

18 Materials

18.1 Introduction

18.1.1 This chapter presents the Environmental Impact Assessment (EIA) of the use and consumption of material resources and the production and management of waste, that can reasonably be anticipated with the construction of Project 8 – Dalwhinnie to Crubenmore of the A9 Dualling Scheme (the ‘Proposed Scheme’, as described in **Chapter 5**). It identifies measures for mitigating potential environmental impacts and effects, where possible, and describes the significance of the residual impacts and effects that remain after mitigation.

18.1.2 In accordance with ‘*Design Manual for Roads and Bridges*’ (DMRB) guidance, the assessment excludes potential impacts associated with the transport of materials to/ from the Proposed Scheme extents.

18.2 Approach and Methods

18.2.1 This assessment addresses ‘Materials’ in accordance with the aims and objectives of DMRB, Volume 11, Section 1, Part 1, ‘*Aims and Objectives of Environmental Assessment*’ (HA 200/08) which identifies ‘Materials’ as an EIA topic to be assessed.

18.2.2 The assessment has been undertaken in accordance with unpublished draft guidance DMRB Volume 11, Section 3, Part 6 HD 212/11 ‘*Materials*’ (Highways Agency *et al*, 2012) which considers the environmental impacts associated with:

- The use and consumption of ‘Material Resources’ from primary and recycled/ secondary sources, and manufactured construction products; many material resources will originate off-site, purchased as construction products, and some will arise on-site such as excavated soils or recycled road planings
- The production and management of ‘Waste’, defined by Article 1(a) of the ‘*European Waste Framework Directive 2008/98/EC*’ as “*any substance or object in the categories set out in Annex I which the holder discards or intends to discard or is required to discard*”. Waste can be further classified as hazardous, non-hazardous or inert waste as follows:
 - Inert waste: waste that does not undergo any significant physical, chemical or biological transformations, e.g. rock, naturally occurring soils (excluding topsoil, peat and soil and stones from potentially contaminated sites), cemented materials, etc.
 - Non-hazardous waste: waste that is not hazardous but does undergo a physical, chemical or biological transformation, e.g. topsoil, timber, metal, plastics etc.
 - Hazardous waste: waste that contains substances or has properties that might make it harmful to human health or the environment, e.g. batteries, mineral oils, etc.

18.2.3 HD 212/11 promotes 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 impacts and where the extent of these can be quantified after the ‘Simple Assessment’ stage (i.e. at DMRB Stage 2). In accordance with HD 212/11, this chapter presents a ‘Detailed Assessment’.

- 18.2.4 The objective of the Detailed Assessment is to gain an in-depth appreciation of the environmental consequences of the use and consumption of materials, and the production and management of waste, associated with the Proposed Scheme (HD 212/11).
- 18.2.5 The Detailed Assessment utilises and builds on the information and data gathered at the Scoping (DMRB Stage 1) and Simple (DMRB Stage 2) assessment levels, and collates additional information to quantify as accurately as possible the materials required for the Proposed Scheme, forecasting the quantities and types of waste which are likely to be produced (HD 212/11).
- 18.2.6 The Detailed Assessment, for the purposes of the Materials topic, is therefore largely a desk-based quantitative study that aims to identify the following:
- baseline data for the Proposed Scheme
 - information about the design, potential construction methods and techniques
 - the principal material types required and, where information is available, the quantities
 - the anticipated waste arisings and, where information is available, the quantities and type (e.g. inert, non-hazardous, hazardous)
 - the key environmental impacts, the magnitude or significance associated with materials resource use and waste, and the measures which will be implemented to mitigate those impacts
 - the alignment of the Proposed Scheme proposals with the regulatory and policy context, as reported in **Chapter 19** and **Appendix 19.1**, contained within **Volume 2** of this report.
- 18.2.7 The assessment is reported using the Detailed Assessment Reporting Matrix provided for 'Material Resources' and 'Waste' in HD 212/11. Mitigation measures developed to address identified environmental impacts are reported using the Mitigation Measures Matrix provided in HD 212/11.
- ### Scope
- 18.2.8 The assessment primarily focuses on the potential environmental impacts arising from the construction of the Proposed Scheme in the form of the:
- embodied carbon emissions associated with material extraction, manufacturing and any pre-distribution transportation (i.e. 'cradle-to-gate emissions' as defined in **paragraph 18.2.23**)
 - use of natural resources, notably the depletion of non-renewable mineral resources (e.g. crushed rock and sand and gravel)
 - generation and management of waste on-site, and potential impact on the available off-site waste management infrastructure
 - potential alignment of the Proposed Scheme proposals with the legislative and policy framework for sustainable development, material resources and waste
- 18.2.9 Operational (maintenance) impacts associated with the use of materials and waste generation have not been assessed, as they were considered not to be significant in the context of the Proposed Scheme, and would be similar to the operational and maintenance regime of the existing A9.

Study Area

18.2.10 The study area for the Materials topic includes the:

- Project 8, Dalwhinnie to Crubenmore, extents as described in **Chapter 5**
- Global climate system as the ultimate receptor of any new greenhouse gas (embodied carbon) emissions generated from constructing the Proposed Scheme
- Tayplan and Highland & Moray Scottish Aggregates Survey areas (including the Perth & Kinross, Angus, Fife North, Dundee City, The Highland Council (THC) and Moray Mineral Planning Areas (MPAs)) which are likely to be the primary source of construction aggregates
- Perth & Kinross Council (P&KC), Angus Council, Dundee City Council, THC and Moray Council areas where the waste management infrastructure, likely to be used in managing the majority of waste generated by the Proposed Scheme, is located

18.2.11 The study area for the available waste management infrastructure has been further delineated based on an approximate HGV journey distance of 100km from the extents of the A9 Dualling Central Section (Glen Garry to Dalraddy). This distance was selected using the guidance on estimating transport distances provided for the Highlands geographic region in Transport Scotland's Carbon Management System (CMS) Projects Carbon Tool. The study area has been delineated based on an approximate 100km road journey using the Scottish Trunk Road Network (to avoid local roads and villages), and not as the crow flies.

Baseline Data

18.2.12 In reporting the Detailed Assessment, the following baseline data has been gathered from desk-based reviews of existing information, and analysis and review of available stakeholder information:

- a description of the study area, including information about current material use and details of the types and quantities of wastes generated
- the key legislative and policy instruments influencing the consideration of the environmental assessment of material resources and waste
- the sensitivity of the global climate system to continued greenhouse gas emissions
- an assessment of the regional available landbank for sand and gravel, and crushed rock (chosen to act as a proxy indicator of regional natural resources), facilitated by a review of the '*Scottish Aggregates Survey Report 2012*' (published 2015)
- an assessment of the waste management infrastructure available to treat and dispose of the waste anticipated to be generated by the Proposed Scheme. This included: the types of waste management facilities, such as landfill sites, recycling/ sorting facilities, transfer stations and exempt sites; the locations of permitted waste management facilities within an appropriate distance of the Proposed Scheme extents as defined in **paragraph 18.2.11**; and the capacities and waste types the identified facilities can accept, via a review of the following Scottish Environment Protection Agency (SEPA) documents:
 - SEPA (2015) '*Scottish waste sites and capacity tool*'
 - SEPA (2015) '*List of waste sites and capacities in Scotland*'
 - SEPA (2015) '*List of landfill sites and capacities in Scotland*'

- 18.2.13 At this stage, no further direct consultation has been undertaken with SEPA, P&KC, Angus Council, Dundee City Council, THC and Moray Council, as the stakeholder information required to support the Detailed Assessment was readily available via sources identified above.

Assessment Parameters

- 18.2.14 The DMRB Stage 3 Bill of Quantities (BoQ) for the Proposed Scheme has facilitated the completion of the Detailed Assessment as follows:
- embodied carbon emissions associated with the extraction, manufacturing and any pre-distribution transportation of the major material types likely to be used (i.e. site won soils/ rock and imported aggregates, asphalt, bitumen, concrete, metal, concrete and plastics products) have been estimated using Transport Scotland’s Carbon Management System (CMS) Projects Carbon Tool
 - depletion of natural mineral resources has been estimated based on the quantities of key aggregate-using products (sub-base, base course, binder course, surface course, capping and drain filter/ bedding materials) to be used
 - construction, demolition and excavation (CD&E) waste arisings have been estimated through a number of methods, including the application of material specific wastage rates to the materials identified in the BoQ, reference to the Site Clearance BoQ information, material take-offs for existing structures to be demolished, and review of DMRB Stage 3 model requirements for earthworks quantities
- 18.2.15 These assessment parameters have been used to assess the significance of environmental effect (based on the value/ sensitivity of the receptor and the magnitude of the impact), prior to and after mitigation, using the criteria provided in **paragraph 18.2.16** to **paragraph 18.2.33**.

