18. Materials

18.1. Introduction

18.1.1. This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 3 assessment of the use and consumption of material resources, and the production and management of waste, that is associated with construction of the Proposed Scheme (as described in Chapter 5: The Proposed Scheme). It identifies measures for mitigating potential impacts, where possible, and describes the significance of the residual impacts that remain post mitigation. In accordance with DMRB guidance, the assessment excludes any effects associated with the transport of materials to / from the Proposed Scheme.

18.1.2. This assessment addresses 'materials' in accordance with the aims and objectives of DMRB, Volume 11, Part 1: HA 200/08[i] which identifies 'materials' as an Environmental Impact Assessment (EIA) topic to be assessed. Reference has been made to draft guidance DMRB Volume 11, Section 3, Part 6 HD 212/11 Materials[ii] , as agreed with Transport Scotland. The guidance is hereafter referred to as draft HD 212/11, which considers the environmental impacts associated with:

- the use and consumption of material resources from primary and recycled / secondary sources, and manufactured construction products required for the construction of roads, represented as total embodied carbon emissions
- the production and management of wastes resulting from the construction of roads in terms of the application of the waste hierarchy and the availability of waste management facilities

18.1.3. The focus of the assessment is the construction stage, as this phase of the project will likely result in the greatest source of potentially significant effects, due to the material consumed and potential waste arisings. It is anticipated that impacts associated with the operation and maintenance of the Proposed Scheme would be mitigated by the continued application of the waste hierarchy principles. As such, operational impacts are scoped out of this assessment.

18.1.4. The consumption of materials is assessed using published data to assign embodied carbon dioxide equivalents (CO_2e) per unit of material used (i.e. tonnes of CO_2 per tonne, or per cubic metric (or similar) of material used). This assessment does not consider any other environmental impacts associated with off-site extraction of raw materials or the off-site manufacture of materials / products. Embodied tonnes of CO_2e is taken as a proxy for the energy and other inputs required to bring these materials to the factory gate. These stages of material, or product, lifecycles are outside the scope of this assessment as it is difficult to ascertain whether an assessment of environmental impacts would have been undertaken through other established consent processes associated with the production of materials, or products.

18.1.5. Detailed aspects of the Proposed Scheme design such as the source of materials will depend on the approved construction proposals of the appointed contractor(s), details of which will not be available until the detailed design and construction stages. Therefore embodied carbon associated with transportation of materials to site has not been included within this assessment.

18.1.6. In addition, transportation of materials to the site and the removal of surplus materials / waste from the site are excluded from the design stage assessment in accordance with the methodology set out in draft HD 212/11[ii].

18.1.7. With regards to mitigation, it is an objective of this assessment to improve the sustainability in design and construction and to address this from an early stage. Sustainability relates to the efficient use of resources (energy, water, materials). Implementing materials resource efficiency at the design stage is commonly referred to as 'Designing out Waste'. The Waste Hierarchy would be applied to inform priority order in recommendations regarding material procurement and site won materials and waste generation, treatment and disposal associated with the Proposed Scheme; and is as follows:

- prevention
- preparing for re-use
- recycling
- other recovery, e.g. energy recovery
- disposal

Study Area

18.1.8. The study area covers the local waste infrastructure, natural / material resources and the potential waste management capacity within a 100km road journey (using the Scottish Trunk Road Network) of the Proposed Tomatin to Moy Scheme extents. This boundary was based on the proximity of the available waste management facilities and the total quantities of materials required for the construction of the Proposed Scheme.

18.2. Approach and Methods

Scope

18.2.1. DMRB, Vol.11, Part 1: HA 200/08[i] identifies, in Table 1.1, the Environmental Impact Assessment topics. One of the topics identified here is Materials and draft guidance has been published for this topic within DMRB Volume 11 – Environmental Assessment – Section 3, Part 6 (HD 212/11)[ii].

18.2.2. The draft guidance identifies two levels of assessment that may be undertaken: a simple and a detailed assessment.

18.2.3. Paragraph 4.40 of draft HD 212/11[ii] states that:

- '[a] detailed assessment should be applied where there is the potential for the use and consumption of materials and the production and management of waste to cause significant environmental effects and where the extent of these can be quantified after the simple assessment'

18.2.4. A detailed assessment has therefore been undertaken given:

- the simple assessment (undertaken at DMRB Stage 2) identified the potential for significant environmental effects
- the level of detail available for the Proposed Scheme
- the availability of Transport Scotland's Carbon Management System[iii] (CMS) to quantify embodied carbon emissions

Legislation, Plans, Policies and Guidance

18.2.5. The following guidance / key policies and strategies relevant in Scotland that seek to influence the sustainable use of material resources and waste management include but are not limited to:

- Directive on Waste (2008/98/EC)[iv]
- Climate Change (Scotland) Act, 2009[v]
- Environmental Protection Act 1990, Part II[vi]
- The Scottish Government, Choosing Our Future: Scotland's Sustainable Development Strategy, 2005[vii]
- The Scottish Government, Scottish Planning Policy, 2014[viii]
- The Scottish Government, Zero Waste Plan, 2010[ix]
- The Scottish Government, Zero Waste Regulations, 2012[x]
- The Waste (Scotland) Regulations, 2012[xi]
- The Scottish Government, Low Carbon Scotland: Meeting Our Emissions Reduction Targets 2013-2027, 2013[xii]
- The Scottish Government, Making Things Last: A Circular Economy Strategy for Scotland, 2016[xiii]
- SEPA Land Remediation and Waste Management Guidelines, 2009[xiv]
- SEPA Promoting the Sustainable Reuse of Greenfield Soils in Construction, 2010[xv]
- SEPA Guidance on the Production of Fully Recovered Asphalt Road Planings[xvi]
- SEPA Guidance on Recycled Aggregates from Inert Waste[xvii]

18.2.6. Transport Scotland's Corporate Plan 2012 to 2015[xviii] states that Transport Scotland will *"...embed resource efficiency into our practices".*

18.2.7. The A9 Dualling Sustainability Strategy[xix] states that a sustainability objective of the project is "optimising resource efficiency across the life of the A9 Dualling Programme, with particular regard to geographical scale and project alignment".

18.2.8. The priority of Scotland's Zero Waste Plan[ix] is to treat resources as high up the waste hierarchy as possible by preventing, reusing or recycling resources wherever feasible and to achieve the best overall environmental outcome and the Proposed Scheme is also committed to this objective.

18.2.9. The 'Low Carbon Scotland: Meeting Our Emissions Reduction Targets 2013 – 2017 issued by the Scottish Government reiterates the aim of recycling all waste with zero waste to landfill by 2050.

