7 Air Quality

This chapter assesses the potential impacts of the proposed scheme upon air quality. An air quality assessment has been undertaken to assess the impacts of the proposed development upon local air quality, designated sites, and regional air quality.

The impact of construction of the proposed Scheme has the potential to lead to dust impacts at sensitive receptors. The implementation of specified mitigation measures (as detailed in Appendix A7.3: Construction Phase Assessment), would reduce these potential impacts to acceptable levels.

A detailed air quality assessment has been undertaken for potential local air quality impacts of the proposed development. The assessment has utilised the ADMS Roads dispersion modelling software to produce predictions of NO_2, PM_{10} and $PM_{2.5}$ concentrations at selected receptors in the Do-Minimum (DM) and Do-Something (DS) scenario. The study area was identified based on changes in traffic between DM and DS scenarios as a result of the proposed scheme using qualifying criteria published in DMRB HA207/07. The baseline conditions were established by a 6-month diffusion tube survey and a desk based assessment.

The local air quality assessment indicates that the proposed Scheme would result in a reduction in air pollutant concentrations at a number of properties within Nairn and along the existing A96, whilst there are increases closer to the new dual carriageway alignment. Overall, more properties receive an improvement in air quality than those which experience a worsening.

The air quality assessment at relevant designated sites did not identify any significant impacts.

The assessment of regional air quality indicated increases in NOx, PM_{10} and CO_2 emissions. However, there is no available guidance to determine significance of impacts, and regional scale emissions are managed at a national level only. The increase in emissions from the proposed Scheme are very small in the context of the national UK emissions.

Overall, there is not considered to be a significant effect on local air quality as a result of the proposed Scheme.

7.1 Introduction

7.1.1 Air quality is a consideration in any development proposal involving significant changes in the nature and location of emissions to air. An air quality assessment has been undertaken to establish the potential effects of the proposed Scheme on local and regional air quality. This chapter describes the assessment and the construction and operational effects arising from the proposed Scheme.

7.1.2 This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) for the A96 Dualling Inverness to Nairn (including Nairn Bypass) scheme (hereafter referred to as the proposed Scheme) in relation to the impacts of Air Quality.

7.1.3 The chapter is supported by the following appendices and figures which are cross referenced where relevant:

- Appendix A7.1 (Dispersion Modelling Setup);
- Appendix A7.2 (Verification and Adjustment);
- Appendix A7.3 (Construction Assessment);
- Appendix A7.4 (Receptor Results);
- Figure 7.1 (Air Quality Constraints Plan);
- Figure 7.2 (Sensitive Receptor Results – Base Scenario);
- Figure 7.3 (Sensitive Receptor Results – Do-Minimum Scenario);
- Figure 7.4 (Sensitive Receptor Results – Do-Something Scenario); and
- Figure 7.5 (Sensitive Receptor Results – Change in Concentration).

7.1.4 The assessment includes the following aspects:

- Baseline air quality: review and assessment of the existing air quality situation within the study area;
- Local air quality: a detailed dispersion modelling assessment of the potential air quality impacts of the proposed Scheme upon representative residential receptors within the study area;
- Designated sites: an assessment of the potential air quality impacts of the proposed Scheme upon relevant designated sites within the study area. The changes to air pollution at relevant designated sites are presented in this chapter, and the potential impacts upon ecological receptors due to these changes are considered in detail in Chapter 11 (Habitats and Biodiversity); and
- Regional air quality: an assessment of the potential air quality impacts of the proposed Scheme upon the wider area.

Legislative and policy background

7.1.5 This section provides a summary of the relevant air quality legislation and standards that have been referenced for this assessment.

Table 7.1: Relevant Air Quality Legislation

Legislation	Description
Environment Protection Act 1990 Part III.	Provides statutory nuisance provisions for nuisance dust.
Environment Act 1995, Part IV.	Defines requirements for Local Air Quality Management (LAQM).
The Air Quality (Scotland) Regulations 2000, and The Air Quality (Scotland) (Amendment) Regulations 2002.	Legislates for the air quality objectives for pollutants set out in the 2007 Air Quality Strategy.
The National Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland, 2007.	Updates the 2000 Air Quality Strategy, and sets out how local air quality is managed, through the application of Air Quality Objectives (AQO) based on the Air Quality (Scotland) Regulations 2000 and 2002 Amendments.
The Air Quality (Scotland) Regulations 2010	Transpose formalised limit values set out in the EU Ambient Air Quality Directive 2008/50/EC to UK law.
Conservation (Natural Habitats etc) Regulations (as amended) 1994	The presence of protected habitats and ecosystems within the air quality study area introduces legislative requirements that must be taken into account in assessing air quality and dust impacts. The substances associated with potential impact on habitats and ecosystems are NOx, and associated nitrogen deposition.
Cleaner Air for Scotland 2015	A strategy setting out the Scottish Government's proposals for delivering further improvements to air quality.

7.1.6 European Union Directive 2008/50/EC Ambient Air Quality and Cleaner Air for Europe was published to consolidate previous European Directives on ambient air quality. These European Directives form the basis for UK air quality legislation. Although published in 2007, the Air Quality Strategy is consistent with The Air Quality Standards Regulations (Scotland) 2010.

7.1.7 The UK government is currently responsible to the European Commission (EC) for ensuring that it complies with the provisions of the EU Directives. The UK government and governments of other member states are currently in negotiations with the EC over breaching limit values for nitrogen dioxide (NO_2) and PM_{10} (particulate matter with an aerodynamic diameter of less than 10 microns).

7.1.8 On the UK government's behalf, the Department for Transport (DfT) and Department for Environment Food and Rural Affairs (Defra) have Public Service Agreements relating to EU Limit Values.

7.1.9 The responsibilities of Local Authorities with respect to meeting air quality standards are not the same as the responsibilities of the UK government to the EC. As detailed in Local Air Quality Management Policy Guidance 2016 (PG(S)16), local Authorities do have statutory duties for Local

Air Quality Management, but are not obliged to ensure Air Quality Objectives are met but are worked towards in the shortest practical time.

7.1.10 It is important to recognise the difference between the EU Limit Values (for which compliance is determined at a national level by government) and the Air Quality Objectives (AQO) (for which compliance is determined at a local level by local authorities under the LAQM regime). Whilst the Limit Values and Air Quality Objectives for the relevant pollutants (NO_2 and PM_{10}) may be set at the same concentration value (e.g. 40µg/m^3, as an annual mean) the means of determining compliance are fundamentally different, and they must be considered separately.

7.1.11 Article 3 of the EU Directive requires Member States to nominate the competent authority for the assessment of air quality (which in the UK is the Secretary of State for the Environment) and it may be interpreted that only the competent authority can determine compliance with the Limit Values. Compliance is determined via the national monitoring network and national model (the Pollution Climate Mapping (PCM) model), and there are a number of important differences between this and the monitoring/modelling carried out by local authorities to determine compliance with the objectives. Some of these differences are summarised in Table 7.2.

Table 7.2: Comparison between National and Local Compliance Approaches

Factor	National Compliance	Local Compliance
Relevant exposure	Limit Values apply everywhere there is public access	Annual mean objectives only apply at locations where public exposure is relevant to the averaging period, e.g. at residential building facades
Treatment of junctions	Monitoring is not carried out within 25 metres of a junction and the same constraint is applied to the modelling	Junctions are specifically considered in both monitoring and modelling
Microscale	Excludes micro-environments and focuses on locations representative of 100m lengths of roads	Focuses on 'hot-spot' locations
Roadside	Modelled concentrations apply to a distance of 4m from kerbside of the national road network. Local roads are excluded from the model	Focus is on concentrations at the building façade, whatever distance from the kerb and alongside any road.
Monitoring	Restricted to monitoring stations in the national network, operated to meet the Data Quality Objectives of the Directive	Principally based on local authority monitoring, including both automatic and passive diffusion samplers

7.1.12 Because of these differences, there are many locations across the UK where the national compliance with the Limit Values, and local compliance with the AQOs, are not in agreement. For the purpose of this assessment, they are treated separately. This is consistent with the advice in the relevant Planning Advice Note (PAN 51) produced by the Scottish Government which provide further guidance on specific topics.

Air Quality Strategy and Local Air Quality Management (LAQM)

7.1.13 The air quality objectives applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97) and the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297). The pollutants relevant to this assessment are nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$. The National Air Quality Strategy for England, Scotland, Wales and Northern Ireland (the AQS) also provides for a non-statutory objective for NOx. The relevant AQOs are presented in Table 7.3.

Table 7.3: National Air Quality Objectives (AQOs)

Pollutant	AQOs	
	Concentration	Measured as
Nitrogen dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times/yr	1 hour mean
	40µg/m^3	Annual mean
Nitrogen oxides (NO_x) for the protection of vegetation	30µg/m^3	Annual mean

Pollutant	AQOs	
	Concentration	Measured as
PM_{10}	50µg/m^3 not to be exceeded more than 7 times/yr	24 hour mean
	18µg/m^3	Annual mean
$PM_{2.5}$	10µg/m^3	Annual mean

7.1.14 For a full description of the terms used in relation to air quality, the science and the legislation, reference should be made to the AQS documents, and to the supporting Local Air Quality Management Technical Guidance (16) (Defra 2016) (hereafter referred to as LAQM TG(16).