Assigning the Value (Sensitivity) of the Receptor

Embodied Carbon Emissions

- 18.2.16 The assessment of embodied carbon emissions has been based on quantifying the Proposed Scheme’s material requirements. The magnitude of the environmental impact has been assigned, where possible, through the use of a proxy in the form of the embodied carbon emissions associated with specific materials and construction products (HD 212/11).
- 18.2.17 Consequently, this precludes the application of a methodology to derive a measure of the significance of effect based on the value of a resource/ receptor and the magnitude of an identified impact (HD 212/11).
- 18.2.18 The magnitude of the impact, and hence the scale, has therefore been assigned without regard to the value of the resource/ receptor according to the criteria provided in **Table 18-3** below.

Depletion of Natural Resources

- 18.2.19 Assessing the scale and significance of the potential impacts associated with the depletion of natural resources has been based on a combination of quantities of mineral resources to be used by the Proposed Scheme, and the effects that the forecast consumption will have on the available minerals landbank. The assessment therefore reflects both the relative quantities of primary aggregates to be consumed, and the sensitivity of regional mineral resources to further extraction.

- 18.2.20 The value and/ or sensitivity of the regional natural resource (sand and gravel, and crushed rock) has been assigned as described in **Table 18-1** below.

Table 18-1: Value/ sensitivity of regional natural resources (based on professional judgement)

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

Waste Management

- 18.2.21 Assessing the scale and significance of the potential impacts associated with the production and management of waste has been based on a combination of the waste management methods likely to be employed, and the effects that forecast waste arisings will have on the available waste management infrastructure. In this way, the assessment reflects both the relative quantities of waste produced, and the position within the waste hierarchy of the likely waste management methods (HD 212/11).
- 18.2.22 The value or sensitivity of the receptor has been assigned as described in **Table 18-2** below.

Table 18-2: Value/ sensitivity of the waste management infrastructure receptor (HD 212/11)

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

Assigning Magnitude of Impact

Embodied Carbon Emissions

- 18.2.23 The carbon assessment boundary utilised in this assessment is based on the 'Product Stage', as defined in the Publicly Available Specification (PAS) 2080:2016 'Carbon Management in Infrastructure' as the total carbon dioxide equivalent emissions associated with:
- raw material extraction, precursor product processing, and final product manufacture, and the energy use and waste management within these processes
 - transportation of materials and goods within the supply chain, up to the point of the final factory gate
- 18.2.24 As per the HD 212/11 requirements, the assessment does not include the carbon emissions associated with the boundary of 'Construction Process Stage', which is defined by PAS 2080:2016 as the total carbon dioxide equivalent emissions associated with:
- transportation of products/ materials and construction equipment from point of production (or point of storage in the case of plant and machinery) to the construction-site

- environmental conditions required to keep materials in a required state
- processing waste materials (due to spillage or damage during transportation) and the provision of new material
- construction-site works activities including:
 - temporary works, ground works, and landscaping
 - materials storage and any energy, or otherwise, needed to maintain necessary environmental conditions
 - transport of materials and equipment within the site
 - installation of materials and products
 - emissions associated with site water demand
 - waste management activities (transport, processing, final disposal) associated with waste arising from the construction-site
 - production, transportation, and waste management of materials/ products lost during works

18.2.25 Due to the absence of data and the complexity in modelling the fuel/ electricity consumption associated with the 'Construction Process Stage', these emissions will be reported by the contractor throughout the course of construction using Transport Scotland's CMS Projects Carbon Tool, or equivalent. The magnitude of embodied carbon impact, and hence the scale, has been assigned according to the criteria provided in **Table 18-3** below.

Table 18-3: Magnitude of impact for embodied carbon emissions (HD 212/11)

Magnitude of Impact	Total CO ₂ e of Materials (Tonnes)
Major	> 40,000
Moderate	20,000 – 40,000
Minor	5,000 – 20,000
Negligible	1,000 – 5,000
No change	<1,000

Depletion of Natural Resources

18.2.26 The magnitude of the impact for natural resources has been assessed against the scale provided in **Table 18-4** below.

Table 18-4: Magnitude of impact for depletion of natural resources (based on professional judgement)

Magnitude of Impact	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) in relation to the use of mineral resources

Waste Management

- 18.2.27 The magnitude of the impact for waste management has been assessed against the scale provided in **Table 18-5** below.

Table 18-5: Magnitude of impact for waste (HD 212/11)

Magnitude of Impact	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 recycling or further segregation at a materials recovery facility
Negligible	Wastes are predominantly re-used on-site or at an appropriately licensed or registered exempt site elsewhere

Assigning Significance of Effect

- 18.2.28 The significance of effect has been assigned before, and after, consideration of the effectiveness of any mitigation measures required to prevent, reduce or offset any significant adverse effects from the consumption of materials and the generation and management of waste.

Embodied Carbon Emissions

- 18.2.29 The scale of the magnitude of impact in **Table 18-3** above was based on benchmarking data from previous roads projects, where the magnitude of embodied carbon emissions as a result of material use has been quantified. HD 212/11 recognises that, although the scale of the magnitude is not strictly a measure of the significance of the effect, in the absence of a true measure of significance, it provides an indication of the severity or otherwise of the identified impacts.

Depletion of Natural Resources and Waste Management

- 18.2.30 **Table 18-6** below has been used to determine the significance of effect in relation to the depletion of natural resources and waste management based on the value/ sensitivity of the receptor and the magnitude of the impact.

Table 18-6: Significance of effect for depletion of natural resources and waste management (HD 212/11)

		Value/ Sensitivity of the Receptor			
		Very High	High	Medium	Low
Magnitude of Impact	Major	Very Large	Very Large / Large	Large/ Moderate	Moderate/ Slight
	Moderate	Very Large/ Large	Large/ Moderate	Moderate	Slight
	Minor	Large/ Moderate	Moderate/ Slight	Slight	Slight/ Neutral
	Negligible	Slight	Slight	Slight/ Neutral	Neutral

Determining What Level of Significance is Considered Significant

- 18.2.31 The Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017 requires an Environmental Statement to include “a description of the likely significant effects of the project on the environment” but neither it, nor HD 212/11, gives advice as to what level of significance is considered significant for the purposes of EIA.

- 18.2.32 In the absence of this information, the assessment has utilised the ‘*Descriptors of the Significance of Effect Categories*’ provided in DMRB Volume 11, Section 2, Part 5 ‘*Assessment and Management of Environmental Effects*’ (HA 205/08), and reproduced them in **Table 18-7** below to frame discussions of significance.

Table 18-7: *Descriptors of the Significance of Effect Categories (HA 205/08)*

Significance Category	Typical Descriptors of Effect
Very Large	Only adverse effects are normally assigned this level of significance They represent key factors in the decision making process These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity However, a major change in a site or feature of local importance may also enter this category
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor
Slight	These beneficial or adverse effects may be raised as local factors They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error

- 18.2.33 For the purposes of this assessment, significance of effect categories of ‘Very Large’ and ‘Large / Very Large’ for the depletion of natural resources and waste management (as shown in **Table 18-6** above), are likely to be considered ‘significant’ in the context of the EIA regulations and typical descriptors of effect provided in HA 205/08 (i.e. due to the increased likelihood of being key factors or material in the decision-making process).
- 18.2.34 It has not been possible, for the reasons discussed above in **paragraph 18.2.29**, to derive a measure of the significance of effect from the Proposed Scheme’s embodied carbon emissions using the standard EIA terminology described above. However, given the Institute of Environmental Management and Assessment (IEMA) (2017) principle that all new greenhouse gas emissions might be considered significant, estimating the Proposed Scheme’s embodied carbon contribution has enabled the magnitude of impact to be contextualised against national carbon budgets in order to provide an additional sense of scale. This approach is consistent with the latest good practice guidance promoted by IEMA (2017) on assessing greenhouse gas emissions and evaluating their significance.

Assigning Mitigation

- 18.2.35 According to HD 212/11, where adverse effects associated with the use and consumption of materials and the production and management of waste have been identified, mitigation measures should consider avoidance, reduction and remediation. As such, the assessment presents mitigation measures to minimise all adverse effects identified, where these are of Slight/ Neutral adverse significance or higher as per **Table 18-6** above.

