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Brighton and Hove City Plan Part 2 Ashdown Forest Air Quality Impact Assessment 2018
Traffic Related Effects on Ashdown Forest SAC

Brighton and Hove City Council

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Quality information

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1. Introduction and Methodology

Introduction

1.1 HRA Screening of the Brighton and Hove City Plan Part 2 has been undertaken. This enabled all potential linking impact pathways between the City Plan Part 2 and European sites to be screened out with the exception of potential air quality effects on Ashdown Forest SAC in combination with other plans and projects. As such this impact pathway requires further consideration in the form of Appropriate Assessment. That is the subject of this report.

1.2 Ashdown Forest is an extensive area of common land lying between East Grinstead and Crowborough entirely within Wealden District. The soils are derived from the predominantly sandy Hastings Beds. It is one of the largest single continuous blocks of heath, semi-natural woodland and valley bog in south-east England, and it supports several uncommon plants, a rich invertebrate fauna, and important populations of heath and woodland birds. It is both a Special Area of Conservation (SAC) and Special Protection Area (SPA), underpinned by designation as a Site of Special Scientific Interest (SSSI). However, the interest features of the SSSI are broader than those of the SAC and SPA.

1.3 The SPA is designated for its populations of breeding Dartford Warbler *Sylvia undata* and Nightjar *Caprimulgus europaeus*. The SAC is designated for its Annex I habitats, namely Northern Atlantic wet heaths with *Erica tetralix* and European dry heaths; as well as for its Annex II species, namely Great Crested Newts *Triturus cristatus*.

1.4 Vehicle exhaust emissions are capable of adversely affecting the protected heathland found in Ashdown Forest. In April 2018 AECOM undertook an air quality impact assessment jointly commissioned by Lewes District Council, South Downs National Park Authority, Tunbridge Wells Borough Council and Sevenoaks District Council. This modelled forecast traffic growth on key roads within 200m of Ashdown Forest SAC over the period 2017 to 2033. This included traffic expected due to the quantum and distribution of growth in the adopted Lewes Joint Core Strategy and the South Downs, Tunbridge Wells and Sevenoaks Local Plans. It also included growth in other authorities (such as Mid-Sussex District and Wealden District). The methodology used in that analysis is compliant with the requirement of the Conservation of Habitats and Species Regulations 2017 to consider whether an adverse effect on the integrity of a European site will result either alone, or in combination with other plans and projects. The modelling was updated for Hastings District Council.

1.5 Since that modelling was undertaken, Brighton and Hove City Council commissioned AECOM to advise them on the adverse effects on the integrity of Ashdown Forest SAC and SPA arising from the housing and employment growth proposed in the Brighton & Hove City Plan Part Two (including reviewing previous HRA work undertaken for the adopted City Plan Part One)[1]. . That is the subject of this report.

1.6 Since the original modelling described in this report was undertaken Natural England have made public their internal approach advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (Version: June 2018). AECOM has examined this guidance and the modelling and interpretation set out in this report does not conflict.

Methodology

1.7 The methodology for the air quality modelling in this analysis is identical to that for the wider modelling recently undertaken and reported in separate studies for South Downs National Park, Lewes District Council, Sevenoaks District Council and Tunbridge Wells Borough[2]. However, both that modelling and its conclusions are summarised in this document as they form the basis for this analysis. Most recently, the model was updated to allow for additional flows attributable to a Civic Development in Royal Tunbridge Wells (April 2018) and for growth in Hastings District (June 2018). It is the latter iteration of the modelling that is used as the basis for this analysis. The modelling reported in this document involves taking the previous model and re-running it to allow for the additional flows attributable to Brighton & Hove development in the Do Something scenario.

1.8 Vehicle exhaust emissions generally only have a local effect within a narrow band along the roadside, within 200m of the centreline of the road. Beyond 200m emissions are considered to have dispersed sufficiently that atmospheric concentrations are essentially background levels. The rate of decline is steeply curved rather than linear. In other words concentrations will decline rapidly as one begins to move away from the roadside, slackening to a more gradual decline over the rest of the distance up to 200m.