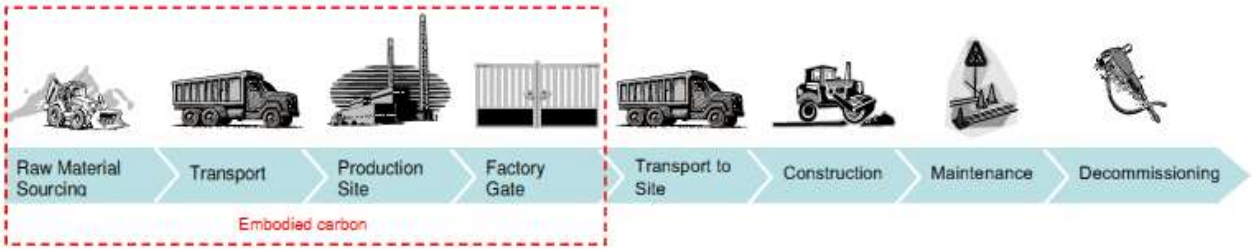
18.2.10. Scottish Planning Policy[viii] paragraph 179 states that waste should be minimised during the construction and operation of new developments.

18.2.11. The Scottish circular economy strategy[xiii] aims to recycle and reuse 70% of construction and demolition waste by 2020 by keeping products and materials in a high value use for as long as possible.

18.2.12. Draft HD 212/11[ii] defines the embodied CO_2 emissions of a material as the total CO_2e emissions released from 'cradle-to-gate'. According to draft HD 212/11[ii] the 'cradle-to-gate' boundary normally includes CO_2 emissions from extraction (or harvesting), the

manufacturing process and any pre-distribution transportation (refer to illustration 18.1 below).

Illustration 18.1: Diagrammatic Representation of the Measures of Embodied Carbon in Relation to



Material Life Cycle (Highways Agency et al, unpublished 2012)

18.2.13. As can be seen by Illustration 18.1, the embodied carbon in the materials assessment boundary does not include the CO_2 emissions associated with transport from the factory gate to site, construction activities (i.e. plant fuel use emissions), maintenance or decommissioning of the Proposed Scheme.

18.2.14. A number of tools have been developed which facilitate the quantification of carbon impacts of different materials and waste management methods, including Transport Scotland's CMS Project Carbon Tool[xx].

18.2.15. Transport Scotland has developed the CMS[iii] to measure carbon emissions associated with their construction activities across their road and rail schemes. The CMS[iii] is intended to provide a robust and reliable means of measuring, monitoring and reporting a project's carbon footprint across its life cycle.

18.2.16. The CMS[iii] uses an 'activity' based system to categorise emissions based on the activity that is the source of the emissions, and includes: material use, transport of materials and wastes, plant fuel combustion and electricity consumption, waste treatment, construction site utilities and operational electricity consumption.

18.2.17. Reporting via the CMS[iii] is intended to be used throughout the design process with more detailed materials, waste, fuel use for plant and transportation data being used as it becomes available at each project delivery stage, enabling wider carbon and sustainability performance reporting.

18.2.18. The CMS[iii] also enables broad estimates on material resourcing requirements (i.e. users can apply local / regional / national transport distance assumptions to each material); however, whilst such broad transportation assumptions may support wider sustainability reporting, they are not required by draft HD 212/11[ii].

18.2.19. Consultation has been undertaken by Transport Scotland as part of the A9 Dualling Programme Strategic Environmental Assessment (SEA)[xxi]. One of the key outputs of the SEA was the development of a range of Strategic Environmental Design Principles in collaboration with consultation authorities, including SEPA. The Principles of relevance to this Materials Assessment relate to the following aspects:

- designs developed to minimise land take
- maximise the use of existing route infrastructure where appropriate
- minimise waste generation through re-use of excavated materials

18.2.20. The above aspects have been considered during the Proposed Scheme development and in identifying mitigation measures set out in Section 18.5.

Desk Studies

18.2.21. A desk based review of information to help establish baseline conditions was undertaken and this included specific reference to SEPA Waste Facility Data, 2015[xxii] to identify waste facilities within the vicinity of the Proposed Scheme.

Field Surveys

18.2.22. An advanced Stage 2 ground investigation programme started in late July 2015 for four weeks duration targeting areas of exposed rock and peat. Further peat probing was carried out in April 2016 based on the initial design for the Proposed Scheme.

18.2.23. A preliminary Stage 3 ground investigation[xxiii] commenced in August 2016 for a six week period as well as further peat probing in December 2016.

18.2.24. The outcome of these investigations has been used to assess the predicted volumes of reusable material as well as potential volumes of unsuitable / surplus material.

Assessment of Impacts

18.2.25. As per draft HD212/11[ii], a detailed assessment of impacts is proposed as there is the potential for the use of materials and production / management of waste to cause significant environmental effects.

Depletion of Natural Resources

18.2.26. An assessment of the predicted use of natural resources, mainly the depletion of non-renewable mineral resources (i.e. crushed rock, and sand and gravel) has been undertaken.

18.2.27. Data has been collated from the TAYplan and Highland & Moray Scottish Aggregates Survey areas which include the Perth & Kinross, Highland Council and Moray Mineral Planning Areas (MPAs) as these are likely to be the primary sources of imported aggregates.

18.2.28. The depletion of natural resources assessment has been undertaken by estimating the quantities of the main aggregate-using products such as sub-base, base course, binder course, regulating course, surface course, ballast and capping as part of the engineering assessment.

Embodied Carbon Emissions

18.2.29. An assessment of the potential embodied carbon impacts associated with the material resource demands of the Proposed Scheme has been undertaken using Transport Scotland's CMS[iii], in line with the requirement of draft HD 212/11[ii] detailed assessment. Total embodied carbon has been estimated, based on the indicative consumption of materials determined for the DMRB Stage 3 design for the Proposed Scheme.

18.2.30. The material quantities required for the Proposed Scheme were entered into the CMS[iii], which calculates the CO_2e of each of the materials. The tool can also be used to quantitatively estimate which principal components of the Proposed Scheme are likely to have a greater carbon footprint in terms of material resource consumption.

18.2.31. Construction elements were identified using Volume 1 of the Manual of Contract Documents for Highways Works (MCHW) – Specification for Highways Works[xxiv]. This

guidance contains the material specifications required in all components of the construction, improvement or maintenance of the Trunk Road network.

18.2.32. The material import data was entered into the CMS[iii] taking account of the following assumptions:

- Civil engineering structures: includes precast and in situ concrete, steel for reinforcement and structural steel.
- Drainage: includes filter materials and concrete chambers.
- Road pavement: includes sub-base, base, surface and binding layers, and kerbs.
- Safety barrier: includes steel safety barriers.
- Earthworks: due to the scale of the earthworks associated with the Proposed Scheme, site-won soil and topsoil have been specified as 'imported soil / general fill' and site-won aggregates have been specified as 'recycled aggregates'. These specifications are used as a proxy to account for the emissions associated with the excavation and processing of materials onsite[1].
- Road signage: includes road markings and road studs.
- Railway associated materials: includes ballast and tracks
- Fencing: not included as quantities not available at this stage of the design.
- Lighting: not included as no lighting requirements have been identified.

18.2.33. Given that the range of material consumption requirements may differ between design assessment and construction stages, an additional 15% uplift has been applied to the principal material demands. This uplift aims to account for additional materials not covered in this design stage assessment (e.g. fencing noted above).