18.3 Baseline Conditions

- 18.3.1 The baseline conditions, for the purposes of assessing the potential environmental impacts associated with Materials, are considered to be homogenous across the Proposed Scheme extents.

Existing Materials Use and Waste Generation

- 18.3.2 The key materials resources used in the maintenance of the existing A9 are likely to include primary raw materials such as aggregates and manufactured construction products such as asphalt, bitumen products, sealants, thermoplastics, paints.
- 18.3.3 Waste produced during the operational maintenance of the existing A9 is likely to include soft estate vegetative arisings, gully arisings, oil separator waste, animal by-products, litter and road planings, etc. At the time of writing there were no figures available regarding the baseline quantities of operational/ maintenance materials used and waste generated across the study area.

Global Climate System

- 18.3.1 The Intergovernmental Panel on Climate Change (IPCC, 2013) states that “*Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions*”. Furthermore, IPCC (2014) reports that in order to remain below a 2°C threshold (the level defined as dangerous climate change impacts by the IPCC), global greenhouse gas emissions must remain within a carbon budget of 1,000 billion tonnes.
- 18.3.2 As described above, the adoption of the HD 212/11 methodology precludes the need to assign a value/ sensitivity to the global climate system for the purposes of this assessment.

Natural Resources (Primary Aggregate)

- 18.3.3 ‘Primary aggregate’ is defined by the British Geological Society as “*aggregate produced from naturally occurring mineral deposits and used for the first time*”.
- 18.3.4 The Department for Environment Food & Rural Affairs (Defra, 2011) identifies “*primary aggregates as being at risk of future scarcity for the UK construction and civil engineering sector*”.
- 18.3.5 In the UK, aggregate minerals such as sand, gravel and crushed rock, are not physically scarce. However, Defra (2011) states that there is considerable concern regarding the security of domestic supply due to the local geopolitical context.
- 18.3.6 Whilst there is no danger of physically running out of such resources, Defra (2011) suggests that competition for land (frequently with environmental designations, such as National Parks) and negative public perceptions towards mineral development, have made it increasingly difficult for aggregate companies to secure permits to exploit these resources. In addition, aggregates are not economical to transport long distances, therefore lack of local availability of primary aggregates poses a potential supply risk in the aggregates sector. Correspondingly, access to such resources is currently a major concern in the UK’s mineral industry.
- 18.3.7 Scottish Planning Policy (SPP) 4: ‘*Minerals*’, continues the UK landbank approach to planning for the supply of construction 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 ten-year period, based on current production levels. The ten-year period recognises the likely time scale between an operator deciding that there is a need for a new site, and bringing the site into full production.

- 18.3.8 The ‘*Scottish Aggregates Survey Report 2012*’ (published in 2015) confirms that for the Tayplan and Highland and Moray aggregates survey area, the combined available landbank at the end of 2012 was 24 years for hard rock and 23 years for sand and gravel. This survey also confirms that in 2012 these areas produced a total of 8,236,000 tonnes of primary aggregates (6,888,000 tonnes of hard rock and 1,348,000 tonnes of sand and gravel).
- 18.3.9 A review of the British Geological Survey (BGS, 2014) ‘*Directory of Mines and Quarries*’ suggests that the mines and quarries in the P&KC, Angus Council, Fife Council, THC and Moray Council MPAs are able to supply a wide range of materials, including but not limited to aggregate, concrete and asphalt products.
- 18.3.10 These data indicate that there is likely to be a good landbank of both crushed rock and sand and gravel in the study area at the time of assessment. For the purposes of assessment this is likely to equate to the study area having a **Low** sensitivity to the depletion of primary aggregates; i.e. the study area has good supplies of mineral resources. These data were accurate as of the end of 2012, but are likely to have changed in the interim as new planning permissions are granted and as existing reserves are worked. Nevertheless, policy, strategic and legislative drivers are likely to ensure that sufficient capacity is provided.

Waste Management Infrastructure

- 18.3.11 The construction of the Proposed Scheme is likely to produce a range of waste types including inert, non-hazardous and special (hazardous) wastes.
- 18.3.12 The majority of wastes are assumed to be inert and non-hazardous CD&E wastes. However, there will also be Municipal Solid Waste (MSW) generated by construction workers (e.g. canteen, office and staff welfare waste), and small quantities of hazardous waste (e.g. paints and solvents, admixtures, spill absorbent materials, waste lubricants, oil filters, waste electrical and electronic equipment, batteries, fluorescent light tubes and potentially asbestos containing materials within existing structures).
- 18.3.13 The available waste treatment and disposal infrastructure within the study area accepting commercial, industrial and hazardous waste is summarised in **Table 18-8** and **Table 18-9** below. A number of the aggregated waste facilities, identified in **Table 18-8**, operate more than one waste management activity on-site. The reported tonnages therefore represent the total wastes inputted to each facility type and not tonnages per activity. Similarly, the reported capacities are for the facility type as a whole, not per activity as these data are not currently published by SEPA.
- 18.3.14 A more detailed summary of the available waste management infrastructure is provided in **Appendix 18.1 (Volume 2)**, including the type, locations and capacities of each facility. The locations of the operational waste management infrastructure within the study area are identified in **Drawing 18.1 (Volume 3)**. These data have been ascertained through a review of the baseline information sources identified in **paragraph 18.2.12**.

Table 18-8: Aggregated authorised waste management facilities and capacities as of 31 December 2015

Waste Management Facility Type	Annual Waste Capacity (Tonnes)	Annual Waste Inputs (in 2015)	Utilised Capacity (%) (in 2015)
Civic amenity	73,215	38,457	52.5
Civic amenity / Composting / Landfill (closed)	300,000	14,146	4.7
Civic amenity / Other treatment	4,999	2,930	58.6
Civic amenity / Transfer station	296,920	178,902	60.3
Civic amenity / Transfer station / Landfill (closed)	7,000	5,774	82.5
Composting / Landfill (closed)	16,500	9,719	58.9
Incineration	150,000	90,651	60.4
Landfill	75,000	21,503	28.7
Landfill / Civic amenity	122,000	44,045	36.1
Waste Management Facility Type	Annual Waste Capacity (Tonnes)	Annual Waste Inputs (in 2015)	Utilised Capacity (%) (in 2015)
Landfill / Civic amenity / Other treatment	26,000	14,413	55.4
Landfill / Composting	145,000	23,839	16.4
Landfill / Transfer station / Composting / Other treatment	44,999	16,173	35.9
Metal recycler	128,329	32,424	25.3
Metal recycler / Transfer station	127,494	43,201	33.9
Metal recycler / Transfer station / Other treatment	87,000	3,105	3.6
Other treatment	65,599	44,589	68.0
Transfer station	828,444	247,325	29.9
Transfer station / Composting	70,800	59,868	84.6
Transfer station / Landfill (closed)	75,000	0	0.0
Transfer station / Other treatment	308,499	159,222	51.6

Table 18-9: Authorised landfill capacity as of 31 December 2015

Site Name	Site Activity				Capacity on Permit 2015 (t)		Remaining Capacity at the End of 2015 (t)		
	Hazardous	Non-hazardous	Inert	Asbestos cell	Annual	Total	Capacity (t)	Expected Rate of Infill (tpa)	Estimated Date for Ceasing Infill
Restenneth Landfill Site	x	√	x	x	145,000	3,240,000	687,255	Information not known	Information not known
Granish Landfill Site Cell 3, By Aviemore	x	√	x	x	25,000	126,000	800,000	12,000	Feb-2027
Ardownie Landfill, Monifieth	x	x	√	x	75,000	253,178	3,208	150,000	Dec-2035
Prettycur Landfill, Forfar	x	x	√	x	24,999	53,067	76,000	3,000	Dec-2016
Binn Farm Landfill	x	√	x	√	372,000	3,500,000	1,155,709	-	Mar-2015
Nether Dallachy Landfill Site	x	√	x	x	120,000	1,320,000	496,000	32,000	Aug-2020
Duisky Landfill Site, Kinlocheil, Fort William	x	√	x	√	24,000	590,000	400,000	12,500	Dec-2040

18.3.15 The baseline review suggests that there is likely to be adequate waste transfer, recycling and recovery capacity within the study area for the majority of wastes likely to arise from the

construction of the Proposed Scheme, but there is likely to be limited inert, non-hazardous and hazardous waste disposal capacity. The closest alternative inert and non-hazardous waste landfills, with suitable remaining capacity, are located in Fife (approximately 130 km away), Friockheim (approximately 140 km away) and Aberdeen (approximately 200 km away); and the closest hazardous waste landfill is located at Falkirk (approximately 170 km away).