7.1.15 There are no assessment methods available that can produce robust predictions of short term concentrations from road traffic. Therefore, compliance with the short term AQOs is assessed by following the guidance presented in LAQM TG(16), which provides a relationship between the annual mean concentration and the number of periods per year where the short term AQO is likely to be exceeded. These relationships have been derived from examination of monitoring data across the UK.

7.1.16 The annual mean equivalent concentration for the NO_2 1 hour mean AQO is 60µg/m^3, whilst the annual mean equivalent concentration for the PM_{10} 24 hour mean AQO is 22.4µg/m^3.

7.1.17 The AQS introduces measures to control exposure to $PM_{2.5}$ (the fraction of particulate matter with an average aerodynamic diameter less than 2.5µm). This is intended to be delivered at the national level, so the control has not been incorporated into LAQM, authorities have no statutory obligation to review and assess against them.

7.1.18 Following their review of the LAQM system, and as noted in their document 'Cleaner Air For Scotland' (2015), the Scottish Government has decided to replace the existing Scottish objectives with the World Health Organisation (WHO) guideline values (WHO, 2005). LAQM TG(16) details a PM_{10} annual mean for Scotland of 18µg/m^3 and $PM_{2.5}$ annual mean of 10µg/m^3.

7.1.19 The majority of AQOs are health-based standards that were set at a level to provide protection to the whole population.

7.1.20 NO_2 is a colourless, odourless gas which has been shown to have adverse health effects, including respiratory irritation in asthmatics. There is believed to be a threshold at which it has an effect. It is formed principally from the oxidation of nitric oxide (NO) through the action of ozone in the atmosphere. Combustion in air forms mainly NO and some NO_2 (collectively termed 'NOx') from the combination of atmospheric nitrogen and oxygen. NOx is emitted from internal combustion engines as well as other forms of combustion and formed from natural sources such as lightning. NOx is also a precursor to PM_{10} and $PM_{2.5}$.

7.1.21 PM_{10} and $PM_{2.5}$ are the fractions of particulate matter (dust) in the air with an average aerodynamic diameter of less than 10 and 2.5µm, respectively. This size range of particulate matter can penetrate deep into the lungs and has been shown to have a range of adverse health effects. These include a causal association with cardiovascular and respiratory illnesses. According to the AQS, *'it is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health'*. In terms of harm, economically PM is costed as being more harmful as NO_2 by Defra. PM is formed from both man-made and natural sources. Primary PM is formed from the incomplete combustion of fuel (e.g. soot from diesel exhausts), sea-salt and wind-blown dust. Secondary PM is formed in the atmosphere from other pollutants such as NOx and sulphur oxides, and in certain circumstances in photochemical smogs. PM has a residence time of several days in the atmosphere, so pollution events can occur in the UK when polluted air is blown from the continent.

7.1.22 Responsibility for determining whether AQOs are complied with lies with Local Authorities within the system of LAQM. This LAQM regime is under review by Defra. Currently, Local Authorities are required to review and assess air quality within their districts, against the AQOs. Where the AQOs are not being met at relevant locations, they must declare Air Quality Management Areas (AQMAs)

and develop an Air Quality Action Plan (AQAP) setting out measures to work towards reducing the concentrations of the relevant pollutants to below the relevant AQOs. The given dates for compliance with the AQOs as described in the National Air Quality Strategy for England, Scotland, Wales and Northern Ireland have all now passed.

7.1.23 Pollutants such as benzene and 1,3 butadiene are associated with the use of fuels for road transport (petrol). The other pollutants are potentially associated with emissions from diesel combustion. However, based on review and assessment across the UK, DMRB specifies that there is no potential risk of exceedance of the AQO or significant impacts for any pollutants other than NO_2 and PM_{10} as a result of a road scheme.

Dust Nuisance

7.1.24 One of the main concerns regarding the air quality impact during construction is the potential of impacts from fugitive dust. There are no nationally recognised criteria defining levels of dust that can cause an annoyance.

7.1.25 Fugitive dust effects can be controlled under the Statutory Nuisance provisions of Part III of the Environmental Protection Act, 1990. Where required, best practice fugitive dust control measures outlined in the Institute of Air Quality Management (IAQM) Guidance, 2014 have been identified.

Policies and Plans

7.1.26 Scottish Planning Policy (SPP) notes that decision making in the planning system should contribute to the reduction in greenhouse gasses in line with the targets set in the Climate Change (Scotland) Act 2009. The Act sets a target of an 80% reduction in emissions by 2050 and an interim target of a 42% reduction by 2020 for Scotland. The design of new development should address the causes of climate change by minimising carbon and other greenhouse gas emissions. Annual targets for 2010 – 2022 are set out in the Climate Change (Annual Targets) (Scotland) Order 2010 (Scottish Government 2010).

7.1.27 An assessment of compliance of the proposed Scheme against National, Regional and Local Planning Policies relevant to air quality is reported in Appendix A18.2 (Assessment of Development Plan Policy Compliance) and summarised in Chapter 18 (Policies and Plans).

7.2 Methodology

7.2.1 This air quality assessment identifies potential air quality impacts by predicting the changes in concentrations of air pollution as a result of the combination of background concentrations and the contributions of the roads, including the proposed Scheme, in the study area.

7.2.2 This assessment conforms to the standard practice of Environmental Impact Assessment, whereby a baseline is established, and then a future situation with the proposed Scheme in place (Do Something (DS)) is compared with the situation without them (Do Minimum (DM)).

7.2.3 The potential impacts of the proposed Scheme have been assessed following DMRB Volume 11, Section, Part 1 HA 207/07 Air Quality (hereafter referred to as HA 207/07) and associated DMRB Interim Advice Notes, and LAQM TG(16). Following the process set out in DMRB, a detailed assessment has been carried out using the dispersion modelling software, Air Dispersion Model Software (ADMS)-Roads. In addition to the DMRB guidance, the assessment has also included the assessment of $PM_{2.5}$ to address the greater regulatory requirements applied in Scotland.

Construction Phase

Dust Deposition Impacts

7.2.4 Major construction projects can give rise to increased long term and short term PM_{10} concentrations. There is also the potential for dust nuisance at receptors within 350m of construction sites and haulage routes associated with the proposed Scheme. This nuisance, which

is separate from adverse effects on health, can arise through annoyance caused by the soiling of windows, cars, washing and other property.

7.2.5 Very high levels of deposition of dust can also affect plants and ecosystems, by covering their leaf surfaces and by changing the chemical composition and texture of the soil. The maximum distance at which any dust effects are likely to be experienced is 50m from the source.

7.2.6 The assessment considers the potential air quality impacts of dust at the nearest sensitive receptors within 350m of the proposed route and general areas within the CPO that might be used for construction activities. These locations are considered the most likely locations to experience the generation of significant PM_{10} and dust deposition from construction activities.

7.2.7 The construction process consists of a series of different operations, each with its own duration and potential for dust generation, which would vary substantially over different phases of the construction period. If the construction phase were to produce excessive emissions of dust, the impact on sensitive locations near to the sites (namely residential properties) could potentially be significant due to their close proximity.

7.2.8 In line with the Institute of Air Quality Management (IAQM) 2014 Guidance, a construction dust assessment has been carried out, providing a qualitative risk-based appraisal with reference to the proposed Scheme in relation to sensitive locations, the planned construction process and local site characteristics.

7.2.9 Depending on the level of risk determined for each site, as a result of the assessment, a suite of mitigation measures and site controls can be used to reduce the impact of dust during the construction phase. The level of measures and controls differs in relation to the level of risk for potential for dust nuisance. The mitigation measures are generally suitable for inclusion in a Construction Environmental Management Plan (CEMP) which would normally be agreed with the respective Council prior to commencement of activity on the site. Mitigation measures and controls for this proposed Scheme are detailed further in Section 7.7 (Mitigation).

7.2.10 The methodology for the construction dust assessment is provided in greater detail in Appendix A7.3 (Construction Assessment). A summary is provided in Table 7.4.

Table 7.4: Summary of IAQM Construction Dust Assessment Methodology

Step	Methodology Summary
Step 1	Screen the need for a detailed assessment
Step 2a	*Assess the Risk of Dust Impacts* Small, Medium and Large scale risk, based around scheme construction elements – Demolition, Earthworks, Construction and Trackout[1]
Step 2b	*Define the Sensitivity of the Area*, which includes Receptor sensitivity based on distance from source Sensitivity of the construction area to human health
Step 2c	*Define the Risk of Impacts*, based on the risk and sensitivity conclusions from Step 2a and 2b
Step 3	Site Specific Mitigation (if required)
Step 4	Determination of Significant Residual Effects

Assessment of Potential Air Quality Impacts from Construction Traffic

7.2.11 Construction of the proposed development would result in associated construction traffic, comprising Contractors' vehicles and Heavy Duty Vehicles (HDVs). This would result in additional

[1] Trackout is the transport of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when HDVs leave the construction site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

emissions of NOx, particulate matter and other combustion related pollutants on the local road network in the vicinity of the proposed development.