18.2.34. The CMS[iii] has the functionality to assess CO_2e associated with transport of materials to site, transport onsite and maintenance. However, as the sourcing of materials is unknown at this time, the tool has only been completed to report in accordance with draft HD 212/11[ii]. It is anticipated that the construction stage carbon footprint will be further developed and monitored through the construction stage process as more information becomes available.

18.2.35. Plant emissions are also excluded at this stage due to the lack of data and the complexity in modelling this fuel / electricity consumption.

18.2.36. Waste emissions are excluded at this stage as the impacts associated with management of waste are assessed based on the capacity for any waste arisings from the Proposed Scheme; it is also likely that the environmental effects associated with waste management would have been dealt with through the facilities own consents.

Waste Assessment

18.2.37. The waste assessment identifies and estimates the likely waste arisings as a result of the Proposed Scheme for the construction stages.

18.2.38. The assessment also considers the potential for onsite / offsite reuse of site won materials. These figures are derived from the cut and fill balance calculated for the Proposed Scheme at the DMRB Stage 3 design stage. All material that did not qualify

[1] In relation to earthworks, the embodied carbon emissions of site-won materials are specified as zero within the CMS in terms of materials use. Emissions for site-won materials are captured within the CMS under the plant fuel consumption activity, details of which can be completed during the construction phase. As a result, specifying the materials as site-won would underestimate the embodied carbon of the material resources of the Proposed Scheme.

for re-use on site by virtue of the type of material or there being no capacity within the design for re-use was recorded. Further details regarding the re-use of site won soils / peat and the associated volumes can be found in the Appendix A10.2 Outline Soil and Peat Management Plan.

18.2.39. U1A, U1B and U2 refer to materials considered to be unsuitable and which will require treatment to render them to be a usable resource within a road scheme. These definitions are provided with the MCHW document and relate to the specification which will govern the scheme earthworks. The MCHW document[xxiv] is advocated by Transport Scotland. Within the MCHW guidance[xxiv], U1A is defined as material that does not meet the requirements of Table 6/1 or Appendix 6/1 of a Series 600 earthworks specification. U1A materials generally relate to materials considered to be geotechnically unsuitable for use and, for example, this includes peat-containing soil materials. The term U1B relates to materials that do not meet the Appendix 6.14 and 6.15 limiting criteria provided within the Series 600 Specification and generally this relates to contaminated materials. Lastly, U2 materials are those that are considered to be hazardous materials or radioactive waste.

18.2.40. It is expected that most waste generated onsite would be Construction and Demolition (C & D) waste. Therefore, the assessment has considered waste facilities within a 100km road journey using the Scottish Trunk Road Network from the Proposed Scheme extents that may have the capacity to process or dispose of C & D waste.

18.2.41. The type and number of each type of waste facility within 100km which includes facilities located within the Highland, Perth & Kinross and Moray Council areas were identified from SEPA Waste Data[xxii].

Impact Assessment Criteria

Value/Sensitivity

Depletion of Natural Resources

18.2.42. The assessment of the scale and significance of the potential impacts related to the depletion of natural resources has been based on a combination of the predicted quantities of mineral resources to be used in the Proposed Scheme, and the effects that this predicted consumption will have on available mineral resources.

18.2.43. As such, the assessment indicates both the relative quantities of primary aggregates to be used and the sensitivity of regional mineral resources.

18.2.44. The sensitivity of the regional natural resource (crushed rock, and sand and gravel) has been determined using the terminology presented in Table 18.1 below, as per Draft HD 212/11[ii].

Table 18.1: Sensitivity of Regional Natural Resources

Sensitivity	Description
Very High	There are no supplies of mineral resources within the study area
High	There are limited supplies of mineral resources within the study area
Medium	There are adequate supplies of mineral resources within the study area

Sensitivity	Description
Low	There are good supplies of mineral resources within the study area

Embodied Carbon Emissions

18.2.45. Draft HD 212/11[ii] does not define sensitivity, in terms of EIA methodology, for material consumption and use (calculated as embodied carbon emissions), and therefore the significance of the impact cannot be defined. As such the assessment reports on the magnitude of impact only, through the use of a proxy in the form of the embodied carbon emissions associated with specific materials and construction products.

Waste Assessment

18.2.46. With regard to waste, the sensitivity of the waste capacity and therefore sensitive receptors within the study area is determined by using the terminology in Table 18.2 below, as per Draft HD 212/11[ii].

Table 18.2: Sensitivity of Receptor(s) – Waste Assessment

Sensitivity	Description
Very High	There is no available waste management capacity for any waste arising from the project
High	There is limited waste management capacity in relation to the forecast waste arising from the project
Medium	There is adequate waste management capacity for the majority of wastes arising from the project
Low	There is adequate available waste management capacity for all wastes arising from the project

Magnitude of Impact

Depletion of Natural Resources

18.2.47. The magnitude of the impact related to the depletion of natural resources has been assessed against the scale provided in Table 18.3 below, as per Draft HD 212/11[ii].

Table 18.3: Scale of Impact Magnitude – Depletion of Natural Resources

Magnitude	Description
Major	Considerable impact (by quantity) of more than local significance in relation to the use of mineral resources
Moderate	Moderate impact (by quantity) of more than local significance in relation to the use of mineral resources
Minor	Slight impact (by quantity) of more than local significance in relation to the use of mineral resources
Negligible	Negligible impact (by quantity) of more than local significance in relation to the use of mineral resources.

Embodied Carbon Emissions

18.2.48. The embodied carbon emissions are considered a proxy measure of the environmental impacts of materials according to the scale of impact magnitude[2] summarised in Table 18.4, as per draft HD 212/11[ii].

Table 18.4: Scale of Impact Magnitude – Material Resource

Impact Magnitude	CO_2e represented as tonnes of carbon
No change	<1,000
Negligible	1,000 – 5,000
Minor	5,000 – 20,000
Moderate	20,000 – 40,000
Major	>40,000

Waste Assessment

18.2.49. The scale of the magnitude of impact for waste is ranked according to scale, as summarised in Table 18.5 below, as per draft HD 212/11[ii].

Table 18.5: Scale of Impact Magnitude - Waste

Magnitude	Description
Major	Wastes are predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation
Moderate	Wastes are predominantly disposed of to incineration with energy recovery
Minor	Wastes are predominantly segregated and sent for composting, recycling or further segregation and sorting at a material recovery facility
Negligible	Wastes are predominantly re-used on site or at an appropriately licensed or registered exempt site elsewhere

Nature of Impact

18.2.50. The nature of each impact for natural resources, material resources and waste is classified as being:

- adverse – detrimental or negative impact to an environmental resource or receptor
- beneficial – advantageous or positive impact to an environmental resource or receptor
- direct or indirect
- short term or long term
- temporary or permanent

[2] The scale of magnitude identified in draft HD 212/11, is based on benchmark data from previous road projects where the magnitude of change as a result of material use has been quantified.