- 18.3.16 In response to DMRB Stage 2 consultations, SEPA confirmed that Binn Farm Landfill is no longer accepting waste, and that the estimated date for ceasing infill at Restenneth Landfill and Prettycur Landfill is likely to occur before the start of Proposed Scheme construction. SEPA has since confirmed, in response to the DMRB Stage 3 consultations, that Granish Landfill is also no longer accepting waste. However, it has been suggested by SEPA that these sites may require inert materials and soils for capping and restoration purposes and therefore may be amenable to accepting any suitable surplus materials.
- 18.3.17 It is envisaged that the majority of waste arising from the Proposed Scheme will be re-used on-site or at an appropriately licensed or registered exempt site elsewhere, or segregated and sent for recycling or recovery at a materials recovery facility. This is likely to be required in order to demonstrate the Proposed Scheme's contribution to achieving Scotland's Zero Waste Plan target to recycle 70% of all waste, and landfill a maximum of 5% by 2025; and to comply with the material specific provisions of 'The Waste (Scotland) Regulations 2012' (e.g. banning the incineration or landfill of segregated waste).
- 18.3.18 For the purposes of assessment this is likely to equate to the available waste management infrastructure having a **Medium** sensitivity to any waste generated as a result of the Proposed Scheme, i.e. there is adequate waste management capacity for the majority of wastes arising during construction.

Summary

- 18.3.19 The baseline environment is comprised of receptors which have been identified based on the likely impacts and effects as set out in HD 212/11. These receptors and their value (or sensitivity) have been identified in **Table 18-10** below.

Table 18-10: Identification of the receptors that are relevant to the Materials assessment

Receptor	Value/ Sensitivity of the Receptor
Global climate system	Not applicable ; the adoption of the HD 212/11 methodology precludes the need to assign a value/ sensitivity to the global climate system for the purposes of this assessment.
Natural Resources (Primary Aggregates)	The baseline review indicates that there is likely to be a good landbank of both crushed rock and sand and gravel in the study area at the time of assessment For the purposes of assessment this is likely to equate to the study area having a Low sensitivity to the depletion of primary aggregates, i.e. the study area has a good supply of mineral resources
Waste Management Infrastructure	The baseline review suggests that there is likely to be adequate waste management capacity for the majority of wastes arising from the construction of the Proposed Scheme For the purposes of assessment this is likely to equate to the available waste management infrastructure having a Medium sensitivity to any waste generated as a result of constructing the Proposed Scheme

18.4 Key Issues and Limitations to Assessment

- 18.4.1 The environmental assessment presented in this chapter currently has limitations, as it is predominantly based on a desk-based review of the preliminary DMRB Stage 3 Bill of Quantities (BoQ) and preliminary earthworks volumes for the Proposed Scheme. These documents provide a preliminary estimate of the key materials likely to be required during construction; however, they do not quantify all material and products types that would be required. Therefore the estimated quantities presented in this assessment can only be taken as approximate and indicative, based on the available Stage 3 design information.
- 18.4.2 The embodied carbon emissions of site-won earthworks materials are zero rated in Transport Scotland's CMS Projects Carbon Tool, for the purposes of determining a project's design stage carbon footprint. Emissions for site-won materials are typically captured within the CMS during the construction phase using the Principal Contractor's plant fuel consumption activity, which is considered to be a more accurate method of measurement.
- 18.4.3 As a result, this risks potentially underestimating the embodied carbon impact of the Proposed Scheme's consumption of material resources during the EIA. Due to the scale of the earthworks associated with the Proposed Scheme, site-won engineering and landscaping fill items have therefore been recorded in the CMS as 'imported soil/ general fill' for the purposes of the EIA.
- 18.4.4 It is acknowledged that the embodied carbon coefficient for general (rammed) soil of 0.023 tCO₂e/t, as published in the University of Bath's Inventory of Carbon and Energy database and utilised in the CMS Project Carbon Tool and other carbon tools, is likely to significantly overestimate the fuel use associated with earthworks activities as it includes all the necessary processing required to produce rammed soil.
- 18.4.5 Reference to Hughes (2012) confirms that a more accurate embodied carbon coefficient for site-won earthworks materials is likely to be in the range of approximately 0.0007 – 0.003 tCO₂e/t depending on haul distances and excavator and articulated dump truck combinations. The CMS emissions factor for general (rammed) soil has therefore been overridden with an emissions factor of 0.003 tCO₂e/t (based on a 35T excavator, 30T articulated dump truck and 4km haul). This is considered to provide a more realistic, yet conservative, assessment of the embodied carbon emissions associated with sourcing site-won engineering and landscaping fill, and to facilitate a like-for-like comparison with other imported construction materials.
- 18.4.6 The embodied carbon emissions associated with precast concrete and in-situ concrete have been based on a worst case CEM I (Portland Cement) specification. However, in reality this specification is unlikely as some level of cement substitution is standard practice in construction.
- 18.4.7 The embodied carbon emissions associated with aggregates have also been based on a worst case assumption of primary aggregates consumption, whereas in reality this is unlikely as some level of secondary or recycled aggregates use is standard practice in construction. It is anticipated that a more accurate estimate of concrete and aggregate related carbon emissions will be reported by the Principal Contractor during the construction phase.
- 18.4.8 The assessment parameters which form the basis of the carbon emissions, aggregates consumption and waste forecasting, will inevitably be subject to some changes as the Proposed Scheme evolves through the detailed design and construction stages. Given that the range of material consumption requirements may differ between this design assessment and the as-built construction, an additional 15% uplift has been applied to the principal material demands. This uplift aims to account for additional materials not covered in the design stage BoQ. Therefore,

estimates would need to be refined at later stages in the process when further information is available during pre-construction preparation or during the construction period itself.

18.4.9 Furthermore, there is also limited additional information available at this stage regarding:

- the Principal Contractor’s design and procurement decisions, particularly those involving the selection of construction materials, products and additives
- the quantities of materials arising on-site that are likely to be reused or recycled within the Proposed Scheme to replace materials sourced from off-site
- the precise geographical sources of imported materials; whether they are from virgin or from recycled or secondary sources, incorporate recycled or secondary content, are from sources with existing recognised responsible sourcing certification
- whether any site-won materials or imported materials from recycled or secondary sources are regulated as “Waste” under the Pollution Prevention & Control (Scotland) Regulations or Waste Management Licensing Regulations
- the chosen waste management methods (recycling, recovery, disposal) and precise geographical locations for managing each waste stream that cannot be re-used on-site

18.4.10 Notwithstanding, the above limitations are not untypical of a DMRB Stage 3 Assessment, and the information presented in this chapter is considered of an appropriate level of detail to undertake a full EIA in line with the Detailed Assessment methodology outlined in HD 212/11. These limitations will be addressed during construction using a variety of methods as identified in **paragraph 18.6.5**.

18.5 Potential Impacts

18.5.1 Throughout the DMRB Stage 3 iterative design process, a number of environmentally led workshops considered each aspect of the developing design and made recommendations for certain features to be included in the next design iteration. These aspects have been defined as ‘Embedded Specific Mitigation’ and, where they are included in the Proposed Scheme design, they are considered within the context of the impact assessment as providing mitigation to avoid or reduce environmental impacts, and in some cases, provide environmental benefits. The impact assessment has therefore been undertaken in cognisance of the embedded mitigation features noted below.

18.5.2 With respect to the Materials topics under consideration in this chapter, the relevant aspects of embedded mitigation include designs being informed by ongoing consideration of earthworks materials balance across the Proposed Scheme.