7.2.12 Current construction information indicates that the import and disposal of materials may require a significant number of additional HDV movements upon the local road network. Calculations have been undertaken based on receptor results close to the potential construction haulage routes in order to determine whether the additional HDVs have the potential to cause an exceedance.

Operational Phase

Local Air Quality Modelling Methodology

7.2.13 This assessment conforms to the standard practice of Environmental Impact Assessment, whereby a baseline is established, and then a future situation with the route options in place (Do Something (DS)) is compared with the situation without them (Do Minimum (DM)). For the purposes of the assessment, the Opening Year has been assumed as 2021, and the design year (15 years after opening) has been assumed as 2036.

7.2.14 The assessment of the potential air quality effects of the proposed Scheme has been undertaken using the ADMS-Roads software. It is an atmospheric dispersion modelling system that focuses on road traffic as a source of pollutant emissions, and is a recognised tool for carrying out air quality impact assessments. Version 4.0 (November 2015) was used for this assessment.

7.2.15 Further information on the modelling methodology can be found in Technical Appendix A7.1 (Dispersion Model Setup).

Assessment Scenarios

7.2.16 This assessment consists of two different geographic scales:

- local air quality, focusing only on the headline pollutants of NOx, NO_2, PM_{10} and $PM_{2.5}$; and
- regional air quality, focusing on NO_x, PM_{10}, carbon dioxide (CO_2), and total hydrocarbons (HC).

7.2.17 The assessment method is to quantify the ambient pollution concentrations and annual emissions for the road traffic scenarios as follows:

- Baseline Year (2014);
- Modelled Opening Year (2021) – without scheme – DM; and
- Modelled Opening Year (2021) – with scheme – DS.

7.2.18 As well as this, future scenarios (15 years after the modelled opening year) are also considered for the regional assessment:

- Design Year (2036) – DM; and
- Design Year (2036) – DS.

7.2.19 Assessment of potential impacts at designated habitat sites focuses on NO_x concentrations and nitrogen deposition, at statutorily designated sites within 200m of affected roads.

Study Area

Construction Phase

7.2.20 Potential air quality impacts were considered at selected representative receptor locations up to 500m from the proposed Scheme, and at the following distances from dust raising activities (distances from the site boundary), in accordance with IAQM guidance (IAQM February 2014):

- 0 to 20m;

- 21 to 50m;
- 51 to 100m; and
- 101 to 350m.

7.2.21 Representative receptor locations include human and ecological receptors as shown in Figure 7.1 and Figure 7.2 through to Figure 7.5.

7.2.22 With regard to construction haulage routes, the local air quality assessment study area or 'affected' road network is defined by qualifying criteria published in the DMRB guidance, based on changes between the 'without scheme' and 'with scheme' scenarios, and are as per those set out for the operational phase below.

Operational Phase

7.2.23 The study area for the assessment of local air quality has been defined in line with the guidance contained in the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1 HA207/07 (referred to hereafter as 'HA207/07'). It comprises:

- all land within 200m of the centre line of the existing road;
- land within 200m of the centre line of the proposed Scheme; and
- land within 200m of any other 'affected roads'.

7.2.24 'Affected roads' were identified based on changes between Do Minimum (DM) and Do Something (DS) scenarios that would occur as a result of the proposed Scheme being implemented, using qualifying criteria published in HA207/07, as follows:

- Horizontal road alignment would change by 5m or more;
- Daily traffic flows would change by more than 1,000 Annual Average Daily Traffic (AADT);
- Heavy Duty Vehicle (HDV) flows would change by more than 200 AADT;
- Daily average speed would change by more than 10kph; or
- Peak hour speed would change by more than 20kph.

7.2.25 Data from the traffic model has been used to define the study area, in line with these qualifying criteria. The study area covers the proposed Scheme, as well as sections of the wider local road network serving these areas.

Traffic Data

7.2.26 Traffic data for the modelling scenarios has been provided from the traffic models, which have been developed by Jacobs. The base year air quality modelling uses traffic data, pollution measurements and meteorological measurements from 2014.

7.2.27 During the timescale of the EIA, Interim Advice Note (IAN) 185/15 has been published by Highways England (formerly the Highways Agency). IAN185/15 provides supplementary guidance to HA207/07 regarding traffic speeds and the generation of speed-band banding for vehicle emissions. However, Transport Scotland do not apply IAN185/15, and it is therefore not considered further within this assessment.

7.2.28 Traffic data which represents the average conditions occurring in specific time periods was provided for the periods specified in Table 7.5.

Table 7.5: Annual Average Time Periods Used

Traffic Period	Time Period
Annual Average Daily Traffic (AADT)	00:00 – 23:00
Annual Average Weekday Traffic (AAWT) AM Peak (AM)	07:00 – 10:00

AAWT Inter-Peak (IP)	10:00 – 16:00
AAWT PM Peak (PM)	16:00 – 19:00
AAWT Off Peak (OP)	19:00 – 07:00

7.2.29 For each time period, the following traffic data parameters were provided:

- Total traffic flow, defined as vehicles/hour;
- Percentage heavy duty vehicles (HDV); and
- Vehicle speed, in kilometres per hour (kph).

Vehicle Emissions

7.2.30 The dispersion modelling process takes into account the emissions produced by Light Duty Vehicles (LDV, less than 3.5 tonnes) and Heavy Duty Vehicles (HDV, greater than 3.5 tonnes) travelling at a certain speed along a section of road over an average hour for the period considered, and predicts the dispersion of these emissions. Emissions for light and heavy duty vehicles are derived from the Defra Emissions Factor Toolkit (EFT) Version 6.0.2 (November 2014).

Meteorological Data

7.2.31 The effect of meteorological conditions on dispersion is given a complex treatment within the model. The most significant factors in the dispersion of emitted pollutants are wind speed and direction. The meteorological data site considered to be most representative of conditions across the study area was Inverness Airport for 2014.

Background Concentrations

7.2.32 Scottish Air Quality and Defra provide empirically-derived national background maps, which provide estimates of background pollutant concentrations on a 1km x 1km grid square resolution. This model relates the National Atmospheric Emissions Inventory to the national network of pollution measurements. Data for NO_x, NO_2 and PM_{10} have been obtained from Scottish Air, and $PM_{2.5}$ data obtained through Defra for the Highland Council area.

7.2.33 The 'in-grid square' contribution from road sectors have been removed from the background annual mean NO_x, PM_{10} and $PM_{2.5}$ concentration estimates, and background annual mean NO_2 estimates have been corrected using the Defra's Background NO_2 Calculator (Defra 2014). This process has been undertaken to avoid double counting of road traffic emissions. The predicted background pollutant concentrations in the study area are well below the AQOs.

Verification & Adjustment

7.2.34 The ADMS model is used to predict the road traffic contributions to NO_x, PM_{10} and $PM_{2.5}$ concentrations at specified receptors. Adjustments are applied to the model predictions based on a comparison against measured air quality concentrations, in a process known as model verification and adjustment.

7.2.35 The modelled road contributions were adjusted to correct them against measured road components derived from air quality monitoring data from the Automatic Monitoring Station in Inverness, and data obtained through the diffusion tube survey. These adjustments followed the methodology set out in LAQM TG(16). The adjustment factors applied to the model outputs are provided in Appendix A7.2 (Verification & Adjustment).

7.2.36 A total environmental concentration is then produced by the addition of the adjusted modelled road contribution to the background concentration.

7.2.37 In July 2011, Defra published a report examining the long-term air quality trends in NOx and NO_2 concentrations (Defra 2011). This identified that there has been a clear decrease in NO_2

concentrations between 1996 and 2002. Thereafter, NO_2 concentrations have stabilised with little to no reduction between 2004 and 2014. The report presents a similar pattern for the change in NOx concentrations over the same time period. However, the stabilisation in concentration is not reflected in the emissions factors and modelling methodology. The report concluded the identification of a gap between current projected vehicle emission reductions and measurements on the annual rate of improvements in ambient air quality, which are built into the vehicle emission factors, and the projected background maps.

7.2.38 The current trends in air quality are based on measurements of emissions from the existing vehicle fleet. New vehicles will need to comply with the more stringent Euro 6/VI emissions standards from September 2014 onwards. Vehicles complying with the Euro 6/VI emissions standard are not yet present in the datasets used to analyse long term air quality monitoring trends. If the Euro 6/VI fleet emissions perform as predicted, then this would lead to substantial reductions in predicted future roadside air quality concentrations.

7.2.39 An approach to adjust for this issue is known as the Gap Analysis method, as set out in IAN170/12v3 (Highways Agency Highways Agency, Transport Scotland, Welsh Assembly Government and the Department of Regional Development for Northern Ireland 2013b), which has been used in this assessment.

Receptors

7.2.40 Sensitive receptors have been identified that represent where the maximum potential impacts of the proposed Scheme may occur. These included residential receptors, as well as schools, hospitals and care homes. Building usage was determined using the Ordnance Survey Address Layer dataset, and calculations are made at the nearest façade to the busiest road.

7.2.41 A total of 401 residential receptors (within 200m of affected road links) were included in the assessment and were selected using professional judgement and are either close to the affected roads, or representative of the maximum impacts of a route option in that area. Receptors were usually those closest to the road section in the study area, or the proposed scheme. The identified receptor modelling locations are shown on Figure 7.2 to Figure 7.5 and are detailed in Technical Appendix A7.3 (Construction Assessment).