1.9 There are two measures of particular relevance regarding air quality impacts from vehicle exhausts and which are modelled using standard forecasting. The first is the concentration of oxides of nitrogen (known as NOx) in the atmosphere. In extreme cases NOx can be directly toxic to vegetation but its main importance is as a source of nitrogen, which is then deposited on adjacent habitats. The guideline atmospheric concentration advocated by Government for the protection of vegetation is 30 micrograms per cubic metre (μgm^{-3}), known as the Critical Level, as this concentration relates to the growth effects of nitrogen derived from NOx on vegetation.

1.10 The second important metric is a measure of the rate of the resulting nitrogen deposition. The addition of nitrogen is a form of fertilization, which can have a negative effect on heathland and other habitats over time by encouraging more competitive plant species that can force out the less competitive species that are more characteristic. Unlike NOx in the atmosphere, the nitrogen deposition

[1] The Brighton & Hove City Plan covers the period to 2030; however the modelling undertaken covers the period to 2033 in line with the modelling undertaken for South Downs National Park, Lewes District Council, Tunbridge Wells Borough Council Sevenoaks District Council and Hastings Borough Council.

[2] The most recent published analyses are 'Tunbridge Wells Local Plan: Ashdown Forest Air Quality Impact Assessment: Traffic-Related Effects on Ashdown Forest SAC' dated March 2018 and South Downs Local Plan and Lewes Joint Core Strategy: Habitat Regulations Assessment Addendum: Traffic-Related Effects on Ashdown Forest SAC – April 2018'. Both these reports present the same modelling results.

rate below which we are confident effects would not arise is different for each habitat. The rate (known as the Critical Load) is provided on the UK Air Pollution Information System (APIS) website (www.apis.ac.uk) and is expressed as a quantity (kilograms) of nitrogen over a given area (hectare) per year ($kgNha^{-1}yr^{-1}$).

1.11 A third pollutant included in this assessment is ammonia emissions from traffic. In ecological terms ammonia differs from NOx in that it is not only a source of nitrogen but can also be directly toxic to vegetation in relatively low concentrations. Using the process set out in Design Manual for Roads and Bridges, ammonia emissions for traffic are not normally calculated. However, for completeness, and in response to representations made by Wealden District Council to the first iteration of modelling undertaken for the South Downs Local Plan, they have been included in subsequent iterations of AECOM's modelling, both in terms of atmospheric concentrations and as a source of nitrogen.

1.12 Using these scenarios and information on total traffic flow, average vehicle speeds and percentage Heavy Duty Vehicles (which influence the emissions profile), AECOM air quality specialists calculated expected NOx concentrations, nitrogen deposition rates, ammonia concentrations and acid deposition rates at receptor points along each modelled road link. The predictions for NOx and nitrogen deposition are based on the assessment methodology presented in Annex F of the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 (HA207/07)[3] for the assessment of impacts on sensitive designated ecosystems due to highways works[4]. Background data for NOx and NO_2 were sourced from the Department of Environment, Food and Rural Affairs (Defra) background maps[5]. Background data for ammonia was sourced from monitoring undertaken at Ashdown Forest[6].

1.13 The DMRB does not provide a method for forecasting ammonia emissions from traffic. A method has therefore been devised for this modelling. The methodology for this is presented in detail in Appendix B. The research undertaken in Ashdown Forest indicates that beyond 20m from the roadside ammonia contributions are expected to tend towards background levels and so the contribution of road sources would be limited beyond this point.

1.14 Given that the assessment year (2033) is a considerable distance into the future, it is important for the air quality calculations to take account of improvements in background air quality and vehicle emissions that are expected nationally over the plan period. Making an allowance for a realistic improvement in background concentrations and deposition rates is in line with the Institute of Air Quality Management (IAQM) position[7] as well as that of central government[8]. Background nitrogen deposition rates were sourced from the Air Pollution Information System (APIS) website[9]. Although in recent years