Impact Significance

Embodied Carbon Emissions

18.2.51. As per draft HD 212/11[ii] for material resource in terms of embodied carbon emissions, significance is not defined. The scale of magnitude as outlined in Table 18.2 above gives an indication of the scale of the identified impacts.

Depletion of Natural Resources and Waste Assessment

18.2.52. For depletion of natural resources and waste, the assessment of significance is based on the characteristics of the impact and the sensitivity of the receptor. By establishing the sensitivity / value of the receptor and the magnitude / nature of the impact the significance level of the environmental effect is determined, as in Table 18.6 below, as per Draft HD 212/11[ii].

Table 18.6: Significance of Depletion of Natural Resources and Waste Effects Matrix

Magnitude of Impact	Level of Significance Relative to Sensitivity / Value of Receptor			
	Very High	High	Medium	Low
Major	Very Large	Large / Very Large	Moderate / Large	Slight / Moderate
Moderate	Large / Very Large	Moderate / Large	Moderate	Slight
Minor	Moderate / Large	Slight / Moderate	Slight	Neutral / Slight
Negligible	Slight	Slight	Neutral / Slight	Neutral

18.2.53. Impacts of Large / Very Large and above are considered to be significant in the context of the EIA Regulations. Mitigation measures to avoid or reduce impacts have been considered and reported in Section 18.5 of this chapter.

Limitations of the Assessment

18.2.54. In relation to the provided materials quantities, the following limitations should be noted:

- Estimated quantities are based on information available at the time of writing and based on the DMRB Stage 3 level of design with associated embedded mitigation (including variations to mainline earthwork slope gradients) and it is anticipated that this information will adjust in the future during the detailed design and construction process.
- All provided information is considered to be factually correct based on the available design information at the time of writing.
- Information relating to certain quantities was not available at the time of writing. This relates to elements such as the volume of fencing and signage materials arising from the construction works.

18.3. Baseline Conditions

18.3.1. It should be noted that this section differs to other chapters in that it provides background information rather than a baseline. For a scheme that has yet to be constructed, there are no baseline conditions relating to materials / waste.

Depletion of Natural Resources

18.3.2. Primary aggregates are materials extracted directly from the ground and are defined by the British Geological Survey (BGS) as 'aggregates produced from naturally occurring mineral deposits, extracted specially for use as aggregates and used for the first time'.

18.3.3. Scottish Planning Policy[xxv] outlines a landbank approach to planning the supply of aggregates. This approach is intended to ensure that a stock of reserves, with planning permission, is maintained to ensure adequate supplies of minerals over a minimum 10 year period, based on current production levels.

18.3.4. The Scottish Aggregates Survey Report for 2012[xxvi] highlights that the most important primary aggregate sources in Scotland are crushed rock, and sand and gravel. An estimate of aggregate production in 2012 is recorded.

18.3.5. The Highland and Moray, and TAYplan aggregates survey areas are relevant to the Proposed Scheme. The Scottish Aggregates Survey Report confirms the amount of aggregates produced during 2012 and the available landbank at the end of 2012. Table 18.7 below summarises this data.

Table 18.7: Primary Aggregate Production in Highland & Moray and TAYplan Survey Areas

Regions	Hard Rock		Sand & Gravel	
	Primary Aggregate Production (tonnes)	Maximum Supply from Active Sites at 2012 Production Levels (years)	Primary Aggregate Production (tonnes)	Maximum Supply from Active Sites at 2012 Production Levels (years)
Highland & Moray	6,040,000	4	521,000	10
TAYplan	848,000	20	827,000	13

18.3.6. The BGS Directory of Mines and Quarries 2014[xxvii] highlights that there are a number of mines and quarries located within the study area that are able to supply a wide variety of materials.

18.3.7. The baseline data indicates that there is a sufficient landbank of crushed rock and sand and gravel at the time of the assessment. As such, the study area is considered to have a Low sensitivity with regard to the depletion of natural resources.

Embodied Carbon Emissions

18.3.8. As mentioned earlier, there are no baseline conditions with regard to embodied carbon emissions for a scheme that is yet to be built.

Waste Assessment

18.3.9. The local waste infrastructure and the potential waste management capacity have been identified using SEPA waste data for 2015[xxii] .

Construction and Demolition Wastes

18.3.10. This assessment defines C & D waste as waste materials arising from UK commercial C & D sites. This type of waste comprises, but is not limited to:

- off-cuts and waste timber
- plastics (such as uPVC and HDPE)
- glass
- packaging waste materials (such as card, wood and plastic film)
- inert materials (such as soil)
- aggregate materials (such as masonry, brick, block paving, tiles and ceramics) and plasterboard in mixed waste

18.3.11. In addition, the following represent additional waste materials associated with the Proposed Scheme that are anticipated:

- green waste (site clearance)
- existing Vehicle Restraint System
- demolition of structures
- disposal of unsuitable materials (U1A, U1B and U2), and
- disposal of existing traffic signs

18.3.12. SEPA produce data sheets, the latest in 2014[xxviii], which indicate the quantities of C & D waste produced and treated in each Local Authority area. The total quantity of C & D wastes managed in the Highland area amounted to 19,792 tonnes and comprised the waste types in Table 18.8.

Table 18.8: Quantity of Construction and Demolition Waste Treated in the Highland Area in 2014

Waste Type	Amount (Tonnes)
Contaminated Soils	7,108
Metals	4,117
Mineral Waste	1,167
Mixed C and D Waste	1,556
Wood	5,844

Waste Management Facilities

18.3.13. The different facilities available for the management of C & D wastes in the study area comprise the following:

- landfill site / civic amenity / other treatment
- landfill site / civic amenity
- metal recycler

- transfer station
- other treatment
- composting

18.3.14. Table 18.9 below provides details of the relevant key waste facilities located within 100km of the Proposed Scheme.

Table 18.9: Waste Management Facilities within 100km

Name	Approximate Distance in Relation to the Site	Type	Annual Capacity (tonnes)	Remaining Capacity (tonnes at 31 Dec 2015)
Granish Landfill Site Cell 3, Aviemore	21km	Landfill / civic amenity / other treatment	25,000	70,000*
Nether Dallachy Landfill Site, Spey Bay	90km	Landfill / civic amenity	122,000	145,000^
Johnstone Metals Highlands Ltd, Inverness	15km	Metal recycler / transfer station	4,995	N/A
R Finnie Skip Hire, Inverness	15km	Metal recycler / transfer station	10,000	N/A
SITA UK, Inverness	15km	Transfer station	150,000	N/A
Pat Munro (Alness Ltd), Inverness	15km	Transfer station	20,200	N/A
HRL Scrap and Waste Solutions Ltd, Inverness	16km – NB/ due move to a new location	Currently metal recycler / transfer station / other treatment, however, metals only at new location	Current location - 87,000 New location - TBC	N/A
William Munro Construction (Highland) Ltd, Inverness	16km	Transfer station	74,995	N/A
David Ritchie & Sons Ltd, Granish Farm, Aviemore	21km	Transfer station	25,000	N/A
Highland Clearance Ltd, Muir of Ord	32km	Metal recycler	4,725	N/A
Highland Waste	41km	Transfer station	4,999	N/A