7.2.42 It is understood that there are a number of consented planning applications within the study area. Some of these include consent for residential dwellings. These have the potential to increase the number of residential receptors within the study area. The locations of current (March 2016) planning applications have been reviewed as part of this assessment, and modelled receptor locations within planning application areas have been included in the assessment.

Designated Sites

7.2.43 As well as the effect on human health, the proposed Scheme may result in potential air quality impacts upon the natural environment. Concentrations of pollutants in the air and deposition of nitrogen can damage vegetation directly or affect plant health and productivity. The pollutant of most concern for sensitive vegetation near roads is NO_x. Increases in concentrations of NO_x directly increase nitrogen deposition.

7.2.44 An assessment of designated sites within 200m of the affected roads that are sensitive to nitrogen has been undertaken from the methodology in Annex F of HA207/07. The sites included within the assessment are detailed in Table 7.6, together with an indication of which is the habitat within the designated site that is sensitive to nitrogen.

Table 7.6: Designated sites

Ecological Site	Designation	APIS Priority Habitat Type
Longman Stuart Castle Bays/ Inner Moray Firth	SSSI, SPA/Ramsar	Littoral sediment
Kildrummie Kames	SSSI	Juniper Scrub

7.2.45 The assessment compares the current baseline situation, future baseline situation (DM) and the future situation with scheme (DS) for NO_x concentrations and nitrogen deposition (loads) where applicable.

7.2.46 In order to assess the risk of air pollution impacts to ecosystems Critical Loads (CL) and Critical Levels are used as benchmarks. This information has been obtained from the Air Pollution Information System (APIS 2016).

7.2.47 A transect point was measured from the boundary of the designated site to the centreline of nearest affected road, and then further transect points at 10m increments up to 200m. The NO_x contribution at each transect point was calculated using the ADMS software. If the resulting NO_x concentration exceeds the AQO of 30µg/m^3, further data calculations into the impact upon nitrogen deposition would be required.

Regional Assessment

7.2.48 A DMRB regional air quality assessment methodology has been undertaken for the study area. This is an estimate of the change in total emissions of PM_{10}, NO_x, carbon dioxide (CO_2) and hydrocarbons (HC) per year from all vehicles on the affected roads. The assessment was undertaken using the Defra Emissions Factor Toolkit (v6.0.2), using the traffic data provided for each link, for each of the proposed Scheme and for both the modelled year of opening (2021) and design year (2036). The results have then been compared with the NAEI national (UK) emissions for road transport.

Impact Assessment & Significance

7.2.49 In order to convey the level of impact of the proposed Scheme, it is necessary to determine significance. The significance of an environmental impact is a function of the sensitivity of the receptor and the scale or magnitude of the impact. All assessed receptors are considered of equal sensitivity.

7.2.50 Box 1.1 of LAQM TG(16) details that annual mean objectives should apply to 'all locations where members of the public might be regularly exposed, building facades of residential properties, schools, hospitals, care homes etc'.

7.2.51 As noted in LAQM TG(16), there is not a specific requirement to define sensitivity or importance of receptors when using the magnitude of change criteria. If the receptor is the façade of a residential building, it is assumed that any member of the public could be present within the building, including the elderly, infants, or other vulnerable groups. The sensitivity of all receptors, such as dwellings, hospitals or schools are therefore assumed to be equal. The magnitude of change is determined by comparing DS to DM scenarios.

7.2.52 IAN174/13 (Highways Agency, Transport Scotland, Welsh Assembly Government and the Department of Regional Development for Northern Ireland 2013a) provides updated advice for evaluating significant local air quality effects, and is adopted by Transport Scotland. In line with this, the magnitude of change criteria for the assessment of air quality is provided in Table 7.7.

Table 7.7: Air quality magnitude of change criteria (AQO = Air Quality Strategy Objective)

Magnitude	Magnitude of Change (Annual Mean)		
	NO_2 (AQO: 40µg/m^3)	PM_{10} (AQO: 18µg/m^3)	$PM_{2.5}$ (AQO: 10µg/m^3)
Imperceptible (<1% +/- of AQO)	<0.4µg/m^3	<0.18µg/m^3	<0.10µg/m^3
Small (1-5% +/- of AQO)	0.4 – 2µg/m^3	0.18 – 0.85µg/m^3	0.10 – 0.50µg/m^3
Medium (5-10% +/- of AQO)	2 – 4µg/m^3	0.85 - 1.8µg/m^3	0.50 - 1.0µg/m^3
Large (>10% +/- of AQO)	>4µg/m^3	>1.8µg/m^3	>1.0µg/m^3

7.2.53 Highways England, in consultation with Transport Scotland, has developed a framework to provide guidance on the number of receptors for each of the magnitude of change categories that might result in a significant effect. These are guideline values only, and are to be used to inform

professional judgement on significant effects of the proposed Scheme. The guideline bands are based on the Highways England/Transport Scotland considered opinion and are intended to help provide consistency across all road schemes. The significance categories and guideline property numbers are summarised in Table 7.8.

Table 7.8: Guideline to Number of Receptors Constituting a Significant Effect

Magnitude of Change in Pollutant Concentration	Number of Receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large	1 to 10	1 to 10
Medium	10 to 30	10 to 30
Small	30 to 60	30 to 60

7.2.54 The significance of the change is likely to be greater, the higher above the air quality thresholds the changes are predicted to occur. Where it is predicted that the short term NO_2 and / or PM thresholds are exceeded, then more significance would be attributed to these effects.

7.2.55 The upper and lower bands presented are guidelines and not absolutes. On occasions when the number of properties affected is above the upper guideline band, consideration should be given to all the evidence that may support or detract from a conclusion of a significant effect when coming to a concluding view. The further above the upper guideline band the more likely local air quality effects would be significant.

7.2.56 Where the results reside between the lower and upper guideline bands for any of the magnitude criteria, then the proposed Scheme effects could be significant and a judgement is required taking into account the results for all six categories of small, medium and large benefit/worsening. This judgement is based on the technical knowledge and experience of the air quality professional.

7.2.57 Scheme effects are more likely to be significant where:

- there are no / few receptors with any improvements;
- PM annual averages are also affected by small, medium or large deteriorations; and
- short term exceedances may be caused or worsened by the proposed Scheme for either NO_2 or PM.

7.2.58 Scheme effects are more likely to be not significant where:

- there are receptors with small, medium or large improvements;
- PM annual averages are not affected by small, medium or large deteriorations; and
- short term exceedances are not caused or worsened by the proposed Scheme for either NO_2 or PM.

7.2.59 The establishment of overall air quality significance for the proposed Scheme would also consider:

- whether the proposed Scheme detracts or supports measures set out in relevant local authority AQAPs;
- if the proposed Scheme represents a low or high compliance risk with the EU Directive on Ambient Air Quality; or
- if any designated site(s) are affected and potential effective mitigation.

7.2.60 With respect to the EU Directive on Ambient Air Quality and Clean Air for Europe (2008/50/EC) Defra reports annually (on behalf of the UK government) on the status of air quality to the European Commission.

7.2.61 There are no locations within the air quality study area that are considered at risk of exceeding the EU Limit Values as reported by Defra. Therefore the proposed Scheme cannot lead to change in the UK's reported position to the European Commission on national compliance with the Air Quality Directive.

7.2.62 There is no government guidance published for assessing the significance of the effects of individual road schemes on regional or greenhouse gas emissions.

7.2.63 The Climate Change (Annual Targets) (Scotland) Order 2010 publishes budgets for the reduction of the emissions of greenhouse gases. However, total Scottish emissions are managed and considered at a national level not on a scheme by scheme basis.

Mitigation

7.2.64 Potential mitigation measures have been considered during this assessment and these are discussed in Section 7.7 (Mitigation).

Limitations

7.2.65 It should be emphasised that the air quality impact assessment is based on a series of computer models of future conditions. The process begins with the modelling of future traffic flows, which is subject to its own inherent degree of uncertainty. This traffic data is then used in the air quality model to compare future air quality conditions both with and without the proposed Scheme. The air quality model draws on a number of other trends and parameters that must be projected into the future. The modelling process includes atmospheric dispersion modelling, which provides an estimate of concentrations arising from input emissions and historical meteorological data.

7.2.66 As with any computer model that seeks to predict future conditions, there is therefore uncertainty in the predictions made. Whilst being the best predictions available, elements of impact prediction such as the specific concentration of a given pollutant at a given property, or whether an exceedance of Air Quality Objectives would or would not occur at a specific location, are not precise and are always subject to a margin for error. However, the assessment process is considered to be based on the most reasonable, robust and representative methodologies taking advice from published guidance.

7.2.67 Identification of sensitive receptors is based on Address Base data. There may in some cases be properties, such as those recently built, which are not yet present within these data sources. Every endeavour has been made to identify and consider all such properties during the DMRB Stage 3 assessment.

7.3 Baseline Description and Evaluation

7.3.1 A review and assessment of the current air quality information in the vicinity of the proposed Scheme has been undertaken to establish a 'baseline' situation by which the assessment results can be compared to. This has included a desktop review of Local Authority reports (under LAQM), a review of the latest air quality monitoring, together with air quality background mapping produced by Defra.