18.5.3 Importance has been given to refining the route alignment and levels to optimise the cut/ fill balance. The geotechnical and landscape/ landform design process has sought to identify where any surplus earthwork materials can be beneficially used in environmental mitigation measures such as slackening of embankment slopes, or creation of false cuttings at a number of locations, including:

- Dalwhinnie Junction (the compact junction has also reduced the overall cut volume)
- Southbound mainline (Chainage (ch.) 23,450 - ch. 23,700)
- Northbound mainline (ch. 25,500 - ch. 25,600)
- Northbound mainline (ch. 27,800 - ch. 29,100)
- Southbound mainline (ch. 29,250 - ch. 29,700)

- 18.5.4 The design has also been optimised with respect to the preservation of peat through a number of measures including changes to infrastructure layouts, relocation of certain Sustainable Drainage Systems (SuDS) basins and access features to avoid deeper peat deposits, regrading of certain cutting and embankment slopes to reduce impact on deeper peat deposits and recommending certain construction methods, where possible, that minimise excavation such as floating tracks or piled solutions.
- 18.5.5 Where excavation is unavoidable, peaty soil/ topsoil will be reused, where possible, as part of the landscaping strategy on embankment and cutting slopes with shallow peat used for dressing off/ peat re-instatement on shallow slopes and edges of infrastructure. Residual shallow and deep peat volumes are to be reused in the restoration of degraded peatland habitat areas identified in the Outline Peat Management Plan, subject to approval by Cairngorms National Park Authority (CNPA), SEPA and Scottish National Heritage (SNH) (see **Chapter 10**).
- 18.5.6 Alternatives to primary aggregates have been investigated through design, including opportunities to use recycled aggregates sourced from construction, demolition and excavation waste obtained on-site. Examples of recycled or secondary aggregates considered include:
- reuse of excavated rock as an all-weather bulk fill material
 - reuse of psammite as Type 1 sub-base, capping and as backfill to structures
 - reuse of asphalt planings as general fill and capping materials
 - reuse of inert demolition waste as recycled concrete aggregates
- 18.5.7 The construction of the Proposed Scheme will require the use and consumption of material resources including primary raw materials and manufactured construction products, and hence may result in potential impacts and effects on the environment. These include both direct and indirect impacts related to the depletion of natural resources, embodied carbon emissions associated with the manufacture of materials, and non-compliance of the Proposed Scheme with relevant sustainable development and materials policies and plans.
- 18.5.8 The construction of the Proposed Scheme will also result in surplus materials and waste, leading to potential direct impacts, most notably on the waste management infrastructure available to accept, treat and dispose of the various types of waste generated. For surplus materials and waste, the potential environmental effects are associated with the production, movement, transport, processing, and disposal of arisings from the construction of the Proposed Scheme. For example, the generation of surplus materials and waste may lead to both permanent and temporary impacts on available waste management infrastructure, i.e. through occupying landfill void space and/ or the short-term use of available waste storage, recycling, recovery capacity, and non-compliance of the Proposed Scheme with relevant policies and plans.
- 18.5.9 Significant environmental impacts are likely to arise from those materials which are used in the largest quantities or are high in embodied carbon, and wastes which arise in the largest quantities which have hazardous properties, or which comprise a large proportion of the value of the Proposed Scheme.

Material Resources

Embodied Carbon Emissions

- 18.5.10 An outline estimate of embodied carbon emissions has been calculated using materials quantities information provided in the preliminary Stage 3 BoQ, along with the embodied carbon emission

factors (tCO₂e per tonne of material) provided, for specific construction materials, in the Transport Scotland CMS Projects Carbon Tool.

- 18.5.11 These figures are summarised in **Table 18-11** below and provide an indicative assessment of the magnitude of impact resulting from the Proposed Scheme's use of key construction materials and products.

Table 18-11: Estimated total embodied carbon emissions range (excluding and including 15% contingency)

Material	Units	Approximate Quantity Range	Estimated Emissions Range tCO ₂ e
Site won engineering and landscaping materials	t	902,280 – 1,037,622	2,707 – 3,113
Site won peaty soil, shallow peat and deep peat	t	226,300 – 260,245	680 – 782
Imported capping materials	t	11,200 – 12,880	90 – 103
Imported sub-base	t	133,557 – 153,591	1,069 – 1,229
Imported grey chippings	t	5,152 – 5,925	41 – 47
Material	Units	Approximate Quantity Range	Estimated Emissions Range tCO ₂ e
Imported filter drain, bedding, and SuDS aggregates	t	41,347 – 47,549	331 – 380
Imported asphalt and bitumen (base, binder, surface, regulating, tack coat)	t	206,208 – 237,139	15,355 – 17,658
Imported concrete (structures, kerbs, drains/ beds, catchpits, manholes, culverts, headwalls, fence post)	t	39,148 – 45,020	7,275 – 8,366
Imported iron & steel (structures, reinforcement, safety barrier, fencing)	t	4,142 – 4,763	3,917 – 4,505
Imported plastics (HDPE pipes, thermoplastics, geotextiles, signs, ducts)	t	311 – 358	631 – 725
Imported timber (formwork)	t	5 – 6	2 – 2
	Total	1,569,683 – 1,805,135	32,098 – 36,913

Depletion of Natural Resources

- 18.5.12 An outline estimate of the mineral resources to be consumed in constructing the Proposed Scheme has been calculated through a review of the key aggregate materials (for capping, sub-base, base course, binder course, surface course, regulating course and drain filter/ bedding materials) identified in the preliminary Stage 3 BoQ.
- 18.5.13 These figures are summarised in **Table 18-12** below, and provide an indicative assessment of the magnitude of impact arising from the Proposed Scheme's consumption (depletion) of mineral resources during construction. For comparative purposes, the Proposed Scheme's total consumption of mineral resources during construction is likely to equate to approximately 5% to 6% of the total primary aggregates produced in the study area in 2012.

Table 18-12: Estimated aggregates consumption range (excluding and including 15% contingency)

Material	Units	Approximate Quantity Range
Imported capping materials	t	11,200 – 12,880
Imported sub-base	t	133,557 – 153,591
Imported grey chippings	t	5,152 – 5,925
Imported filter drain, bedding, and SuDS aggregates	t	41,347 – 47,549
Imported aggregates for asphalt (base, binder, surface and regulating courses)	t	205,411 – 236,223
	Total	396,667 – 456,168

Waste Generation

Demolition Waste

- 18.5.14 The quantities of demolition waste likely to be generated during site clearance activities and removal of existing road structures are estimated in **Table 18-13** below, based on the preliminary BoQ (Series 200) information and material take offs from the as-built structure drawings.

Table 18-13: Site clearance and demolition waste range (excluding and including 15% contingency)

Material	Units	Approximate Quantity Range
Concrete	t	3,772 – 4,338
Reinforcement steel and steel parapets	t	774 – 890
Steel safety barrier	t	217 – 250
Steel post and wire fence	t	588 – 676
	Total	5,351 – 6,154

Excavation Waste

- 18.5.15 The quantities of excavation waste likely to be generated during the construction of the Proposed Scheme, after the implementation of embedded specific mitigation, are estimated in **Table 18-14** below based on a review of the DMRB Stage 3 Model requirements for Earthworks Quantities.

Table 18-14: Estimated excavation waste range (excluding and including 15% contingency)

Material	Units	Approximate Quantity Range
Surplus earthworks materials	t	24,820 – 28,543
Asphalt planings	t	23,021 – 26,474
	Total	47,841 – 55,017

Construction Waste

- 18.5.16 The quantities of construction waste likely to be generated during the construction of the Proposed Scheme are estimated in **Table 18-15** below, based on the application wastage rate data, at good practice levels, to the material quantities reported in **Table 18-11** above.
- 18.5.17 These wastage rates have been sourced from the Waste and Resources Action Programme's (WRAP) (2008) 'Net Waste Tool Guide to Reference Data (Version 1.0)', and represent the proportion of a material that could end up as waste during the construction processes associated with 'Modern Methods of Construction'.

Table 18-15: Estimated construction waste range (excluding and including 15% contingency)

Material	Units	Approximate Quantity Range	Good Practice Wastage Rate (%)	Estimated Waste Generation Range
Capping materials	t	11,200 – 12,880	5	560 – 644
Sub-base	t	133,557 – 153,591	5	6,678 – 7,680
Grey chippings	t	5,152 – 5,925	5	258 – 296
Filter drain, bedding, and SuDS aggregates	t	41,347 – 47,549	5	2,067 – 2,377
Asphalt and bitumen products	t	206,208 – 237,139	2.5	5,155 – 5,928
Concrete products	t	39,148 – 45,020	2.5	979 – 1,126
Iron and steel products	t	4,142 – 4,763	5	207 – 238
Plastic products	t	311 – 358	2	6 – 7
Timber products	t	5 – 6	5	0.3 – 0.3
	Total	441,070 – 507,231	N/A	15,911 – 18,298

Summary of Impacts Prior to Mitigation

18.5.18 The significance of the potential impacts, identified for both material resources and waste above, are assessed, prior to the application of additional mitigation, in **Table 18-16** below following the methodology described in **Section 18.1.1** and the Detailed Assessment Reporting Matrix specified in HD 212/11.