[3] Design Manual for Roads and Bridges, HA207/07, Highways Agency
[4] DMRB advocates a nitrogen deposition velocity of 0.1 cms^{-1} for non-woodland vegetation and that velocity is therefore used in AECOMs modelling.
[5] Air Quality Archive Background Maps. Available from: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
[6] Ashdown Forest SAC, Air Quality Monitoring and Modelling, October 2017
[7] http://www.iaqm.co.uk/text/position_statements/vehicle_NOx_emission_factors.pdf
[8] For example, The UK Government's recent national Air Quality Plan also shows expected improvements over the relevant time period (up to 2030) https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017
[9] Air Pollution Information System (APIS) www.apis.ac.uk

improvements have not kept pace with predictions, the general long-term trend for NOx has been one of improvement (particularly since 1990) despite an increase in vehicles on the roads[10]. There is also an improving trend for nitrogen deposition, although the rate of improvement has been much lower than for NOx[11]. The current DMRB guidance for ecological assessment suggests reducing nitrogen deposition rates by 2% each year between the base year and assessment year. However, due to some uncertainty as to the rate with which projected future vehicle emission rates and background pollution concentrations are improving, the precautionary assumption has been made in this assessment that not all improvements projected by DMRB (for nitrogen deposition) or Defra (for NOx concentrations) will occur. With regards to background ammonia concentrations; as there is greater uncertainty associated with rates of improvement over time, background concentrations have been kept the same through all assessment years.

1.15 Therefore, the air quality calculations assume that conditions in 2023 (an approximate midpoint between the base year and the year of assessment) are representative of conditions in 2033 (the year of assessment). The effect on the 2033 data is equivalent to assuming a 0.75% per annum improvement in background NOx concentrations and nitrogen deposition rates between 2017 and 2033. The approach of not assuming all projected improvements occur (known as Gap Analysis) is accepted within the professional air quality community and accounts for known recent improvements in vehicle technologies (new standard Euro 6/VI vehicles), whilst excluding the more distant and therefore more uncertain projections on the evolution of the vehicle fleet. No discussion is made in this analysis of the UK Government's recent decision to ban the sale of new petrol and diesel vehicles from 2040 since it would not affect the time period under consideration, but that announcement illustrates the general long-term direction of travel for roadside air quality in the UK and underlines that allowing for improvements in both vehicle emissions factors and background rates of deposition over long timescales is both appropriate and realistic.

1.16 Annual mean concentrations of NOx were calculated at varied intervals back from each road link up to a maximum of 200m, with the closest distance being the closest point of the designated site to the road. Predictions were made using the latest version of ADMS-Roads using emission rates derived from the Defra Emission Factor Toolkit (latest version) which utilises traffic data in the form of 24-hour Annual Average Daily Traffic (AADT), %HDV and average speed.

1.17 To assist in the verification of the model AECOM were provided with a partially redacted version of a report prepared for Wealden District Council by Air Quality Consultants ('AQC') (Ashdown Forest SAC, Air Quality Monitoring and Modelling, December 2017). This report provided grid references, distance to road (m) and NO_2/NO_x concentrations for a number of measurement locations. The measurement height of these diffusion tubes was not recorded in the AQC

[10] Emissions of nitrogen oxides fell by 69% between 1970 and 2015. Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/579200/Emissions_airpollutants_statisticalrelease_2016_final.pdf [accessed 08/06/17]

[11] Total nitrogen deposition (i.e. taking account of both reduced and oxidised nitrogen, ammonia and NOx) decreased by 13% between 1988 and 2008. This is an improvement of 0.65% per annum on average.

report and this has been taken as 2m to match the stated height of the Ammonia ALPHA samplers, which are also included within this report.

1.18 Using these diffusion tube data AECOM was able to apply the latest version of the Ashdown Forest model, which uses 2017 background based on the base year 2015 and the NO_x to NO_2 Calculator v6.1 for 2017 using All non-urban UK traffic for the local authority of Wealden.

1.19 This verification process calculated a model adjustment factor of 2.73[12] with an RMSE of 4.2. The RMSE should ideally be within 10% of the relevant air quality criterion, but is acceptable where it is within 25% of the relevant air quality criterion, as is the case here[13].