The Highland Council

7.3.2 Under Part IV of the Environment Act 1995, and the establishment of SEPA, the Government introduced LAQM, which placed duties on local authorities to undertake periodic reviews of air quality in their areas to assess present and likely future air quality against the AQS objectives. Where these objectives are not likely to be met, the local authority must designate an AQMA, and produce an action plan for improvement in air quality.

7.3.3 The study area falls within the local authority area of The Highland Council. The latest LAQM report, the 2015 Updated and Screening Report (Highland Council 2016) has been obtained and reviewed.

7.3.4 The report summarises previous rounds of LAQM assessments, and concludes that air quality in the Highland Council area is good, but that previous rounds of review and assessment have identified an area of Inverness City Centre with poorer air quality, and as such, an AQMA has been declared. The required Action Plan is due to be published in 2016. The report concluded that no detailed assessment was required for any pollutants.

Automatic Monitoring Data

7.3.5 The Highland Council operate a Continuous Monitoring Station (CMS) on Telford Street, Inverness, four metres from the A862, which monitors NO_x, NO_2, PM_{10} and $PM_{2.5}$. The relevant monitoring data is presented in Table 7.9.

Table 7.9: Automatic Monitoring Station Data: Telford Street, Inverness (Highland Council)

Telford Street Station	Grid Reference	2010 µg/m^3	2011 µg/m^3	2012 µg/m^3	2013 µg/m^3	2014 µg/m^3	Data Capture 2014
NO_2	265709, 845670	24.5	27.0	29.2	21.0	21.0	99.3%
PM_{10}		14.0	11.8	11.0	11.7	11.0	98.7%

7.3.6 The CMS results indicate NO_2 and PM_{10} concentrations within the relevant AQOs. $PM_{2.5}$ is not yet available from The Highland Council.

Non-automatic Monitoring Data

7.3.7 The Highland Council operate 10 passive NO_2 diffusion tubes across both Inverness and Dingwall. The locations and positioning of these tubes have been reviewed with regard to using the data as background concentrations for the assessment, and to feed into the modelling verification process. The review concluded:

- Inverness: The diffusion tubes were located along the main streets within Inverness town centre, and in areas where taller buildings would create a 'street canyon' whereby pollutant concentrations tend to be higher due to the reduced level of dispersion where tall buildings are present. This type of monitoring location was not thought to be representative of the rural nature of the study area, and was not included as part of the assessment.
- Dingwall: The two relevant diffusion tube locations are classified as 'urban backgrounds' within Dingwall town and are not suitable for model verification.

NO_2 Monitoring Survey

7.3.8 Due to the lack of suitable monitoring locations in the vicinity of the proposed Scheme study area to enable model verification, an NO_2 diffusion tube survey has been undertaken. This has been carried out to measure NO_2 concentrations and background concentrations across the study area.

7.3.9 The measurements will give an indication of longer-term average NO_2 concentrations for comparison with Air Quality Strategy (AQS) objectives based on the annual mean. A triplicate study was co-located alongside the automatic analysers at Telford Street (Inverness City Centre), with permission of the Highland Council air quality team.

7.3.10 The survey was deployed between July 2015 and January 2016. The results have provided data for the verification of the ADMS modelling results as part of the assessment. For further details on the processing of the monitoring data, refer to Appendix A7.2 (Verification & Adjustment).

7.3.11 The survey locations and results are summarised in Table 7.10. Diffusion tube locations are shown on Figure 7.1.

Table 7.10: NO_2 Diffusion Tube Monitoring Survey – Annual Mean 2014 Adjusted Concentration (µg/m^3)

Location	X	Y	NO_2 Concentration	Data Capture (%)
CMS	265708	845671	26.0	100%
01_LP	270261	846335	36.2	100%
02_LP	270612	846040	13.2	83%
03_RS	271528	847478	19.4	100%
04_LP	273028	847396	10.0	100%
05_TP	275118	849202	25.7	100%
06_TP	276164	849703	14.2	67%
07_TP	277351	850860	14.2	100%
08_TP	279937	852717	7.0	100%
09_TP	284942	854582	3.7	67%
10_TP	285636	855708	18.8	100%
11_RS	286409	854055	4.3	100%
12_LP	286856	855946	17.2	100%
13_LP	287749	856216	22.9	100%
14_LP	288415	856711	25.8	100%
15_LP	288900	856447	24.2	50%
16_LP	289535	856223	17.9	67%
17_TP	287903	854930	3.9	83%
18_LP	288746	855358	4.2	100%
19_TP	290616	854527	4.0	83%
20_LP	291707	855451	7.0	100%
21_TP	292180	856037	7.0	83%
22_TP	294219	855912	7.2	100%
23_LP	273822	846892	3.2	100%
24_LP	288365	856667	35.1	100%
25_LP	288459	856694	42.9	100%
26_TP	291253	856358	4.7	83%
322*	270261	846335	4.0	100%

*Additional site added in November 2015. Reported data capture refers to available period of two months, as defined in LAQM TG(16).

7.3.12 The results from the survey indicate that existing NO_2 concentrations across the study area are good, with the majority of the locations well below the AQO. Concentrations in more rural locations are shown to be very low. The highest concentration, which exceeds the NO_2 AQO is a roadside location in the centre of Nairn. This monitoring location is sited on a road sign, and may not be representative of relevant annual mean exposure locations. Location 25_LP (nearby and a similar distance from the road) is likely to be more representative of annual mean exposure, with a concentration of 35.1 µg/m^3.

Consultation

7.3.13 As part of the assessment, consultation has taken place with the air quality team at The Highland Council to agree the assessment methodology, obtain the necessary LAQM reports, and gain permission for the co-location of a diffusion tube at the CMS.

Modelled Baseline Concentrations

7.3.14 The air quality study area is defined by the traffic changes predicted to result from the proposed development. At the receptor locations, estimates are made by dispersion modelling of what the air

quality situation was in the base year (2014); this is taken to represent the current air quality situation at these locations. One receptor to the west of the A9 (AQ_045 Milburn Crossing) is predicted to exceed the NO_2 annual mean AQO in the Base year. This location is not sited within an AQMA.

7.3.15 A total of 401 sensitive receptors (residential properties, schools etc) were included in the modelling. The results for receptors representative of impacts across the local air quality study area are described and discussed within the chapter and are specifically labelled on Figure 7.2. The results for all the receptors assessed can be found in Appendix A7.4 (Receptor Results).

7.3.16 Estimated annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for selected representative receptors are presented in Table 7.11. Figure 7.2 presents the modelled NO_2 annual mean concentrations at all modelled receptor locations within the study area for the base scenario.

7.3.17 The discussion and presentation of the modelled estimates at human receptor locations uses a subset of the total modelled receptors located across the study area. These include receptors located close to the existing A96, and the new dual carriageway alignment. This subset provides the results at receptors selected to illustrate the changes (such as worsening or benefit), or new/removed exceedances of air quality objectives over the study area. The results for all the receptors assessed can be found in Appendix A7.4 (Receptor Results). To enable clearer description of the range of local air quality impacts across the overall study area, the results have been divided into three spatial groups in the discussion and tables within in this chapter.

Table 7.11: Base (2014) Concentrations at Selected Representative Receptors

		Base Concentration (Annual Average) (µg/m^3)		
Receptor		**NO_2**	**PM_{10}**	**$PM_{2.5}$**
Western Study Area (Inverness, Smithton Junction)				
AQ_001	Roseacre, Inverness, IV2 7NS	17.8	11.1	6.9
AQ_007	Churchfield Cottage, Barn Church Road, Inverness, IV2 7NS	11.9	10.2	6.4
AQ_045	Millburn Crossing, Millburn Road, Inverness, IV2 3TR	48.5	15.0	9.7
AQ_102	2 Morayston Farm Cottages, Dalcross, IV2 7JQ	26.5	13.3	8.6
AQ_110	Upper Cullernie, Edgefield, Cullernie Road, Inverness, IV2 7HU	9.0	9.5	5.9
AQ_124	The Bungalow At Farm, Inverness, IV2 7HX	8.0	9.1	5.8
AQ_126	6 Milton of Culloden Inverness, IV2 7NX	10.9	9.4	6.0
AQ_127	Mardon, Milton Of Culloden, Inverness, IV2 7NU	34.5	14.4	8.9
AQ_132	Allanfearn Farm House, Inverness, IV2 7HX	14.4	10.1	6.4
Central Study Area (existing A96)				
AQ_105	Chestnut Cottage, Dalcross, IV2 7JQ	20.8	11.1	7.1
AQ_232	Crook Farmhouse, Nairn, IV12 5RY	3.3	8.5	5.4
AQ_261	The Cottage, Taste Of Moray, Inverness, IV2 7QT	12.2	11.6	6.7
AQ_282	Blackcastle Cottage, Gollanfield Road, IV2 7QP	8.7	9.8	6.1
AQ_283	Blackcastle, Gollanfield, Nairn, IV2 7QP	20.7	11.0	7.2
AQ_294	1 The Cotterhouse, Milton Of Breachlich Road, Inverness, IV2 7QT	7.0	10.3	5.9
AQ_301	Kerrowaird Cottage East, Kerrowaird, Dalcross, IV2 7JQ	23.7	12.0	7.7
AQ_305	2 Station Cottages, Dalcross Station Road, Dalcross, IV2 7JJ	6.7	8.6	5.8
Eastern Study Area (Nairn, Auldearn)				
AQ_332	8 Waterloo Cottages, Nairn, IV12 5JU	5.8	10.3	6.1
AQ_223	Macintosh Buildings, High Street, Auldearn, IV12 5TJ	10.2	9.6	6.2
AQ_226	1 New Biggins Building, High Street, Auldearn, IV12 5TG	10.2	9.6	6.2
AQ_227	1 Dunbar Flats, High Street, Auldearn, IV12 5TG	10.2	9.6	6.2
AQ_212	Courage Cottage, The Courage, , Nairn, IV12 5QG	12.3	9.8	6.4
AQ_203	Heathfield Easter Hardmuir, Nairn, IV12 5QG	12.5	10.4	6.5
AQ_206	The Bungalow, Wester Hardmuir, Nairn, IV12 5QG	14.3	10.3	6.6

