events. The relationship between such events and the impact on the use of public spaces is further uncertain.	Low - Due to the sporadic and irregular nature of such events this is expected to have low consequence on people and communities.	Low	none
				(5) Increased temperature during the summer months may increase the number of cyclists and pedestrians, further exacerbating the effects of the scheme on cyclists and pedestrians.	Low - It is possible that more cyclists are attracted to the area during the summer	Low - the increase in positive effects of the scheme on cyclists and pedestrians due to climate change in the area is expected to be small. Eight new facilities are to be provided for non-motorised travellers, providing an overall improvement (slight benefit)	Low (positive)	none

Resources/receptors potentially impacted by the proposed scheme by environmental topic		Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional mitigation and allowances for future monitoring
Communities	(Severance, Housing, Demolition of private property, Community Land, Development Land,) Economy, social, Health	(6) Impact on the economy through tourism (7) Lost time due to construction work related delays could lead to economic losses	(6) Private land take to be minimised where possible. (5) PRoW should remain open where possible and diverted if necessary, instead of closures.	(5) Increased likelihood of precipitation and storms during winter months may increase likelihood of flooding, which could affect community severance due to loss of footpaths and open spaces etc.	Low - likelihood of flooding in the area is low. Risk to be mitigated through the implementation of a robust drainage system, incorporating climate change considerations.	Medium - If flooding does occur, there may be an impact on local communities, if, for example, an underbridge is flooded.	Low	none
				(6) Increased summer temperatures may lead to increased number of tourists visiting the area and potential economic benefits.	Medium – an increase of summer temperatures can be expected, which may lead to an increased number of tourists will travel to Cornwall.	Low (positive) - While increased tourist flows are expected to have a beneficial effect on local economy, the net positive consequence is expected to be low.	Low (Positive)	none
Land and Property	Tourism, Land Use, Agricultural land	(8) Impacts on Agriculture (9) Destruction of agricultural land and impacts on Agriculture (10) Acquisition of land/ demolition of existing structures (11) Dust and Noise and Vibration may affect residents nearby	Where possible, the workforce and project supply chain to be sourced locally. (9) Although some agricultural land required within the footprint of the route will be lost permanently, the following measures can be implemented during construction: - Wherever possible, land required in addition for construction, would be returned to agricultural use; - Severance during construction to be minimised through careful siting of construction compounds and lay down areas, and careful planning of construction activities through consultation with landowners; - Crop loss can be reduced by giving advanced warning to enable farmers to plan ahead;	(8,9) Drier summer conditions may affect the quality and capability of soils and potential to harvest – it may be more difficult to reinstate soils to their previous condition.	Medium – More frequent occurrence of drier conditions will be more likely in the future. This may affect the quality of soils and may make it more difficult to reinstate soils to their previous condition, although the predicting the impact on soil quality is associated with uncertainty.	Low – Only limited amount of land taken for construction compounds, and selected of low value to the land owner. Land returned to land owners with soil of the same grade as pre-construction.	Low	none
				(11) Increased temperature may exacerbate discomfort and health impacts from dust and noise and vibration, felt by local residents.	Medium - it is possible that the health of local residents is negatively affected in hot, dry weather due to the increased spread of dust and pollutants during construction and operation.	Low – the scheme lies in a rural area, with low number of residential receptors. Effects on air quality are deemed to be insignificant – discussed in the Air quality ICCI assessment.	Low	none

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			- Consideration of field drainage impacts during the design phase; - Compliance with outline CEMP. (10) Best practice construction methods to be used to minimise noise and vibration and emissions to air during construction Noise and dust to be kept to a minimum and within acceptable working limits, using best practice methods to be outlined in the outline CEMP. (12) Signage and layout to be clear to understand and avoid creating Route Uncertainty.					

Table 15-11 In-Combination Climate Change Assessment Results: Road drainage and the water environment

Resources/receptors potentially impacted by the proposed scheme by environmental topic	Effects of proposed scheme on receptors/resources identified by environmental topic	Existing/embedded mitigation measures	Potential climate change impacts on resources/receptors	Likelihood of in-combination climate change impacts given existing/embedded mitigation measures	Consequence of in-combination climate change impacts given existing/embedded mitigation measures	Significance of in-combination climate change impacts given existing/embedded mitigation measures	Additional Mitigation and Allowances for future monitoring
Flood risk and land drainage	The proposed scheme would reduce the infiltration in the area/increase in impermeable surfacing. If proper drainage is not constructed this can lead to increase flooding of: (1) properties and surrounding area. (2) The scheme itself	(1) A robust surface water drainage system to be provided to ensure discharge from the proposed scheme does not increase flood risk elsewhere up to and including the 1 in 100 annual probability rainfall event, allowing for climate change effects, in accordance with EA guidance.	(1, 2) Increased winter rainfall may put increased pressure on drainage systems.	Low – the flood risk for the area is low. Drainage systems will account for projected increases in rainfall in line with EA guidance.	Medium - If the drainage systems are overloaded localised flooding can occur which could affect local communities.	Low	none
			(1, 2) Increased likelihood and severity of storms may place short term stress on drainage systems and could result in flooding.	Low – an increase in frequency and severity of storms is projected. This is accounted for through the design of drainage systems in line with EA guidance.	Medium - If the drainage systems are overloaded localised flooding can occur which could affect local communities.	Low	none
Surface water resources	(3) Dust during construction may contaminate surface water. (4) Pollutants could enter surface water during construction. (5) Surface water runoff from highway schemes typically contains high levels of sediment and hydrocarbons that can pollute surface water features through direct migration or via the surface water drainage system.	(4) Compliance with outline CEMP (5) A robust treatment system to be provided.	(3) Hotter drier summers may result in higher levels of particle contamination to surface water during construction (e.g. dust).	Low - risk of increase in dust pollution to be mitigated as per outline CEMP.	Low - No major increase in dust pollution to surface water features expected in view of short-term nature of construction, especially following implementation of proposed mitigation measures.	Low	none
			(5, 7, 8) More frequent and intense periods of drought may result in less dilution of road runoff.	Low – longer and more severe periods or drought are projected; however, the effect on water pollution is not well understood.	Low – effect is mitigated by a robust treatment system.	Low	none
			(4, 5, 7, 8) Increased winter precipitation may affect surface water runoff and pollution of watercourses.	Low – The relationship between increased winter rainfall and changes in harmful leakage patterns are not well understood, but it is unlikely that the climate change impact will be substantial.	Low - The effects of increased rainfall on the spread of contaminants are expected to be small, compared to current rainfall levels, as the contaminants may travel faster to rivers but they will be more diluted.	Low	none

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Pollution Impacts from spillages Groundwater resources	(6) Water resources polluted by spillages (7) Pollutants could enter groundwater during construction. (8) Surface water runoff from highway schemes typically contains high levels of sediment and hydrocarbons that can pollute groundwater features through direct migration or via the surface water drainage system.	(5, 6) Method D will be used to determine the potential impacts from accidental spillages.	(5,6) Increase precipitation/fog could increase the risk of accidents, increasing the likelihood of spillages.	Low - Impact to be mitigated through the implementation of a robust drainage system, incorporating climate change considerations.	High - potential reduction in road safety due to worse driving conditions.	Medium	none

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