Modelling Brighton and Hove Growth

1.20 The adopted Brighton and Hove City Plan has an end date of 2030. Brighton and Hove City Council has therefore made a precautionary judgment regarding the total amount of new housing and employment development expected within Brighton and Hove to 2033, as this reflects the ‘worst case’ contribution of growth in Brighton and Hove on Ashdown Forest SAC from the adopted City Plan, outstanding planning permissions and potential additional development that may come forward in excess of the City Plan minimum housing target of 13,200 homes. Brighton and Hove City Council commissioned traffic modellers (AECOM) to generate a 24hr Annual Average Daily Traffic (AADT) forecast for 2033 attributable to this growth, on the A22, A26 and A275 through Ashdown Forest, these being the links with the greatest expected flows.

1.21 The following growth data for Brighton & Hove were included in the modelling.

Period	Description	# Dwellings
2010-2017	*Completed*	*3,000*
2017-2030	Allocations	8,595
2020-2030	Windfall	1,270
2030-2033	Post Plan Period	1,980[14]
Total (2017-2033)	**-**	**11,845**

1.22 In addition, it has been assumed that 111,500 sqm of employment floor space would be delivered between 2017-2033. With regard to distribution of growth the following assumptions were made:

- The 3,000 dwellings built between 2010-2017 have been removed from the overall total to avoid double-counting as these will already be contributing traffic to the network and will be allowed for in the baseline count data. These have been subtracted from each MSOA based on the 2011 Census population of each MSOA, to proportionately distribute these across the city.

[12] This adjustment factor (2.73) is higher than the main factors produced by AQC in their report. The modelling approach taken by AQC includes canyoning effects, time-varying emission profiles, CURED emission rates, terrain data and incorporates the effects of road gradient on NO_X emissions all of which may increase concentrations within close proximity to the road source where the verification diffusion tubes are located. It is also noted that the tube height of 2m is an assumption which would affect the overall factor if the tubes are at a different height.

[13] Defra (2016), Local Air Quality Management Technical Guidance (TG16)

[14] Assumes an equivalent rate of housing delivery to that provided for in the City Plan 2010-2030 (660 net dwellings per year).

- For windfall, it has been assumed that the 1,270 dwellings to be delivered between 2020-2030 (as well as additional delivery of 1,980 dwellings between 2030-2033) would be delivered proportionately across the city, based on 2011 Census population levels.
- For the larger sites which span multiple MSOAs, the projected delivery of housing and jobs has been allocated across these based on their 2011 Census population or number of employees (2016 survey).
- For the smaller residential sites which span a couple of MSOAs, these have simply been split 50/50.

1.23 For the purposes of air quality assessment for South Downs National Park Authority, Lewes District, Tunbridge Wells Borough and Sevenoaks District AECOM has already created a traffic and air quality model for Ashdown Forest that forecasts traffic total flows in 24hr AADT by 2033 taking account of total housing and employment growth, not only in these four authorities but also in other authorities surrounding Ashdown Forest, including Wealden District, Mid-Sussex District, and Tandridge District (the three other authorities most likely to influence average daily traffic flows through the SAC). In addition to these Hastings Borough Council has also been included in the modelling. In addition to those authorities explicitly manually modelled by AECOM other authorities (such as Rother District) are included in the modelling by virtue of the fact that the underlying traffic forecasts are based on the growth assumptions in the National Trip End Model and its presentation programme (TEMPro).

1.24 That 'in combination' scenario (termed the Do Something scenario in AECOM's modelling) therefore presents the forecast 2033 roadside ammonia concentrations, NOx concentrations and nitrogen deposition rates. For the modelling reports published by South Downs National Park Authority and Tunbridge Wells Borough Council the 2033 Do Something air quality was compared with the 2017 baseline air quality to determine whether adverse effects on integrity would arise. It was concluded that no adverse effect on integrity was expected from all growth 'in combination'.

1.25 The additional traffic growth attributable to Brighton and Hove was modelled to be minimal, even though a generous allowance was made for growth:

- a maximum of 409 AADT on the A22, which has 2017 base flows of c.12,000 AADT;
- a maximum of 1,527 AADT on the A26, which has 2017 base flows of more than 16,000 AADT; and
- A maximum of 386 AADT forecast for the A275.