		Base Concentration (Annual Average) (µg/m^3)		
Receptor		NO_2	PM_{10}	$PM_{2.5}$
AQ_364	Lochiel Place, St. Ninian Road, Nairn, IV12 4EH	28.4	13.0	8.1
AQ_334	Drumduan Mill, Nairn, IV12 5JU	4.8	8.9	5.6
AQ_366	1 Bath Street, Nairn, IV12 4NA	32.4	13.7	8.6
AQ_396	2 Manse Road, Nairn, IV12 4RN	27.9	12.3	7.9
AQ_390	Altonsyde, Inverness Road, Nairn, IV12 5NA	27.6	13.6	8.3
AQ_322	East Lodge Cottage, Boath, Nairn, IV12 5JU	5.0	8.9	5.6

7.3.18 The results show that the majority of modelled receptors are well below the NO_2 annual mean AQO (40µg/m^3) in the base year. Location AQ_045 (Milburn Crossing, Inverness) shows the highest NO_2 concentration of 48.5µg/m^3, and is the only receptor that is in exceedance of the annual mean AQO. No receptors approach the 1 hour mean AQO of 60µg/m^3.

7.3.19 None of the receptors approach the PM_{10} annual mean AQO of 18µg/m^3, or are expected to exceed the 24 hour mean AQO because the modelled annual mean concentrations are less than 22.4µg/m^3. All receptors are also within the relevant $PM_{2.5}$ AQO in the Base year.

7.3.20 PM_{10} and $PM_{2.5}$ results are presented for the representative receptors, but are not discussed further.

7.3.21 Receptors in proximity to the proposed Scheme are shown to have relatively low pollutants concentrations, whilst locations in Nairn and towards the centre of Inverness at Millburn Crossing (AQ_45) have poorer air quality.

7.4 Impacts – Construction

Construction Dust Assessment

7.4.1 There is the potential for dust nuisance during the construction phase of the proposed Scheme. The level and distribution of construction dust emissions would depend on where within the proposed Scheme boundary the dust raising activity takes place, the nature of the activity and controls, and weather conditions.

7.4.2 A qualitative assessment of construction phase dust and PM_{10} emissions was carried out in accordance with the latest IAQM guidance (IAQM 2014). Full details of the methodology and dust assessment undertaken are provided in Appendix A7.3 (Construction Assessment).

7.4.3 The dust emission magnitude of construction activity (e.g. earthworks) and the sensitivity of the area (sensitivities, proximity and number of receptors) were combined to determine the risk of impacts from construction dust. The dust emission magnitude and sensitivity of the area varies along the extent of the proposed Scheme, therefore the route was divided into three sections for the dust assessment, based on the number of sensitive receptors in proximity to the proposed Scheme. These sections are as follows:

- Section 1: The western end of the proposed Scheme (around Smithton) from the Seafield Roundabout to Barn Church Road (C1032) (Balloch Junction);
- Section 2: The 'middle' section of the proposed Scheme from Barn Church Road (C1032) to the B9090 Loch Flemington – Clephanton – Cawdor – Nairn Road; and
- Section 3: The eastern end of the proposed Scheme (east of Nairn) from the B9090 Loch Flemington – Clephanton – Cawdor – Nairn Road to Hardmuir.

Construction Dust Assessment: Summary Tables

Potential Dust Emission Magnitude

7.4.4 The IAQM guidance recommends that the fugitive dust emission magnitude should be based on the scale of the anticipated works for demolition, earthworks, construction and trackout (Table 7.12). The magnitudes for each activity apply for all sections of the proposed Scheme described in paragraph 7.4.4. Full details of how the dust emission magnitudes were derived are shown in Appendix A7.3 (Construction Assessment) Table 1-1.

Table 7.12: Dust Emission Magnitude for Construction Activities

Activity	Dust Emission Magnitude
Demolition	Medium
Earthworks	High
Construction	High
Trackout	High

7.4.5 **Define the Sensitivity of the Area**

7.4.6 The sensitivity of the area to dust soiling, human health and ecological effects was defined for each activity using Table 1-2, Table 1-3, Table 1-4 and Table 1-5 in Appendix A7.3 (Construction Assessment). The sensitivities are summarised in Table 7.13.

Table 7.13: Sensitivity of the Surrounding Area to Dust Soiling and Human Health Effects

Scheme Section	Sensitivity to dust soiling effects		Sensitivity to health effects of PM_{10}		Sensitivity to Ecological Effects	
	Source	Sensitivity	Source	Sensitivity	Source	Sensitivity
Section 1	Demolition	Low	Demolition	Low	Demolition	Low
	Earthworks	High	Earthworks	Low	Earthworks	Low
	Construction	High	Construction	Low	Construction	Low
	Trackout	Medium	Trackout	Low	Trackout	N/A
Section 2	Demolition	Low	Demolition	Low	Demolition	Low
	Earthworks	Medium	Earthworks	Low	Earthworks	Low
	Construction	Medium	Construction	Low	Construction	Low
	Trackout	High	Trackout	Low	Trackout	Low
Section 3	Demolition	Low	Demolition	Low	Demolition	Low
	Earthworks	Medium	Earthworks	Low	Earthworks	N/A
	Construction	Medium	Construction	Low	Construction	N/A
	Trackout	Medium	Trackout	Low	Trackout	N/A

Risk of Effects

7.4.7 The dust emission magnitude detailed in Table 7-12 was combined with the sensitivity of the area detailed in Table 7-13 to determine the risk of effects with no mitigation applied, as detailed in Table 1-6, Table 1-7, Table 1-8 and Table 1-9 of Appendix A7.3 (Construction Assessment). The risks without mitigation applied for dust soiling and human health are provided in Table 7.14 below.

7.4.8 Across the proposed Scheme, the risk of dust emissions from earthworks and construction activities having an adverse effect at sensitive locations is summarised below and in Table 7.14, refer to Appendix A7.3 (Construction Assessment) for more detail:

- High to medium risk of dust soiling;
- Low risk of human health effects (due to elevated PM_{10} concentrations as a result of dust generating activities on site); and
- Low risk of ecological effects.

Table 7.14: Summary Dust Risk Table to Define Site-specific Mitigation

Scheme Section	Risk											
	Demolition			Earthworks			Construction			Trackout		
	Dust Soiling	Human Health	Ecological	Dust Soiling	Human Health	Ecological	Dust Soiling	Human Health	Ecological	Dust Soiling	Human Health	Ecological
Section 1	L	L	L	H	L	L	H	L	L	M	L	N/A
Section 2	L	L	L	M	L	L	M	L	L	H	L	L
Section 3	L	L	N/A	M	L	N/A	M	L	N/A	M	L	N/A

Key: H (High Risk) / M (Medium Risk) / L (Low Risk) / N/A (Not applicable)

Site Specific Mitigation

7.4.9 During construction, it is important to control dust emissions to reduce the potential for effects at and around potential site compound areas.

7.4.10 A robust selection of mitigation measures are specified within IAQM guidance. Measures that are relevant and appropriate to the scheme would be considered for incorporation into the Construction Environmental Management Plan (CEMP) for the proposed Scheme. The CEMP would be discussed and agreed with The Highland Council once a project contractor has been appointed. Information on the potential mitigation measures and controls which could form part of the CEMP can be found in Technical Appendix A7.3 (Construction Assessment)

7.4.11 The 'overall dust impact risk' column (Table 7.15) summarises the highest risk level appointed to a particular scheme section overall. This would be used to determine which of the mitigation controls apply to that site location.

7.4.12 With consistent implementation and management of agreed mitigation measures and controls, the potential dust impacts of each location would be sufficiently reduced to a minor or negligible impact.