Name	Approximate Distance in Relation to the Site	Type	Annual Capacity (tonnes)	Remaining Capacity (tonnes at 31 Dec 2015)
Services Ltd, Invergordon				
John Lawrie Ltd, Evanton	41km	Metal recycler / transfer station	24,999	N/A
Biffa Waste Services Ltd, Evanton	41km	Transfer station	4,999	N/A
Kingussie Metals, Kingussie	42km	Metal recycler / transfer station	500	N/A
William Munro Construction Ltd, Evanton	44km	Transfer station / composting	50,000	N/A
Northern Recycling Solutions Ltd, Alness	45km	Transfer station	4,999	N/A
Pat Munro (Alness) Ltd, Caplich Quarry	46km	Transfer station	24,999	N/A
D & S Metals, Forres	50km	Metal recycler	22,260	N/A
Sureclean Ltd, Alness	59km	Other treatment	15,600	N/A
M S Industrial Services Ltd, Invergordon	64km	Other treatment	10,000	N/A
J Gordon Williamson Ltd, Elgin	86km	Metal recycler / transfer station	75,000	N/A
Grays Recycling Services Ltd, Fochabers	90km	Transfer station, composting	20,800	N/A
* SEPA has indicated that this landfill does not have sufficient capacity remaining to deal with waste from this scheme. However, clean soil may be accepted for daily cover / reinstatement material.				
^ Moray Council state that the landfill cannot accept construction waste from contractors. However, clean soil may be accepted for daily cover / reinstatement material.				

18.3.15. Table 18.9 above indicates the volume of potential waste sites within 100km in order to provide a context in which waste will need to be treated for the Proposed Scheme.

18.3.16. The table highlights that there are a number facilities that are considered to have a Medium sensitivity in relation to the amount of metal / concrete / wood etc from the Proposed Scheme that could be recycled or composted 'locally'. The remaining facilities

are considered to have a High sensitivity in relation to materials that may require treatment and / or disposal.

18.4. Potential Impacts

18.4.1. Impacts have been considered with the following embedded mitigation included as part of the Proposed Scheme design.

18.4.2. Carbon dioxide levels in the atmosphere have increased significantly. Upland peat areas are considered to be a significant carbon store. Peat can sequester atmospheric CO_2 in perpetuity if the peat is in good condition. The waterlogged soils promote anaerobic conditions which prevents the decay of vegetation and subsequent release of carbon. Well managed upland soils / peat can assist in counteracting rising CO_2 levels by storing carbon as well as sequestering more CO_2 from the atmosphere. As such, it is desirable to minimise peat loss in terms of carbon emissions / climate change.

18.4.3. With regard to peat / peaty soils, mitigation has included avoidance by design. Areas of deep peat and priority peatland habitats where actively avoided at the option selection stage. As part of the DMRB Stage 3 design development, some proposed options for access roads have been discontinued as well as the inclusion of floating tracks along the proposed accommodation tracks. This has further reduced the anticipated peat excavation volumes.

18.4.4. As detailed within the Appendix A10.2 Outline Soil and Peat Management Plan, there is adequate reuse capacity within the Proposed Scheme to balance the anticipated excavation volumes.

18.4.5. The potential impacts of the Proposed Scheme are discussed in this section. Each impact is assessed using the methods outlined in Section 18.2.

Construction Phase Impacts

18.4.6. The construction phase is the main focus of the assessment as this phase of the project will result in the greatest source of potentially significant effects due to material consumption and potential for waste arisings.

Depletion of Natural Resources

18.4.7. An estimate of the predicted mineral resource requirement in order to construct the Proposed Scheme has been calculated by a review of the main aggregate using materials including capping, sub-base, base course, regulating course and binder course.

18.4.8. Table 18.10 summarises these estimated quantities and provides an indication of the magnitude of impact arising from the Proposed Scheme's depletion of mineral resources during construction.

Table 18.10: Estimated Aggregates Consumption Range (higher number relates to a 15% uplift)

Material	Units	Approximate Quantity Range
Imported aggregates (including chipping and rail ballast)	t	9,375 – 10,781
Imported general fill	t	176,006 – 202,408
Imported sub base (exc. recycling of existing road pavement to sub base)	t	37,409 – 43,020

Imported aggregates for asphalt (base, binder, surface and regulating) course	t	74,790 – 86,006

18.4.9. For comparative purposes, the Proposed Scheme's total potential consumption of mineral resources during construction is likely to be approximately 5% of the total primary aggregates produced in the study area in 2012.

18.4.10. Given that natural resources have been given a Low sensitivity, there is considered to be a minor impact (magnitude) from natural resource consumption during construction of the Proposed Scheme. Therefore, the significance of the depletion of natural resources is considered to be adverse, permanent, direct and **Neutral / Slight**.

Embodied Carbon Emissions

18.4.11. An estimate of the quantity of materials and waste was derived from the DMRB Stage 3 design of the Proposed Scheme, details of which can be found in the following chapters and appendices:

- Chapter 5: The Proposed Scheme which give an indication of the potential materials and construction techniques required to build the Proposed Scheme
- Chapter 10: Geology, Soils and Groundwater which describes the existing ground conditions and an indication for site won materials
- Technical Appendix A10.2 Outline Soil and Peat Management Plan

18.4.12. Data from the cut and fill balance estimates developed for the Proposed Scheme engineering assessment were used.

18.4.13. Table 18.11 below provides a summary of the potential materials required and likely to become available (higher value includes a 15% uplift) from the construction of the Proposed Scheme based on the current DMRB Stage 3 Scheme design and estimated quantities.

Table 18.11: Estimated Quantity of Materials Required for the Scheme (higher number relates to a 15% uplift)

Material Resource	Approximate Range of Material Quantities
Series 0400: Road Restraint System	
N2 Single sided steel safety barrier	10,730m – 12,308m
N2 Double sided steel safety barrier	9,235m – 10,620m
Series 0500: Drainage	
Concrete bed for carrier drain – 450mm internal diameter	2,910m – 3,347m
Concrete bed for carrier drain – 500mm internal diameter	969m – 1,114m
Concrete bed for carrier drain – 900mm internal diameter	1,450m – 1,668m
Filter drain pipe – 150mm internal diameter	6,221m – 7,154m
Filter drain pipe – 225mm internal diameter	9,199m – 10,579m
Filter drain pipe – 300mm internal diameter	7,720m – 8,878m
Filter drain pipe – 375mm internal diameter	4,122m – 4,740m
Precast concrete manhole – type 2a chamber (1500 dia with 700 dia pipe) with Grade B125 cover, 2,500mm deep	82no – 94no