1.26 This is almost certainly due to distance (Brighton and Hove is a minimum of 19.5km from Ashdown Forest as the crow flies) meaning that locations on the far side of Ashdown Forest play a small part in journeys to work for residents of Brighton and Hove even when considerable housing and employment growth is planned for that authority.

1.27 It was determined that the simplest approach to assess the air quality effect of Brighton and Hove growth, was to re-run the Do Something scenario for the existing AECOM Ashdown Forest traffic model but this time with Brighton and

Hove AADT included in the Do Something scenario. The conclusion of AECOM's existing traffic and air quality model was one of no adverse effect on integrity from all forecast traffic growth in combination (a conclusion Natural England has accepted). Therefore, comparison between the air quality results from the new model run with the results of the previous Do Something scenario would reveal the role of Brighton & Hove growth and a conclusion could be drawn as to whether the change to the DS scenario was negligible.

2. Results: Appropriate Assessment

Summary of Conclusions of Existing AECOM Model for Ashdown Forest

2.1 The development of nitrogen dose-response relationships for various habitats clarifies the rate of additional nitrogen deposition required to achieve a measurable effect on heathland vegetation. It is therefore possible to use these relationships to determine that a plan or collection of plans will not have an adverse effect. Such a plan would be one in which one could say with confidence that a) there would not be a significant difference in the vegetation whether or not that plan proceeded and b) there would not be a significant effect on the vegetation (and thus protection conveyed to the European site) whether or not the contribution of that plan was 'mitigated' (i.e. reduced to such an extent that it did not appear in the model at all). It would clearly be unreasonable to claim that such a plan caused an adverse effect 'in combination' or that it should be mitigated. The contribution of the Brighton & Hove City Plan falls within those parameters.

2.2 The existing AECOM model for Ashdown Forest concluded that:

- Ammonia concentrations at the nearest areas of heathland are not forecast to exceed the most stringent critical level of 1 μgm^{-3}, while NOx concentrations and nitrogen deposition in 2033 is forecast to be significantly better than in 2017 notwithstanding the precautionary assumptions made about both growth and improvements in vehicle NO_2 emission factors;
- No significant in combination retardation of vegetation improvement at the closest and most affected areas of heathland is expected. Maximum additional 'in combination' nitrogen deposition of 0.3 kgN/ha/yr is forecast at the closest areas of heathland due to traffic growth to 2033. Following consultation of published nitrogen dose-response relationship data for heathland it was concluded that this would not materially retard any vegetation recovery that may occur due to the aforementioned net improvement in nitrogen deposition rates; and
- Since no adverse effect on integrity is forecast, no mitigation would be required.

2.3 It should be noted that the assessment undertaken to inform this conclusion was precautionary. For example:

- The Design Manual for Roads and Bridges and Defra guidance recommend making a 2% reduction per annum in background emissions/deposition rates throughout the period from base year to assessment year in order to allow for improvements such as the introduction of Euro6 standard vehicles. AECOM took a considerably more cautious approach in this modelling which could therefore prove to underestimate improvements in background nitrogen deposition.
- Rather than simply model the rates of growth set out in adopted or submitted Core Strategies and Local Plans, the AECOM model increased the housing delivery rates for those authorities immediately surrounding Ashdown Forest SAC (Wealden District, Mid-Sussex District and Tandridge District) to allow for additional growth in line with the most-recently expressed Objectively Assessed

Need as of June 2017. In some cases (e.g. Mid-Sussex) this substantially increased the amount of housing allowed for over the period to 2033. In practice, therefore, growth around Ashdown Forest SAC may have been over-estimated. For example, the recent Government consultation on Objectively Assessed Need (OAN) proposes a significantly lower OAN for Wealden District than was allowed for in the AECOM model. Growth assumptions to 2033 made for those authorities closest to Ashdown Forest or otherwise modelled in detail are:

Local authority	Figures Used in Model
Wealden	832 per annum
Tunbridge Wells	795 per annum
Sevenoaks	698 per annum
Tandridge	470 per annum
Mid-Sussex	1,026 per annum
South Downs National Park within Lewes District	78 per annum
Lewes District outside South Downs National Park	291 per annum
Rother	445 per annum
Hastings	273 per annum
Brighton & Hove	740 per annum

Ashdown Forest Traffic Modelling Results for the City of Brighton and Hove

2.4 The change in flows on the A275, A22 and A26 and attributable to the City of Brighton and Hove are provided in Table 1 below. These were provided by Brighton and Hove City Council's traffic modelling consultants (AECOM).