Table 7.15: Summary of Dust Effect Risks across Study Area (Without Mitigation)

Location	Dust Risk of Construction Elements				Overall Dust Impact Risk
	Demolition	Earthworks	Construction	Trackout	
Section 1 (Western extent of proposed Scheme)	Low	High	High	Medium	High
Section 2 (Central section of proposed Scheme)	Low	Medium	Medium	High	High
Section 3 (Eastern extent of proposed Scheme)	Low	Medium	Medium	Medium	Medium

Construction Vehicle Assessment

7.4.13 Available construction information indicates that the number of additional HDVs that would be required for the import and delivery of construction materials would be above the criteria required for assessment. This could potentially include (mainly on the existing A96):

- Inverness to Kerrowaird: 481 AADT (annual average vehicles per day);
- Kerrowaird to Lochside: 277 AADT; and
- Lochside to River Nairn: 577 AADT.

7.4.14 Calculations were undertaken at the most constrained location where a receptor has the highest DM scenario NO_2 concentration for routes where HDV traffic has been provided (in this case, a property on the existing A96 at Morayston), and the location of maximum impact, where the highest number of potential HDVs are predicted (i.e. 481 AADT). Calculations were made to determine the annual emission from a single HDV at the same distance from the road as the receptor, and the increase in vehicle emissions that would be necessary to lead to an exceedance of the AQOs at that location.

7.4.15 In both cases, the HDV movements associated with the construction phase would need to be more than double the current estimated level before approaching potential exceedance of the AQO.

7.4.16 It should be noted that these movements would only be a temporary addition to the local road network. The construction phase of the proposed Scheme would be undertaken over a three year period. Emissions from construction vehicle traffic are therefore not considered to lead to a significant effect on local air quality.

7.5 Impacts – Operation

Local Air Quality

7.5.1 This section presents the effects of the proposed Scheme in operation on local air quality along affected roads in the study area. The results presented throughout this section are based on the values predicted using the IAN170/12 Gap Analysis methodology which takes into account the Long Term Trends (LTT_{E6}) for NO_x and NO_2. This approach is more conservative, and is considered to be more representative of opening year impacts than the LAQM TG(16) methodology.

7.5.2 The presentation of the modelled estimates at human receptor locations includes selected receptors located across the study area, including receptors located close to the existing A96, and the new dual carriageway alignment. This provides the results at receptors selected to illustrate the changes (such as worsening or benefit), or new/removed exceedances of air quality objectives. The results for all the receptors assessed can be found in Appendix A7.4 (Receptor Results), and all modelled locations are shown on the figures described below.

7.5.3 Figure 7.3 and Figure 7.4 show the predicted DM and DS annual mean NO_2 concentrations in 2021, respectively. Figure 7.5 shows the change in annual mean NO_2 concentrations in 2021.

7.5.4 Estimated annual mean NO_2, PM_{10} $PM_{2.5}$ concentrations for the selected representative receptors defined in Section 7.3 (Baseline Description and Evaluation) are presented in Table 7.16 and are specifically labelled on Figure 7.3 to Figure 7.5.

Table 7.16: NO_2, PM_{10} and $PM_{2.5}$ Concentrations at Selected Representative Receptors (Do Minimum 2021 and Do Something 2021)

(Annual Average) (µg/m^3)		Do Minimum Concentration (Annual Average) (µg/m^3)			Do Something Concentration (Annual Average) (µg/m^3)			Change in Concentration (µg/m^3)		
Receptor		**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
Western Study Area (Inverness, Smithton Junction)										
AQ_001	Roseacre, Inverness, IV2 7NS	17.6	10.9	6.6	13.6	10.4	6.3	-4.0	-0.5	-0.3
AQ_007	Churchfield Cottage, Barn Church Road, Inverness, IV2 7NS	10.1	9.9	6.1	10.0	10.0	6.1	0.0	0.1	0.0
AQ_045	Millburn Crossing, Millburn Road, Inverness, IV2 3TR	40.2	14.6	8.9	42.1	14.8	9.1	1.9	0.2	0.2
AQ_102	2 Morayston Farm Cottages, Dalcross, IV2 7JQ	21.3	13.0	8.2	11.3	10.7	6.9	-10.0	-2.3	-1.3
AQ_110	Upper Cullernie, Edgefield, Cullernie Road, Inverness, IV2 7HU	7.1	9.2	5.6	8.7	9.5	5.8	1.7	0.3	0.2
AQ_124	The Bungalow At Farm, Inverness, IV2 7HX	6.2	8.8	5.6	9.8	9.6	6.0	3.6	0.8	0.4
AQ_126	6 Milton of Culloden Inverness, IV2 7NX	8.8	9.1	5.7	14.0	10.1	6.3	5.2	1.0	0.6
AQ_127	Mardon, Milton Of Culloden, Inverness, IV2 7NU	28.7	14.2	8.4	20.0	11.5	6.9	-8.7	-2.7	-1.5
AQ_132	Allanfearn Farm House, Inverness, IV2 7HX	11.6	9.8	6.1	9.5	9.2	5.8	-2.0	-0.6	-0.3
Central Study Area (existing A96)										
AQ_105	Chestnut Cottage, Dalcross, IV2 7JQ	17.0	10.8	6.7	10.4	9.2	5.8	-6.5	-1.6	-0.9
AQ_232	Crook Farmhouse, Nairn, IV12 5RY	2.6	8.3	5.2	4.1	8.6	5.4	1.6	0.3	0.2
AQ_261	The Cottage, Taste Of Moray, Inverness, IV2 7QT	10.1	11.3	6.4	10.8	11.1	6.3	0.7	-0.2	-0.1
AQ_282	Blackcastle Cottage, Gollanfield Road, Ardersier, IV2 7QP	7.0	9.5	5.9	10.1	9.9	6.1	3.1	0.4	0.2
AQ_283	Blackcastle, Gollanfield, Nairn, IV2 7QP	17.1	10.8	6.8	8.8	8.8	5.7	-8.3	-2.0	-1.1
AQ_294	1 The Cotterhouse, Milton Of Breachlich Road, Inverness, IV2 7QT	5.5	10.0	5.7	6.8	10.1	5.8	1.3	0.1	0.1
AQ_301	Kerrowaird Cottage East, Kerrowaird, Dalcross, IV2 7JQ	19.3	11.7	7.2	10.3	9.6	6.1	-9.0	-2.1	-1.1
AQ_305	2 Station Cottages, Dalcross Station Road, Dalcross, IV2 7JJ	5.4	8.4	5.6	6.8	8.6	5.7	1.4	0.2	0.1
Eastern Study Area (Nairn, Auldearn)										
AQ_332	8 Waterloo Cottages, Nairn, IV12 5JU	4.6	10.1	5.9	5.9	10.3	6.0	1.3	0.2	0.1
AQ_223	Macintosh Buildings, High Street, Auldearn, IV12 5TJ	9.3	9.4	6.0	7.1	9.1	5.8	-2.2	-0.3	-0.2

(Annual Average) (µg/m^3)		Do Minimum Concentration (Annual Average) (µg/m^3)			Do Something Concentration (Annual Average) (µg/m^3)			Change in Concentration (µg/m^3)		
Receptor		NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
AQ_226	1 New Biggins Building, High Street, Auldearn, IV12 5TG	9.3	9.4	6.0	7.1	9.1	5.8	-2.2	-0.3	-0.2
AQ_227	1 Dunbar Flats, High Street, Auldearn, IV12 5TG	9.3	9.4	6.0	7.1	9.1	5.8	-2.2	-0.3	-0.2
AQ_212	Courage Cottage, The Courage, Nairn, IV12 5QG	9.9	9.5	6.0	5.1	8.4	5.5	-4.7	-1.1	-0.5
AQ_203	Heathfield Easter Hardmuir, Nairn, IV12 5QG	10.1	10.1	6.2	10.7	10.2	6.3	0.7	0.1	0.1
AQ_206	The Bungalow, Wester Hardmuir, Nairn, IV12 5QG	11.5	10.0	6.3	8.4	9.1	5.8	-3.1	-0.9	-0.5
AQ_364	Lochiel Place, St. Ninian Road, Nairn, IV12 4EH	25.4	13.0	7.8	15.1	11.1	6.8	-10.3	-1.9	-1.0
AQ_334	Drumduan Mill, Nairn, IV12 5JU	4.1	8.7	5.4	6.7	9.2	5.7	2.6	0.5	0.3
AQ_366	1 Bath Street, Nairn, IV12 4NA	28.7	13.8	8.2	17.8	11.7	7.1	-11.0	-2.1	-1.1
AQ_396	2 Manse Road, Nairn, IV12 4RN	24.4	12.3	7.5	16.0	10.7	6.7	-8.4	-1.6	-0.8
AQ_390	Altonsyde, Inverness Road, Nairn, IV12 5NA	24.5	13.7	8.0	14.9	11.6	6.8	-9.7	-2.1	-1.2
AQ_322	East Lodge Cottage, Boath, Nairn, IV12 5JU	3.9	8.7	5.4	4.9	8.8	5.5	1.0	0.1	0.1

7.5.5 With the exception of AQ_045 (Milburn Crossing) for annual mean NO_2, the results show that all of the modelled receptors are within the AQOs for all pollutants in both the DM and DS scenarios.