Table 18-16: Detailed assessment reporting matrix prior to mitigation

Proposed Scheme Activity	Potential Impacts Associated with Material Resource Use/ Waste Management	Description of the Impacts
Site remediation / preparation / demolition	Disposal of site clearance and demolition wastes	<p>Assumes that the Proposed Scheme will generate approximately 5,351 – 6,154 t of waste which will be predominantly segregated and sent for recycling or further segregation at a materials recovery facility:</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, temporary, cumulative Sensitivity of the receptor: Medium Magnitude of impact: Minor Significance of effect: Slight adverse Significant for the purposes of EIA: No
	Disposal of excavation waste	<p>Assumes that the Proposed Scheme will generate approximately 47,841 – 55,017 t of waste which will be predominantly segregated and sent for recycling or further segregation at a materials recovery facility:</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, temporary, cumulative Sensitivity of the receptor: Medium Magnitude of impact: Minor Significance of effect: Slight adverse Significant for the purposes of EIA: No
Construction	Embodied carbon emissions	<p>Assumes that the Proposed Scheme will generate approximately 32,098 – 36,913 tCO₂e of embodied carbon emission from its use of construction materials and products:</p> <ul style="list-style-type: none"> Description of impact: Adverse, indirect, permanent, cumulative Sensitivity of the receptor: Not applicable Magnitude of impact: Moderate Significance of effect: Not applicable Significant for the purposes of EIA: Not applicable
	Depletion of natural resources	<p>Assumes that the Proposed Scheme will consume approximately 396,667 – 456,168 t of mineral resources through its use of key aggregate materials:</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, permanent, cumulative Sensitivity of the receptor: Low Magnitude of impact: Minor Significance of effect: Neutral/ slight adverse Significant for the purposes of EIA: No
	Disposal of surplus construction materials and waste	<p>Assumes that the Proposed Scheme will generate approximately 15,911 – 18,298 t of waste which will be predominantly segregated and sent for recycling or further segregation at a materials recovery facility:</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, temporary, cumulative Sensitivity of the receptor: Medium Magnitude of impact: Minor Significance of effect: Slight adverse Significant for the purposes of EIA: No

18.6 Mitigation

- 18.6.1 Those Embedded Specific Mitigation measures that have been adopted as part of the evolution of the Proposed Scheme design, have been recorded in **Section 18.5**. The objective of this section is therefore to identify any further essential or desirable mitigation (“additional standard or specific mitigation”) measures envisaged to prevent, reduce and offset any significant adverse effects from the consumption of materials and the generation and management of waste.
- 18.6.2 Standard A9 Mitigation measures (e.g. **SMC – M1**) have been identified through a review of current legislation, policy and best practice guidance, and have been taken into account in the subsequent identification of likely residual impacts, both below and in **Section 18.7**. No Additional Specific Mitigation measures have been identified for the Proposed Scheme.
- 18.6.3 Such measures will support the delivery of the A9 Sustainability Strategy objective of “*optimising resource efficiency across the life of the A9 Dualling Programme, with particular regard to geographical scale and project alignment*” through:
- Complying with all relevant legislation, policy and plans pertaining to the use of material resources and the management of waste; and take cognisance of all relevant SEPA definition of waste guidance, end-of-waste guidance, special waste guidance, statutory guidance, position statements
 - Designing for resource efficient construction (DfRE) in order to make the best use of materials and minimise embodied carbon emissions
 - Responsibly sourcing construction materials and products, and investigating alternatives to the use of primary aggregates
 - Designing out waste and facilitating the prevention, reuse, recycling and recovery of CD&E waste through the implementation of a Site Waste Management Plan (SWMP), including setting resource efficiency requirements into the procurement process for the Principal Contractor that support the delivery of the Scottish Government’s Zero Waste Plan Targets
- 18.6.4 The Principal Contractor will be required to develop a management system to structure the implementation of the mitigation measures outlined in this and other chapters of the Environmental Statement. This will include a Construction Environmental Management Plan (CEMP), requirements for which will be established via the Contract Documents. The CEMP, to be developed by the Principal Contractor prior to the start of construction works, will capture and collate all available information relating to the scheme specific environmental objectives, environmental risks, proposed mitigation and commitments that will need to be addressed in the delivery of the Proposed Scheme; this will be achieved by transposing these requirements into a series of clear environmental actions to ensure that each action is fully considered during the construction stage.
- 18.6.5 A description of the Standard A9 Mitigation measures is provided below and in **Table 18-17**. These measures shall be secured through contractual responsibilities between Transport Scotland and its design and construction contractors, and implemented, measured and monitored during construction using a variety of methods including, but not limited to:
- Contract documents
 - Construction Environmental Management Plan
 - Transport Scotland’s CMS Projects Carbon Tool (or equivalent)
 - Site Waste Management Plan

- Materials Management Plans (where required)
- Materials procurement register/ invoices/ certifications records
- Weighbridge records/ waste transfer notes/ consignment notes

Comply with All Relevant Legislation, Policy and Plans

- 18.6.6 The use and consumption of material resources and the production and management of waste are subject to a complex framework of legislative and policy instruments at the European, National and Local levels. In addition to material and waste-specific policies, legislation and guidance, there is also the legislative framework for sustainable development which must be considered in assessing the environmental impacts/ effects of material resource use and waste management associated with constructing the Proposed Scheme.
- 18.6.7 The Principal Contractor shall comply with all relevant material and waste specific legislation, policies and plans, including but not limited to those identified in **Chapter 19** and **Appendix 19.1 (Mitigation Item SMC – M2)**. Furthermore, the Principal Contractor shall take cognisance of all relevant SEPA definition of waste guidance, end-of-waste guidance, special waste guidance, statutory guidance and position statements.
- 18.6.8 The Principal Contractor shall take all such measures available to it as are reasonable in the circumstances to apply the waste hierarchy of prevention; preparing for re-use; recycling; other recovery, including energy recovery; and disposal in a way which delivers the best overall environmental outcome. The hierarchy, as illustrated in **Figure 18-1**, may be departed from for particular types of waste, where justified, in order to ensure this outcome and by reference to the overall impact of the generation and management of such types of waste (**Mitigation Item SMC – M3**).



Figure 18-1: The waste hierarchy as applied to materials and waste

Implement Design for Resource Efficient Construction Principles

- 18.6.9 The Proposed Scheme shall implement Zero Waste Scotland's DfRE Construction Principles, throughout the design and construction phases, in order to make the best use of materials over the lifecycle of built assets, to minimise embodied carbon emissions (**Mitigation Item SMC – M4**).
- 18.6.10 All opportunities to DfRE are covered by five key principles:
- Design for Reuse and Recovery: through salvaging and reuse of components and materials from the site or elsewhere locally; on-site or off-site recycling of materials, and ensuring new materials brought onto site have high recycled content

- Design for Off-site Construction: through designing in prefabricated road assets structures and components which offer reduced consumption of materials and reduced waste; and thinking about how site activities can become a process of assembly rather than construction
- Design for Resource Optimisation: through designing road assets that can be constructed and used with reduced consumption of materials, selecting responsibly sourced materials, and producing minimal waste
- Design for Resource Efficient Procurement: through setting resource efficiency requirements into the procurement process; working with the principal contractor throughout the design process to select resource efficient construction methods; and when waste does arise, making provision to select the waste contractor who can offer the best overall reuse and recycling performance
- Design for the Future: through considering the potential future uses of the roads assets and designing in flexibility and adaptability; selecting materials and components to match the intended use and durability; designing the road assets to be easy to maintain and refurbish, and taking into account future needs to update, modernise and eventually deconstruct.

18.6.11 These DfRE principles shall be implemented by applying the simple three-step process illustrated in **Figure 18-2** and described below:

- Identify opportunities for alternative design solutions which improve resource efficiency, and prioritise those which will have the greatest impact and be easiest to implement
- Investigate the prioritised solutions further to fully ascertain their viability, and quantify the potential benefits
- Implement the agreed solutions, ensuring that they are agreed with Transport Scotland and recorded by way of the CMS Projects Carbon Tool (or equivalent) and/ or SWMP.



Figure 18-2: DfRE process

Responsibly Source Construction Materials

- 18.6.12 The key material elements (aggregates, asphalt, cement, concrete and steel) used within the Proposed Scheme shall be specified to be responsibly sourced (**Mitigation Item SMC – M5**).
- 18.6.13 All timber and timber products shall be sourced from independently verifiable legal and sustainable sources (**Mitigation Item SMC – M6**).
- 18.6.14 Alternatives to primary aggregates shall be investigated at detailed design, including opportunities to use recycled or secondary aggregates; either sourced from construction, demolition and excavation waste obtained on-site or off-site; or secondary aggregates obtained from by-product of quarrying and mining operations, or aggregates obtained as a by-product of other industrial processes (**Mitigation Item SMC – M7**).