Material Resource	Approximate Range of Material Quantities
Precast concrete manhole – type 3a chamber (1200 dia with 300 dia pipe) with Grade B125 cover, 3,500mm deep	82no - 94no
Catchpit – type 7 chamber with Grade B125 cover, 1,500mm deep	246no – 283no
Gully grating and frame – class D400 to drainage channel, iron, 255mm wide	100no – 115no
Channels – dished channel, 440 x 150mm	300m – 345m
Headwalls – mass concrete type 2, 100mm diameter pipe	74no – 85no
Series 0600: Earthworks	
Imported virgin aggregates	6,000m^3 – 6,900m^3
Site-won aggregates[3]	59,703m^3 – 68,658m^3
Imported soil / general fill[4]	140,805m^3 – 161,926m^3
Site-won soil / general fill[4]	590,351m^3 – 678,904m^3
Imported topsoil	2,405m^3 – 2,766m^3
Site-won topsoil[4]	213,351m^3 – 245,354m^3
Geotextiles	75,000m^2 – 86,250m^2
Series 0700: Pavement & Series 1100: Kerbs, Footways and Paved Areas	
Surface course (TS2010) (40mm thickness)	7,868m^3 – 9,048m^3
Surface course -5% binder	946m^3 – 1,088m^3
Base course (180mm thickness)	37,937m^3 – 43,627m^3
Binder course (60mm thickness)	12,646m^3 – 14,542m^3
Regulating course (60mm thickness)	435m^3 – 500m^3
Sub-base – primary aggregates	29,927m^3 – 34,416m^3
Sub-base – recycled aggregates	44,402m^3 – 51,062m^3
Kerbs	10,257m – 11,796m
Series 1200: Traffic Signs	
Road markings	47,301m – 54,396m
Road studs	3,844no – 4,421no
Series 1500: Highways Communications	
Power cables	10,200m – 11,730m
Signal and communications cables	6,000m – 6,900m
UPVC cable duct	9,200m – 10,580m
Series 1600: Piling and Embedded Retaining Walls	
Precast concrete piles	5,690m^3 – 6,544m^3
Series 1700: Structural Concrete	
Insitu Concrete	8,684m^3 – 9,987m^3
Precast concrete	3,304m^3 – 3,800m^3

[3] As per the assumptions mentioned earlier in the Chapter, site-won aggregates has been entered into the CMS Tool as 'recycled aggregates'.
[4] As per the assumptions mentioned earlier in the Chapter, site-won topsoil and site-won soil has been entered into the CMS Tool as 'imported soil / general fill'.

Material Resource	Approximate Range of Material Quantities
Recycled steel rebar	1,950t – 2,242t
Formwork	167t – 192t
Associated with Rail Track	
Track (steel bearers)	500m – 575m
Ballast (primary aggregates)	1,500m^3 – 1,725m^3

18.4.14. The CMS Tool[xx] was utilised to assess the total embodied carbon emissions. Assumptions have been made in relation to the types of materials required and as detailed in Section 18.2.32, with regard to site won topsoil, soil and aggregates.

18.4.15. The embodied carbon emissions associated with the predicted material resource for the Proposed Scheme (as detailed in Table 18.11) are presented in Table 18.12 below.

Table 18.12: Total Embodied Carbon for Predicted Quantities of Material Resource (including 15% uplift)

Material Resource	Estimated Range of Embodied Carbon Emissions (tCO_2e)
Series 0400: Road Restraint System	
N2 Single sided steel safety barrier	379 - 434
N2 Double sided steel safety barrier	488 - 561
Series 0500: Drainage	
Concrete bed for carrier drain – 450mm internal diameter	368 – 424
Concrete bed for carrier drain – 500mm internal diameter	137 - 158
Concrete bed for carrier drain – 900mm internal diameter	413 - 476
Filter drain pipe – 150mm internal diameter	28 - 32
Filter drain pipe – 225mm internal diameter	92 - 106
Filter drain pipe – 300mm internal diameter	116 - 134
Filter drain pipe – 375mm internal diameter	85 – 98
Precast concrete manhole – type 2a chamber (1500 dia with 700 dia pipe) with Grade B125 cover, 2,500mm deep	127 - 146
Precast concrete manhole – type 3a chamber (1200 dia with 300 dia pipe) with Grade B125 cover, 3,500mm deep	98 - 112
Catchpit – type 7 chamber with Grade B125 cover, 1,500mm deep	139 - 160
Gully grating and frame – class D400 to drainage channel, iron, 255mm wide	5 – 6
Channels – dished channel, 440 x 150mm	62 - 71
Headwalls – mass concrete type 2, 100mm diameter pipe	11 - 13
Series 0600: Earthworks	

Material Resource	Estimated Range of Embodied Carbon Emissions (tCO_2e)
Imported virgin aggregates	148 - 170
Site-won aggregates	401 - 461
Imported soil / general fill (including site-won topsoil, soil and general fill)	33,096 – 38,060
Imported topsoil	84 - 97
Geotextiles	34 - 39
Series 0700: Pavement & Series 1100: Kerbs, Footways and Paved Areas	
Surface course (TS2010) (40mm thickness)	62 - 71
Surface course (5% binder)	6 - 7
Base course (180mm thickness)	1,037 – 1,192
Binder course (60mm thickness)	124 - 143
Regulating course	71 - 82
Sub-base – primary aggregates	737 - 848
Sub-base – recycled aggregates	298 - 343
Kerbs	135 - 156
Series 1200: Traffic Signs	
Road markings	63 - 73
Road studs	31 - 36
Series 1500: Highways Communications	
Power cables	15 - 17
Signal and communications cables	18 - 21
UPVC cable duct	23 - 26
Series 1600: Piling and Embedded Retaining Walls	
Precast concrete piles	2,720 – 3,128
Series 1700: Structural Concrete	
Insitu Concrete	3,101 – 3,566
Precast concrete	1,577 – 1,814
Recycled steel rebar	1,404 – 1,614
Formwork	75 – 86
Associated with Rail Track	
Track (steel bearers)	220 - 253
Ballast (primary aggregates)	37 – 43
Total Embodied Carbon Emissions (tCO_2e)	48,065 – 55,278

18.4.16. Table 18.12 indicates that the range of total tCO_2e for the Proposed Scheme is 48,065 to 55,278. Therefore, the impact would be adverse, direct and permanent with the scale of magnitude, Major in accordance with the criteria set out in Table 18.4.

Waste Assessment

18.4.17. The main likely arisings from the construction of the Proposed Scheme are indicated in Table 18.13 below. Earthworks are the main component considered to create waste during construction.

18.4.18. Excavated materials which are considered unacceptable, either geotechnically or chemically, for re-use as part of the Proposed Scheme would require off-site disposal/treatment.

18.4.19. The Waste Hierarchy has been considered when assessing the potential for re-use / recycling and disposal with the most appropriate option being selected for the material in question.

Table 18.13: Likely Arisings

Material Resource	Amount (m^3)	Amount (tonnes)
Bricks – for landfill	5	6
Concrete – for recycling	872	1,081
Concrete – for landfill	640	794
Metals – for recycling	647	272
Metals – for landfill	25	11
Wood – for composting	250	85
Soils – geotechnically unsuitable for reuse onsite	55,769	69,711
Total Arisings (tonnes)		71,960

18.4.20. Table 18.13 indicates that likely arisings from construction of the Proposed Scheme total approximately 71,960 tonnes, with the largest component being soils geotechnically unsuitable for re-use on site.