Table 1: AADT that would occur as a result of anticipated growth in Brighton & Hove by 2033

Road	2033 additional daily vehicle trips (AADT)
A22 Royal Ashdown Forest Golf Course	409
A22 Wych Cross	300
A22 Nutley	311
A275 Wych Cross	386
A26 Poundgate	1527

2.5 The flows attributable to the development on the A275, A22 and A26 have been modelled. These flow data were therefore added into the Do Something (i.e. all expected traffic growth) scenario for these links and the previous air quality model re-run.

Air Quality Results

2.6 Appendix A presents the 2033 air quality (ammonia concentrations, NOx concentrations and nitrogen deposition rates) that was previously forecast within 200m of various transects on the A275, A22 and A26. It then also presents the 2033 air quality (identical parameters) forecast in the re-run model. The difference reflects the contribution of Brighton and Hove growth. The closest area of heathland (the SAC habitat) along each link is identified with **bold** text.

2.7 The following transects were modelled, and are reported in Appendix A since they do include areas of SAC, but are not discussed in this section because there is no actual SAC habitat (heathland) within 200m:

- Transect 34: A22 at Nutley;
- Transect 6b_37_33: junction of A22 and A275; and
- Transect 6aNE: A22 at Royal Ashdown Forest Golf Course.

Ammonia

2.8 For ammonia it can be seen that Brighton and Hove growth makes no difference at all to the modelled air quality data for the closest areas of heathland to any link except for the A26 at Poundgate (Receptor 38) and the A275 (Receptors 37W, and 37E). The A26 at Poundgate is identified to contribute an additional 0.03μgm^{-3} (rounded up to the 2 decimal places) at the roadside. However the nearest SAC habitat (heathland) at this location is located 40m from the road. At this distance, the contribution from Brighton and Hove is zero[15]. For the receptors on the A275, growth from Brighton and Hove can be seen to contribute a negligible 0.01μgm^{-3}. This means that Brighton and Hove growth barely registers in the model and is only marginally greater than zero. In all cases, for the closest areas of heathland, ammonia levels are not forecast to exceed the most stringent critical level for ammonia (1 μgm^{-3}), applicable only to areas with significant lichen and bryophyte interest, and will remain well below the critical level applicable to vegetation generally (3 μgm^{-3}).

Nitrogen Oxide Concentrations and Nitrogen Deposition

2.9 For NOx (which is primarily of relevance as a source of nitrogen) it can be seen that Brighton and Hove growth makes a negligible contribution to concentrations at the closest areas of heathland, the greatest contribution (0.10 μgm^{-3}) being at the A26 at Poundgate (Receptor 38). Even at this location such a small change in NOx results in a negligible change in nitrogen deposition (0.01 kgN/ha/yr, rounded up to 2 decimal places). In other words, the NOx concentrations and nitrogen deposition rates on even the most affected link (the A26) are essentially the same as forecast in the previous modelling. A similarly negligible change in nitrogen deposition is modelled at the closest area of heathland to the A275. On all other transects, the contribution of Brighton and Hove growth at the nearest area of heathland is too small to show in the air quality calculations.

[15] Technically, probably greater than zero but too small to model

3. Conclusion

3.1 Expected growth in Brighton and Hove to 2033 (as identified in the adopted City Plan Part 1 and emerging City Plan Part 2) makes virtually no contribution to changes in ammonia concentrations, NOx concentrations or nitrogen deposition at the closest areas of heathland to the modelled links. With the exception of the A26 at Poundgate (Receptor 38) and A275 (Receptors 37E and 37W) (where the contribution of Brighton and Hove growth is very small but just large enough to be visible in the results) the contribution is sufficiently small as to not show in the modelled results at all.