Implement a Site Waste Management Plan (SWMP)

- 18.6.15 A SWMP shall be prepared and implemented in a manner to suit the requirements of the Proposed Scheme, to promote resource efficiency during construction (**Mitigation Item SMC – M1**).
- 18.6.16 The aim of the SWMP is to ensure that each potential waste stream is evaluated against the waste hierarchy of prevention, prepare for reuse, recycling, recovery and disposal to derive management options that reflect the highest possible level within the hierarchy which is required by the Waste (Scotland) Regulations 2011 (as per **Mitigation Items SMC – M2** and **SMC – M3**).
- 18.6.17 For most materials action is best focussed at the top of the waste hierarchy, on reducing use and waste of these materials, and in extending the life of the products which contain them. Zero Waste Scotland's Designing out Waste: A Design Team Guide for Civil Engineering Projects, highlights the range of design solution and engineering techniques that can be used to improve materials resource efficiency in civil engineering projects. This is presented in the form of quick reference look-up tables showing the range of opportunities identified so far in the UK to design out waste. The Principal Contractor shall refer to this guide to assist with identifying any further opportunities to design out waste during the construction phase.
- 18.6.18 The NetRegs SWMP template and guidance shall be used to record these opportunities. The SWMP will allow the Principal Contractor to record actions taken to prevent, reduce, recycle and recover waste arisings, and to identify waste streams and to track them throughout the construction lifecycle.
- 18.6.19 The SWMP should also contain the following targets applicable to the Proposed Scheme; that *“At least 70% of all waste to be recycled, and a maximum of 5% of waste sent to landfill”* in order to support the delivery of the Scottish Government's Zero Waste Plan Targets.
- 18.6.20 The SWMP will set out how all construction phase materials will be managed. This may include specific materials management plans developed under the following SEPA statutory guidance and industry regulated codes of practice, including but not limited to:
- SEPA, Promoting the sustainable reuse of greenfield soils in construction
 - SEPA, Land remediation and waste management guidelines
 - SEPA, Guidance on the production of fully recovered asphalt road planings
 - SEPA, Recycled aggregates from inert waste
 - Institution of Civil Engineers, Demolition protocol

Table 18-17: Mitigation Measures Reporting Matrix

Item Ref.	Approximate Chainage/ Location	Timing of Measure	Description	Mitigation Purpose/ Objective	Specific Consultation or Approval Required
Standard A9 Mitigation					
SMC – M1	Throughout Proposed Scheme	Pre-construction and construction	<p>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, 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:</p> <ul style="list-style-type: none"> • 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 Re-use of Greenfield Soils in Construction (SEPA, 2010). <p>Appropriate waste minimisation and associated KPI targets will also be included.</p>	To set out how all construction phase materials will be managed.	Consultation and approval from the Local Authority and/or SEPA as applicable to regulatory requirements
SMC – M2	Throughout Proposed Scheme	Pre-construction and construction	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.	To ensure waste handling, storage, transport and disposal is compliant with all relevant waste legislation.	Consultation with SEPA
SMC – M3	Throughout Proposed Scheme	Pre-construction and construction	The Contractor will apply the principles of the 'Waste Hierarchy' (Prevention, Preparing for Re-use, 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.	To reduce waste generation, maximise re-use of site-won materials on-site and reduce the need for disposal of waste.	None required
SMC – M4	Throughout Proposed Scheme	Pre-construction and construction	The Contractor will implement Zero Waste Scotland's Design for Resource Efficient Construction Principles.	To make the best use of materials, over the lifecycle of the proposed scheme's built assets, to reduce embodied carbon emissions	None required
SMC – M5	Throughout Proposed Scheme	Pre-construction and construction	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.	To reduce impacts associated with the extraction and manufacture of materials.	None required
SMC – M6	Throughout Proposed Scheme	Pre-construction and construction	All timber and timber products shall be sourced from independently verifiable legal and sustainable sources.	To reduce impacts associated with the extraction and manufacture of materials.	None required
SMC – M7	Throughout Proposed Scheme	Design, Pre-construction and construction	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.	To reduce impacts associated with the extraction, manufacture and transport of materials and to reduce waste generation, maximise re-use of site-won materials on-site and reduce the need for disposal of waste.	None required

- 18.6.21 Further to the above, a number of additional Standard A9 Mitigation items detailed for General Construction; Community and Private Assets; All Travellers; Geology, Soils and Contaminated Land; Road Drainage and the Water Environment; Landscape and Visual and Air Quality topics, in the Schedule of Environmental Commitments (**Chapter 21**), are also relevant to the use and consumption of material resources and the production and management of waste. These include Standard A9 Mitigation items: S1, S2, S4, CP8, CP12, AT3, G3, G6, G8, G9, G10, G14, W2, W6 to W10, LV2, LV3, LV5 to LV7, AQ1 to AQ3 and Additional Specific Mitigation items P08-G4 and G6 to G7.

18.7 Residual Impacts

- 18.7.1 The assessment has indicated that the construction of the Proposed Scheme is likely to consume large quantities of material resources and hence will result in potential impacts on the environment, through the depletion of natural resources and the embodied carbon associated with extraction, manufacturing and any pre-distribution transportation of construction materials and products.
- 18.7.2 Constructing the Proposed Scheme is also likely to generate potentially large quantities of CD&E waste, leading to potential impacts on the available waste management infrastructure (i.e. through the permanent use of landfill void space and/ or the short-term use of waste treatment capacity).
- 18.7.3 Where impacts have been identified these will be addressed through ensuring that the construction of the Proposed Scheme responds to national regulatory standards and local policy requirements as reported in **Chapter 19**, and Standard A9 Mitigation measures reported in **section 18.6**.
- 18.7.4 The significance of each residual impact is assessed in **Table 18-18** following the methodology described in **paragraph 18.1.1** and the Detailed Assessment Reporting Matrix specified in HD 212/11. All impacts have been assessed as being non-significant for the purposes of EIA based on the descriptors of the significance of effect categories provided in HA 205/08.
- 18.7.5 The assessment has concluded that there is likely to be a **Moderate** magnitude of impact in regard to the embodied carbon footprint of the Proposed Scheme, after the application of the mitigation measures outlined in **Table 18-17**, and taking account of the uncertainties presented in **paragraph 18.3.1**. However, it has not been possible, for the reasons outlined in **paragraph 18.1.1**, to derive a measure of the significance of effect from the Proposed Scheme's embodied carbon emissions or to determine whether these emissions are likely to be considered 'significant', in the context of the EIA regulations, using the descriptors provided in HA 205/08.
- 18.7.6 The residual embodied carbon emissions cannot be absolutely predicted and will ultimately depend on the Principal Contractor's design and procurement decisions, particularly those involving the selection of construction materials, products and additives, and excavator plant. The final embodied carbon footprint will therefore not be known until the Principal Contractor has completed the construction of the Proposed Scheme and calculated a construction stage carbon footprint. It is considered unlikely however, that any such reductions will be sufficient to bring the total embodied carbon footprint for the Proposed Scheme to within the 5,000 to 20,000 tCO₂e range, which for the purposes of EIA would be necessary to demonstrate a reduced (Minor) magnitude of impact following the assessment methodology presented **paragraph 18.1.1**.
- 18.7.7 However, compared to the UK's 3rd carbon budget (2018 to 2022) (the period in which construction is likely to be undertaken) of 2,544 MtCO₂e, the Proposed Scheme's estimated total embodied carbon emissions represent a very small proportion (< 0.0015%) of the UK's 5-year Carbon Budget, as published on the Committee on Climate Change (n.d.) website. Furthermore, the embodied carbon emissions associated with the Proposed Scheme's use of material resources will be largely regulated through the European Union's Emissions Trading Scheme (ETS) (a Europe wide emissions cap and trade scheme with a decreasing 'cap' or limit over time) and

other policy tools, as described in **Appendix 19.1 (Volume 2)**, as part of the UK Climate Change Act 2008 target of reducing greenhouse gas emissions by at least 80% of 1990 levels by 2050 (this includes reducing emissions from the devolved administrations (Scotland, Wales and Northern Ireland)), including but not limited to:

- Transport Scotland’s Annual Carbon Accounts to the Scottish Government
- Annual Emissions reporting under the Companies Act 2006 (Strategic Report and Directors’ Reports) Regulations 2013
- UK Greenhouse Gas Reporting for the business sector and industrial process sectors
- The Energy Savings Opportunity Scheme
- The Climate Change Levy (or associated Climate Change Agreements)
- The price feed-through from the EU ETS for bitumen, cement, iron and steel purchased within the EU
- The Carbon Reduction Commitment Energy Efficiency Scheme

18.7.8 Current regulations do not afford trunk road construction schemes the opportunity for carbon offsetting. The embodied carbon emissions from the Proposed Scheme will therefore be encapsulated in UK/ Scottish greenhouse gas reporting and, by default, associated policy measures to achieve the targets of ensuring an 80% reduction in emissions by 2050.