18.4.21. 803,702m^3 (equivalent to 1,004,628 tonnes) of excavated soils and peat and approximately 59,703m^3 (equivalent to 74,629 tonnes) of site-won aggregates would potentially be suitable for reuse as part of the Proposed Scheme. This accounts for approximately 94% of all the expected excavated material for the Proposed Scheme. Approximately 55,769m^3 (or 69,711 tonnes) of excavated soils (6% of all excavated material) are likely to be considered to be unsuitable for reuse onsite and treated as a waste material for off-site reuse or disposal.

18.4.22. It is anticipated that all of the excavated peat / peaty soil could be reused onsite.

18.4.23. With regard to bricks, concrete, metals and wood, the identified waste facilities would likely have sufficient capacity to deal with these materials. However, the identified waste facilities do not have the capacity to treat / handle / dispose of the predicted quantities of unsuitable soils.

18.4.24. In terms of available waste facilities to deal with these materials, these were classified as high sensitivity due to a lack of waste capacity to deal with some waste streams (i.e. unsuitable soils). Given that approximately 94% of all predicted arisings could be reused onsite, with the remainder dealt with either by recycling / composting or at an appropriately licensed facility, the impact magnitude is considered to be Minor. Therefore, the significance of the likely waste arisings is expected to be adverse, direct, permanent and **Slight/Moderate** significance.

Policy Assessment

18.4.25. An assessment of compliance with key legislation / policy relevant to the Proposed Scheme is provided in Chapter 19 (Policies and Plans)

18.4.26. Table 18.14 below provides a summary of the 'impacts' of the Proposed Scheme on the interaction and compliance with legislation and policies relevant to the Materials assessment.

Table 18.14. Compliance of the Scheme with Relevant Policies / Legislation

Legislation / Policy	Description of Interaction	Compliance
Directive on Waste (2008/98/EC)[iv]	The management of waste throughout the project would use the waste hierarchy and prioritise waste prevention and encourage reuse and recovery on site before considering treatment or disposal options.	Yes
Environmental Protection Act 1990, Part II[vi]	The construction Contractor would ensure that excess materials produced during construction would be handled, disposed of or recovered without harming the environment.	Yes
Climate Change (Scotland) Act 2009[v]	There is a major impact with regard to embodied carbon emissions. However, the UK Government recognises states that regarding carbon associated with road schemes, there is up-front recognition of material demands and associated embodied carbon issues. In addition, Transport Scotland is committed to minimising carbon emissions of construction through use of the CMS Projects Carbon Tool.	No
Waste (Scotland) Regulations 2011[x]	Mitigation measures aim to prevent or to reduce, as far as possible, the negative environmental effects of landfilling.	Yes
Zero Waste Plan 2010[viii] / Zero Waste Regulations 2012ix	The construction Contractor of the Proposed Scheme would ensure that waste materials are treated as high up the waste hierarchy as possible by preventing, reusing or recycling waste whenever feasible and to achieve the best overall environmental outcome.	Yes
Transport Scotland Corporate Plan (2012 – 2015)xv	The Proposed Scheme would utilise the CMS to report the total carbon load. Through implementation of a Site Waste Management Plan (SWMP) and Waste and Resource Action Programme (WRAP) Construction Commitments would reconcile the specific commitments relating to materials.	Yes
Scottish Planning Policy (2014)	The Proposed Scheme would aim through design and during construction / operation to minimise waste produced.	Yes

18.5. Potential Mitigation

18.5.1. At DMRB Stage 3, the design of the Proposed Scheme has been sufficiently developed to allow detailed mitigation to be specified based on current legislation, guidance and good practice to minimise the impacts on material resource and waste facilities,

wherever possible. Mitigation for some impacts regarding Materials has been primarily through the design process detailed in earlier chapters (Chapter 4 Iterative Design Development / Chapter 5 The Proposed Scheme).

18.5.2. The mitigation proposed is based on the impact assessment in Section 18.4, with residual effects detailed in Section 18.6.

Mitigation during Construction

18.5.3. Standard measures to mitigate potential impacts associated with the use and consumption of materials and the production and management of waste during construction are detailed in Table 18.15 below. Further details relating to timing of mitigation and consultation/approval requirements are set out in Chapter 21.

18.5.4. The standard mitigation measures listed will be specified as environmental commitments in the contract documents to ensure implementation by the appointed Contractor.

Table 18.15: Materials Mitigation

Mitigation Item	Description
SMC-M1	Prior to construction a Site Waste Management Plan (SWMP) will be developed as part of the CEMP (see **Mitigation Item SMC-S1**) to set out how all construction phase materials will be managed and it will be updated regularly during the construction of the proposed scheme. The SWMP will identify, prior to the start of construction works, the types and likely quantities of wastes that may be generated and it will set out, in an auditable manner, how waste will be reduced, re-used, managed and disposed of in accordance with relevant Zero Waste Scotland Guidance. The SWMP will include specific materials management and soil management plans developed under voluntary and industry regulated Codes of Practice including: • Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA, 2009); • Land Remediation and Waste Management Guidelines (SEPA, 2009); and • Promoting the Sustainable Reuse of Greenfield Soils in Construction (SEPA, 2010). Appropriate waste minimisation and associated KPI targets will also be included.
SMC-M2	The Contractor will comply with all relevant waste legislation in relation to waste handling, storage, transport and disposal (e.g. The Waste Framework Directive) and consultation with SEPA for advice on waste practice, licences and exemptions where appropriate.
SMC-M3	The Contractor will apply the principles of the 'Waste Hierarchy' (Prevention, Prepare for Reuse, Recycling, Other Recovery, Disposal) to minimise waste generation, maximise re-use of site-won materials on-site and minimise the need for disposal of waste. Where re-use is not possible within the proposed scheme, alternative re-use and recycling options will be sought off-site with disposal the final option, with clear justification of options provided.
SMC-M4	The Contractor will implement Zero Waste Scotland's Design for Resource Efficient Construction Principles.
SMC-M5	The key material elements (i.e. aggregates, asphalt, cement, precast concrete products, ready-mixed concrete and steel) used within the proposed scheme shall be specified to be responsibly sourced.
SMC-M6	All timber and timber products shall be sourced from independently verifiable legal and sustainable sources.