3.2 The previous modelling exercise undertaken for Tunbridge Wells Borough Council, South Downs National Park Authority, Sevenoaks District Council, Lewes District Council and Hastings Borough Council concluded that there would be no adverse effect on the integrity of Ashdown Forest SAC from traffic growth on modelled links by 2033 because:

- A net reduction in NOx concentrations and nitrogen deposition rates was forecast, even allowing for traffic growth, due to expected improvements in vehicle emissions factors and background concentrations/rates over the same timescale; and
- The ‘in combination’ reduction in that improvement was too small to result in any retardation of vegetation recovery that might otherwise occur.

3.3 It is considered that the inclusion of Brighton and Hove growth does not change the modelled results and therefore the conclusions reached previously remain valid. It is therefore concluded that growth in Brighton and Hove City will not result in an adverse effect on the integrity of Ashdown Forest SAC either on its own or ‘in combination’ with other plans and projects.

3.4 This document has been subject to consultation (letter dated 9th August 2018) by Natural England who concurred with the findings.

Appendix A Comparison of 2033 Do Something results including the Brighton and Hove City Plan with the previous Do Something results

Rows in ***bold*** indicate the closest location of heathland to the road. If no row is in bold it means that there is no heathland on the transect.

Ammonia Concentrations

Link	Distance From Road (m)	2033 Do Something (excluding Brighton and Hove)	2033 Do Something (including Brighton and Hove)	Difference *(note that all data are rounded to 2 decimal places to avoid false precision. Therefore 0.01 is the smallest reportable change and may in fact mean less than 0.01 but greater than 0.004)*
Receptor 38: the A26 at Poundgate				
	0	2.60	2.62	0.02
	5	1.76	1.78	0.02
	10	1.42	1.43	0.01
	15	1.23	1.24	0.01
	20	1.12	1.12	0.01
	30	0.98	0.99	0.01
	40	***0.90***	***0.90***	***0.00***
	50	0.84	0.85	0.00
	60	0.81	0.81	0.00
	70	0.78	0.78	0.00

	80	0.76	0.76	0.00
	90	0.74	0.74	0.00
	100	0.73	0.73	0.00
	125	0.70	0.70	0.00
	150	0.68	0.68	0.00
	175	0.67	0.67	0.00
	200	0.66	0.66	0.00
Receptor 37W: (A275)				
	0	1.14	1.15	0.01
	5	***0.89***	***0.90***	***0.01***
	10	0.80	0.81	0.01
	15	0.76	0.76	0.00
	20	0.73	0.73	0.00
	30	0.70	0.70	0.00
	40	0.68	0.68	0.00
	50	0.66	0.66	0.00

	60	0.66	0.66	0.00
	70	0.65	0.65	0.00
	80	0.64	0.64	0.00
	90	0.64	0.64	0.00
	100	0.64	0.64	0.00
	125	0.63	0.63	0.00
	150	0.63	0.63	0.00
	175	0.62	0.62	0.00
	200	0.62	0.62	0.00
Receptor 37E: (A275)	0	1.09	1.10	0.01
	5	***0.87***	***0.88***	***0.01***
	10	0.79	0.79	0.00
	15	0.75	0.75	0.00
	20	0.72	0.72	0.00
	30	0.69	0.69	0.00
	40	0.67	0.67	0.00

	50	0.66	0.66	0.00
	60	0.65	0.65	0.00
	70	0.65	0.65	0.00
	80	0.64	0.64	0.00
	90	0.64	0.64	0.00
	100	0.64	0.64	0.00
	125	0.63	0.63	0.00
	150	0.63	0.63	0.00
	175	0.63	0.63	0.00
	200	0.62	0.62	0.00
Receptor 34 – A22 at Nutley				
	0	1.81	1.82	0.01
	5	1.33	1.33	0.00
	10	1.11	1.11	0.00
	15	0.99	0.99	0.00
	20	0.92	0.92	0.00