18.7.9 It should be noted that other large scale roads infrastructure projects throughout the UK have concluded a similar Moderate impact following the HD 212/11 guidance and have been approved on the basis of the suggested mitigation, and the acceptance that nationally important infrastructure projects typically have an unavoidable material demand.

18.7.10 The authorisation of national road network projects in Scotland is devolved to the Scottish Government; in the absence of an equivalent Scottish policy statement, reference has been made to the Department for Transport (2014) ‘*National Policy Statement for National Networks*’ (used as the primary basis for making decisions on development consent applications for national networks and nationally significant infrastructure projects in England) which provides the following pertinent statements with regard to carbon emissions from road developments:

- *“The Government has a legally binding framework to cut greenhouse gas emissions by at least 80% by 2050”*
- *“Emission reductions will be delivered through a system of five year carbon budgets that set a trajectory to 2050”:*
 - 1st carbon budget (2008 to 2012) of 3,018 MtCO₂e
 - 2nd carbon budget (2013 to 2017) of 2,782 MtCO₂e
 - 3rd carbon budget (2018 to 2022) of 2,544 MtCO₂e
 - 4th carbon budget (2023 to 2027) of 1,950 MtCO₂e
 - 5th carbon budget (2028 to 2032) of 1,765 MtCO₂e
- *“The impact of road development on aggregate levels of emissions is likely to be very small”*
- *“It is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets”*

- *“The Government has an overarching national carbon reduction strategy (as set out in the Carbon Plan 2011) which is a credible plan for meeting carbon budgets:*
 - *It includes a range of non-planning policies which will, subject to the occurrence of the very unlikely event described above, ensure that any carbon increases from road development do not compromise its overall carbon reduction commitments*
 - *The Government is legally required to meet this plan. Therefore, any increase in carbon emissions is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the proposed scheme are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets”*

18.7.11 It is also accepted that the Proposed Scheme cannot influence all of the elements that underpin its embodied carbon footprint. Some of the elements of the embodied carbon emissions are only likely to be influenced by the UK/ Scottish Government, whilst others are related to the commercial decision of private manufacturing companies which are outside the direct control of Government. Notwithstanding, Transport Scotland is committed to minimising the embodied carbon emissions of constructing the Proposed Scheme, where practicable, through the implementation of the A9 Dualling Programme Sustainability Strategy objective of “*optimising resource efficiency across the life of the A9 Dualling Programme*”.

Table 18-18: Detailed assessment reporting matrix post mitigation – residual impacts

Proposed Scheme Activity	Potential Impacts Associated with Material Resource Use/ Waste Management	Description of the Impacts
Site remediation / preparation / demolition	Disposal of site clearance and demolition wastes	<p>Assumes that any residual site clearance and demolition waste will be predominantly re-used on site or at an appropriately licensed or registered exempt site elsewhere and therefore the magnitude of impact is expected to reduce to ‘Negligible’:</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, temporary, cumulative Sensitivity of the receptor: Medium Magnitude of impact: Negligible Significance of effect: Slight adverse/ neutral Significant for the purposes of EIA: No
	Disposal of excavation waste	<p>Assumes that any residual excavation wastes will be predominantly re-used on site or at an appropriately licensed or registered exempt site elsewhere and therefore the magnitude of impact is expected to reduce to ‘Negligible’:</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, temporary, cumulative Sensitivity of the receptor: Medium Magnitude of impact: Negligible Significance of effect: Slight adverse/ neutral Significant for the purposes of EIA: No <p>As stated in Chapter 5, the quantities of surplus engineering fill are considered acceptable in terms of further earthworks balancing refinements likely to be realised at the construction stage.</p>

Proposed Scheme Activity	Potential Impacts Associated with Material Resource Use/ Waste Management	Description of the Impacts
Construction	Embodied carbon emissions	<p>Assumes that total embodied carbon emissions, with the application of resource efficient construction practices and the carbon emissions reduction hierarchy, are unlikely to reduce to below 20,000 tCO₂e and therefore the magnitude of impact is expected to remain at 'Moderate':</p> <ul style="list-style-type: none"> Description of impact: Adverse, indirect, permanent, cumulative Sensitivity of the receptor: Not applicable Magnitude of impact: Moderate Significance of effect: Not applicable Significant for the purposes of EIA: Not applicable
	Depletion of natural resources	<p>Assumes that even if the use of secondary/ recycled materials can be maximised during construction, that the order of magnitude of primary aggregates consumption is still likely to remain at a similar level to pre-mitigation levels and therefore the magnitude of impact is expected to remain at 'Minor':</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, permanent, cumulative Sensitivity of the receptor: Low Magnitude of impact: Minor Significance of effect: Slight adverse/ neutral Significant for the purposes of EIA: No
	Disposal of surplus construction materials and waste	<p>Assumes that any residual construction waste will be predominantly segregated and sent for recycling or further segregation at a materials recovery facility and therefore the magnitude of impact is expected to remain at 'Minor':</p> <ul style="list-style-type: none"> Description of impact: Adverse, direct, temporary, cumulative Sensitivity of the receptor: Medium Magnitude of impact: Minor Significance of effect: Slight adverse Significant for the purposes of EIA: No

Summary

18.7.12 A summary of residual impacts with the inclusion of Standard A9 Mitigation is indicated in **Table 18-19** below.

Table 18-19: Predicted residual construction impacts on materials receptors

Activity	Impact Name	Sensitivity of Receptor	Magnitude of Impact	Significance of Effect	Mitigation	Magnitude of Residual Impact	Significance of Residual Effect
Site remediation/ preparation demolition	Disposal of site clearance and demolition wastes	Medium	Minor	Slight	Design out waste and facilitate the prevention, reuse, recycling and recovery of CD&E waste through the implementation of a SWMP; including setting resource efficiency requirements into the procurement process for the Principal Contractor that support the delivery of the Scottish Government's Zero Waste Plan Targets (SMC – M1)	Negligible	Slight/ neutral
	Disposal of excavation waste	Medium	Minor	Slight	Comply with all relevant legislation and policy pertaining to the use of material resources and the management of waste; and take cognisance of all relevant SEPA definition of waste guidance, end-of-waste guidance, special waste guidance, statutory guidance, position statements (SMC – M2) Apply the waste hierarchy of prevention; preparing for re-use; recycling; other recovery, including energy recovery; and disposal in a way which delivers the best overall environmental outcome (SMC – M3)	Negligible	Slight/ neutral
Construction	Embodied carbon emissions	Not applicable	Moderate	Not applicable	Comply with all relevant legislation, policy and plans pertaining to the use of material resources and the management of waste (SMC – M2) Design for resource efficient construction (DfRE) in order to make the best use of materials and minimise embodied carbon emissions (SMC – M4)	Moderate	Not applicable
	Depletion of natural resources	Low	Minor	Slight/ neutral	Responsibly source construction materials and products where possible; and investigate alternatives to the use of primary aggregates (SMC – M5 to SMC – M7)	Minor	Slight/ neutral
	Disposal of surplus construction materials and waste	Medium	Minor	Slight	Design out waste and facilitating the prevention, reuse, recycling and recovery of CD&E waste through the implementation of a SWMP; including setting resource efficiency requirements into the procurement process for the Principal Contractor that support the delivery of the Scottish Government's Zero Waste Plan Targets (SMC – M1) Comply with all relevant legislation, policy and pertaining to the use of material resources and the management of waste; and take cognisance of all relevant SEPA definition of waste guidance, end-of-waste guidance, special waste guidance, statutory guidance, position statements (SMC – M2) Apply the waste hierarchy of prevention; preparing for re-use; recycling; other recovery, including energy recovery; and disposal in a way which delivers the best overall environmental outcome (SMC – M3)	Minor	Slight

18.8 References

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