Western Study Area (Inverness, Smithton Junction)

- The greatest increase in NO_2 concentration between DM and DS is predicted at AQ_126, with a concentration change of 5.2µg/m^3, as a result of the new dual carriageway alignment being brought closer to the property. The receptor is not exceeding the AQO in DM or DS scenario.
- Receptor AQ_045 is predicted to experience an increase of an exceedance in NO_2 of 1.9µg/m^3, which is classed as a small worsening. The model results indicate that NO_2 concentrations at this location would also be in exceedance in the DM scenario (without the proposed Scheme in place).
- Receptor AQ_102 is predicted to experience the greatest decrease in NO_2 concentration within this part of the study area, with a decrease of 10.0µg/m^3. This receptor is located close to the existing A96, where the new dual carriageway alignment (and therefore road emissions) would be moved further from the property.
- The greatest decrease in both PM_{10} and $PM_{2.5}$ concentrations is predicted to occur at Receptor AQ_127, which is also located close to the existing A96.

Central Study Area

- The greatest increase in NO_2 concentration is predicted at AQ_282, with a change of 3.1µg/m^3, as a result of the new Nairn West Junction bringing road emissions closer to the property. However, the property is not in exceedance of the AQO in either the DM or DS scenario.
- Receptor AQ_301 is predicted to experience the greatest decrease in NO_2 concentration, with a decrease of 9.0µg/m^3. This receptor is located close to the existing A96, where the new road alignment (and therefore road emissions) would be moved further from the property. The receptor is also predicted to experience the greatest decrease in PM_{10} and $PM_{2.5}$ in this part of the study area. The receptor concentrations do not exceed the relevant AQOs in DM or DS.

Eastern Study Area

- Assessment results indicate that receptors within the centre of Nairn are predicted to experience beneficial reductions in NO_2 concentration with the proposed development in operation.
- Within this part of the study area, the greatest increase in NO_2 concentration is predicted at AQ_334, with a change of 2.6µg/m^3, as a result of the new Nairn East Junction bringing road emissions closer to the property. However, the property is not in exceedance of the AQO in either the DM or DS scenario, and concentrations are very low.
- Receptor AQ_233 is located on the main road in Auldearn. NO_2 Concentrations at the receptor are predicted to decrease by 2.2µg/m^3, and are within the AQO in both DM and DS.
- Receptor AQ_366 is predicted to experience the greatest decrease in NO_2 concentrations in this part of the study area, with a decrease of 11.0µg/m^3. This receptor is located on the A96 in the centre of Nairn, which is due to experience reduced traffic flows with the proposed development in place. The receptor is not in exceedance of the AQO in DM or DS.
- Receptor AQ_390 is located on the existing A96, and is predicted to experience the greatest decrease in PM_{10} and $PM_{2.5}$ concentrations, with a change of 2.1 and 1.2µg/m^3 respectively. The receptor is not in exceedance of the AQO in either the DM or DS scenario.

7.5.6 In areas close to where the new dual carriageway alignment would be constructed, the results indicate the nearby receptors are predicted to experience increases in NO_2 concentrations. However, with the exception of AQ_045, there are no exceedances for the NO_2 AQO in either the DM or DS scenario.

7.5.7 The results indicate air quality concentrations are predicted to change as would be expected for a proposed Scheme such as this. Concentrations are reduced in the centre of Nairn, as traffic flows are moved onto the new dual carriageway alignment, and concentrations at receptors in the vicinity of the new dual carriageway alignment are predicted to increase although typically by lower levels than those experiencing improvements.

7.5.8 Of the 401 receptors included in the modelling, 242 are predicted to experience a decrease in NO_2 concentrations, whilst 159 are predicted to experience an increase in NO_2 concentrations.

Significance of Local Air Quality Effects

7.5.9 Based on the IAN174/13 guidelines for the consideration of significant effects, the results for the NO_2 annual mean AQO are summarised in Table 7.17, based on all 401 receptors included in the modelling. Only receptors that are predicted to exceed the NO_2 AQO in either the DM or DS scenario are considered, as they have could potentially be subject to significant change.

Table 7.17: Local air quality receptors informing scheme significance (NO_2 Annual Mean) 2021

Magnitude of Change in Annual Average NO_2 (µg/m^3)	Total Number of Receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>4)	0	0
Medium (>2)	0	0
Small (>0.4)	1	0

7.5.10 The results show that for the NO_2 annual mean AQO, the proposed development leads to a small magnitude worsening of one receptor (AQ_045, Milburn Crossing), which is in exceedance in both the DM and DS scenario.

7.5.11 There are no new or removed exceedances of the relevant AQOs with the proposed Scheme in operation. The receptors that are likely to experience a reduction in NO_2 concentration (and therefore an improvement in air quality) are already below the AQO.

7.5.12 There are no exceedances of either the annual mean or 24 hour mean AQOs for PM_{10} nor the $PM_{2.5}$ AQO across the study area in either the DM or DS scenario. Therefore, no significant effects can be considered to occur for either PM_{10} or $PM_{2.5}$, based on the guidance in IAN174/13.

7.5.13 Based on Highways England's guidance the judgement of significance is determined by taking a balanced consideration of all impacts, both beneficial and adverse, over the proposed Scheme study area. Based on the guideline bands described in Table 7.8, the proposed Scheme is not considered to lead to a significant effect on local air quality. As noted in 7.5.8, more properties are expected to experience an improvement to air quality concentrations than those predicted to experience a worsening.

Designated Sites

7.5.14 An assessment of ecological receptors has been undertaken. Transect points measured from the boundary of the designated site to approximately the centreline of the nearest affected road (and then further transect point at 10m increments to 200m) were included as receptor points within the modelling assessment.

7.5.15 The results for Longman Stuart Castle Bays SSSI and Kildrummie Kames SSSI showed sections on the transects with NOx concentrations above 30µg/m^3, mainly due to the new dual carriageway alignment being located 20m from the designation boundary at the latter site. However, in discussion with Ecology representatives, these areas of the SSSIs were confirmed to be not sensitive to nitrogen, and that the APIS priority habitat was not present in these locations. See Chapter 5 (Overview of Assessment Process). Further calculations of deposition were not required.

7.5.16 The air quality impact of the proposed Scheme upon designated sites is therefore considered not significant.

Regional Air Quality

7.5.17 The results for the regional assessment for Opening Year 2021 are shown in Table 7.18 and the Design Year 2036 in Table 7.19.

Table 7.18: Regional air quality assessment (opening year 2021)

Receptor		Annual Regional Emission in kg or tonnes				
		Base 2014	DM 2021	DS 2021	% of 2014 NAEI UK Road Transport Contribution	% of 2014 NAEI UK Emissions
NO_x	*kg/yr*	108,313	69,110	105,255	0.01%	0.00001%
PM_{10}	*kg/yr*	8,799	8,849	12,574	0.02%	0.0001%
CO_2	*tonnes/yr*	37,544	42,092	58,961	0.02%	0.0000001%

Table 7.19: Regional air quality assessment (design year 2036)

Receptor		Annual Regional Emission in kg or tonnes				
		Base 2014	DM 2036	DS2036	% of 2014 NAEI UK Road Transport Contribution	% of 2014 NAEI UK Emissions
NO_x	*kg/yr*	108,313	53,101	79,928	0.01%	0.00001%
PM_{10}	*kg/yr*	8,799	10,247	15,220	0.02%	0.0002%
CO_2	*tonnes/yr*	37,544	46,673	65,841	0.02%	0.0000002%

7.5.18 The results for the Opening Year (2021) indicate an increase in NOx, PM_{10} and CO_2 emissions, compared with the DM scenario, with a similar pattern in 2036.

7.5.19 There is no government guidance published for assessing the significance of effects of individual highway schemes on regional or greenhouse gas emissions. Regional scale emissions are managed at a national level, and are not considered for individual schemes in isolation.

7.5.20 The increase in emissions has been compared with the 2014 National Atmospheric Emissions Inventory (Defra, 2014) emissions for the pollutants. 2014 has been used as the latest dataset as the database is does not currently project forward to future years. As shown in Tables 7.18 and 7.19, the increases from the scheme are very low in comparison to the total UK emissions.

7.6 Mitigation

Construction

7.6.1 The CEMP shall be implemented to prevent or reduce potential impacts associated with dust and air quality **(Mitigation Item AQ1 and GR1)**.

7.6.2 As discussed, the CEMP would be discussed and agreed with The Highland Council once a project contractor has been appointed. Information on the potential mitigation measures and controls that can be implemented can be found in Technical Appendix A7.3 (Construction Assessment).

7.6.3 With consistent implementation and management, the potential dust impacts of each location would be sufficiently reduced to a minor or negligible impact.

Operation

7.6.4 The local air quality assessment concludes that there is not a significant effect on local air quality concentrations at sensitive receptors as a result of the proposed Scheme. Therefore, based on the guidance in IAN174/13 no mitigation is required.

7.7 Residual Effects

7.7.1 With the implementation of appropriate dust management measures there are not predicted to be any residual effects from the construction phase.

7.7.2 The proposed Scheme is predicted to lead to large magnitude decreases in air pollutant concentrations at sensitive receptors. At a single modelled location there is a predicted small magnitude worsening of an exceedance of the NO_2 AQO, but there are no new exceedances anywhere in the entire study area. Mitigation measures are not required and there are not considered to be any significant residual effects on local air quality.

7.8 References

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Directive 2008/50/EC of 21 May 2008 of the European Parliament and of the Council on ambient air quality and cleaner air for Europe, 2008.