Mitigation Item	Description
SMC-M7	Alternatives to primary aggregates shall be investigated, including opportunities to use recycled or secondary aggregates in the construction of the proposed scheme; either sourced from construction, demolition and excavation waste obtained on-site or off-site; or secondary aggregates obtained from a non-construction or post-consumer or industrial by-product source.
n/a (note)	*Further to the above, the following mitigation items detailed in Table 21.2 (Community and Private Assets), Table 21.4 (Geology, Soils and Contaminated Land), Table 21.5 (Road Drainage and the Water Environment) and Table 21.9 (Air Quality) will be implemented to ensure the appropriate management and handling of materials: Mitigation Items SMC-CP8, SMC-G3, SMC-G8, SMC-G9, SMC-G11, SMC-G15, SMC-W2, SMC-W6 to SMC-W10, SMC-AQ1 and SMC-AQ2.*

18.5.5. The principal mitigation will be the CEMP and this will include the following principles:

- materials could be ordered to arrive when required for construction and the quantities would be accurately predetermined
- damage during receiving and storage could be minimised by ensuring storage in accordance with manufacturers' guidelines and in designated areas with offloading supervised by competent personnel using appropriate equipment
- use of renewable materials from legal and sustainable sources (such as timber with appropriate certification)'
- make use of existing waste management infrastructure for sourcing non-virgin and recycled materials

18.5.6. An Outline Soil and Peat Management Plan has been produced as Appendix A10.2 in Volume 2 which outlines the proposals regarding reuse and disposal of soils and peat. This will be further developed by the Construction Contractor prior to commencing construction once more detailed ground investigation and assessment has been carried out.

18.5.7. It is anticipated that all of the peaty soil and peat could be reused onsite for fill and dressing on landscaping embankments.

Summary

18.5.8. Table 18.16 provides a summary of the impacts, proposed mitigation and residual impacts as required by draft HD 212/11 (Detailed Assessment Reporting Matrix).

Table 18.16. Detailed Assessment Reporting Matrix

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impacts
Site Preparation	Impacts associated with site clearance – production of green waste / metal vehicle restraint system for recycling / disposal	Removal of material offsite for composting / recycling. Adequate waste capacity, medium sensitivity of waste site. Impact: Adverse, temporary, direct .Minor magnitude; Slight significance	Prior to construction, a CEMP/SWMP will be developed to set out how all construction phase materials will be managed.	A CEMP / SWMP shall be put in place and adhered to by the contractor. This should be regularly updated during the construction of the scheme. The plan will identify the types and quantities of wastes that will be generated and it will set out in an auditable manner, how waste will be reduced, reused, managed and disposed of. Compliance with all relevant waste legislation in relation to waste handling, storage, transportation and disposal. Where reuse is not possible, alternative reuse and recycling options will be sought offsite with disposal the final option. Clear justification of the options will be provided. The contractor shall carry out the works in such a way to minimise the amount of materials required and waste	Residual impact: Minor, Adverse, temporary, direct. Residual Significance: Slight
Demolition	Demolition of structures resulting in production of inert waste	Reuse of minimal amount of bricks unlikely. Removal of material offsite for reuse via transfer / treatment site. Adequate waste capacity, medium sensitivity of waste site. Impact: Adverse, temporary, direct, Negligible magnitude; Neutral / Slight significance			Residual impact: Minor, adverse, temporary, direct. Residual Significance: Neutral / Slight
Site Construction	Depletion of natural resources	The Proposed Scheme's total potential consumption of mineral resources during construction is likely to be approximately 5-6% if the total primary	Based on the assessment, the following would be implemented: Existing road pavement would be recycled for reuse;		Residual Impact: Minor, adverse, permanent, direct. Residual Significance: Neutral / Slight

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impacts
		aggregates produced in the study area in 2012. Low sensitivity of mineral resources. Impact: Adverse, permanent, direct, Minor magnitude; Neutral / Slight significance	Maximise the amount of site-won soil, topsoil and general fill (c.1,079,257 tonnes of site-won materials to potentially be reused) The following recommendations should also be taken into account: Materials could be ordered to arrive when required for construction and the quantities accurately predetermined; Damage during receiving and storage could be minimised by adhering to manufacturers' guidelines and using designated areas with competent personnel using appropriate equipment to offload materials; Use of renewable materials from legal and sustainable sources; Make use of existing waste management infrastructure for sourcing non-virgin and recycled materials.	produced through design, cost benefit and risk iterations.	
	Embedded carbon emissions due to use of site won and imported materials	Overall embodied carbon emissions are estimated to be in the range of 48,065 – 55,278tCO_2e. The impact would be adverse, direct and permanent. Scale of Impact: Major			Mitigation measures are unlikely to result in lowing the total embodied carbon emissions for the Proposed Scheme to below 40,000tCO_2e (Moderate impact). Residual impact: Major

Project Activity	Potential Impacts Associated with Material Use / Waste Production	Description of the Impacts	Brief Description of Mitigating Measures	Description of how the Measures would be Implemented, Measured and Monitored.	Residual Impacts
	Production of large volumes of waste materials	Storage, treatment and disposal of unsuitable material offsite. Waste capacity only adequate for some wastes. High sensitivity of waste sites. Impact: Adverse, permanent, direct, Minor magnitude; Slight / Moderate significance	A SWMP shall be produced to address the likely waste arisings. An outline Soil and Peat Management Plan has been produced as Appendix A10.2 and outlines proposals regarding the reuse and disposal of soils and peat (c.1,079,257 tonnes of site-won materials to potentially be reused).		Given that the majority of the site won materials (94%) could be re-used onsite with the rest being recycled and minimal landfilling, the impact magnitude is reduced to Negligible, adverse, permanent, direct. Residual Significance: Slight
Operation	N/A	N/A	N/A	N/A	N/A

18.6. Residual Effects

18.6.1. The majority of the residual impacts relating to materials are not able to be absolutely predicted as they will be dependent on the methods by which the Contractor implements the mitigation commitments. It is not possible at this stage of the assessment to identify how the generated waste will be treated.

18.6.2. It should be stated that at all stages of the construction of the Proposed Scheme, the Contactor will strive to minimise waste, re-use as much material as possible on-site, recycle / recover as much waste that cannot be used on-site as possible and minimise carbon emissions. Therefore, the mitigation accord with relevant legislation, policy and guidance included in this chapter.

18.6.3. The overall residual impact magnitude for material resources is anticipated to be major based on the assessment of embodied carbon emissions. Reductions in carbon emissions that occur due to the proposed mitigation commitments are unlikely to lower the total embodied carbon emissions for the Proposed Scheme to below 40,000tCO_2e. A reduction to below 40,000tCO_2e will be required in order to demonstrate a reduced magnitude of impact from Major to Moderate.

18.6.4. However, in terms of overall carbon budget, the UK 3rd Carbon Budget (2018 to 2022) is 2,544 million tCO_2e. The Proposed Scheme's total embodied carbon emissions represents a very small proportion (<0.001%) of this carbon budget.

18.6.5. The assessment of the generation and management of waste predicted the residual impact would be negligible magnitude and **Slight** significance, which is not considered to be significant in terms of the EIA Regulations.

18.7. References

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[ii] Highways England *et al*, (unpublished). Design Manual for Roads and Bridges, Volume 11, Section 3, Part 6: HD 212/11, Materials (Draft).
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[xxii] SEPA, (2017). Waste Data 2015, available from : https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/ (accessed May 2017)
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[xxvii] British Geological Survey. (2014). Directory of Mines and Quarries 2014.
[xxviii] SEPA, (2017). Business Waste Data 2014, available from : https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/ (accessed May 2017)