	30	0.83	0.83	0.00
	40	0.78	0.78	0.00
	50	0.75	0.75	0.00
	60	0.73	0.73	0.00
	70	0.71	0.71	0.00
	80	0.70	0.70	0.00
	90	0.69	0.69	0.00
	100	0.68	0.68	0.00
	125	0.66	0.66	0.00
	150	0.65	0.65	0.00
	175	0.65	0.65	0.00
	200	0.64	0.64	0.00
Receptor 33 – A22 at Wych Cross				
	0	1.44	1.44	0.00
	5	***1.09***	***1.09***	***0.00***
	10	0.95	0.95	0.00

	15	0.87	0.87	0.00
	20	0.82	0.82	0.00
	30	0.76	0.76	0.00
	40	0.73	0.73	0.00
	50	0.71	0.71	0.00
	60	0.69	0.69	0.00
	70	0.68	0.68	0.00
	80	0.67	0.67	0.00
	90	0.67	0.67	0.00
	100	0.66	0.66	0.00
	125	0.65	0.65	0.00
	150	0.64	0.64	0.00
	175	0.64	0.64	0.00
	200	0.63	0.63	0.00
Receptor 6b_37_33 – Junction of A22 and A275				
	0	1.51	1.52	0.01

	5	1.34	1.34	0.00
	10	1.24	1.24	0.00
	15	1.18	1.18	0.00
	20	1.13	1.13	0.00
	30	1.05	1.05	0.00
	40	0.99	0.99	0.00
	50	0.94	0.94	0.00
	60	0.90	0.90	0.00
	70	0.87	0.87	0.00
	80	0.85	0.85	0.00
	90	0.83	0.83	0.00
	100	0.81	0.81	0.00
	125	0.77	0.77	0.00
	150	0.74	0.74	0.00
	175	0.72	0.72	0.00
	200	0.71	0.71	0.00

Receptor 6b - A22 at Royal Ashdown Forest Golf Course				
	3	1.26	1.26	0.00
	8	1.03	1.03	0.00
	13	0.92	0.92	0.00
	18	0.86	0.86	0.00
	23	0.82	0.82	0.00
	33	***0.76***	***0.76***	***0.00***
	43	0.73	0.73	0.00
	53	0.71	0.71	0.00
	63	0.69	0.69	0.00
	73	0.68	0.68	0.00
	83	0.67	0.67	0.00
	93	0.67	0.67	0.00
	103	0.66	0.66	0.00
	128	0.65	0.65	0.00
	153	0.64	0.64	0.00

	178	0.64	0.64	0.00
	203	0.63	0.63	0.00
Receptor 6aSW – A22 at Royal Ashdown Forest Golf Course				
	0	1.68	1.68	0.00
	5	1.18	1.18	0.00
	10	***1.00***	***1.00***	***0.00***
	15	0.90	0.90	0.00
	20	0.84	0.84	0.00
	30	0.77	0.77	0.00
	40	0.73	0.73	0.00
	50	0.71	0.71	0.00
	60	0.69	0.69	0.00
	70	0.68	0.68	0.00
	80	0.67	0.67	0.00
	90	0.66	0.66	0.00
	100	0.66	0.66	0.00

	125	0.65	0.65	0.00
	150	0.64	0.64	0.00
	175	0.63	0.63	0.00
	200	0.63	0.63	0.00
Receptor 6aSE – A22 at Royal Ashdown Forest Golf Course				
	0	1.93	1.93	0.00
	5	1.33	1.33	0.00
	10	1.11	1.11	0.00
	15	0.99	0.99	0.00
	20	0.92	0.92	0.00
	30	0.84	0.84	0.00
	40	0.79	0.79	0.00
	50	0.76	0.76	0.00
	60	0.74	0.74	0.00
	70	0.73	0.73	0.00
	80	0.71	0.71	0.00

	90	0.71	0.71	0.00
	100	***0.70***	***0.70***	***0.00***
	125	0.69	0.69	0.00
	150	0.68	0.68	0.00
	175	0.67	0.67	0.00
	200	0.66	0.66	0.00
Receptor 6aNE – A22 at Royal Ashdown Forest Golf Course				
	0	1.64	1.64	0.00
	5	1.20	1.20	0.00
	10	1.03	1.03	0.00
	15	0.93	0.93	0.00
	20	0.87	0.87	0.00
	30	0.80	0.80	0.00
	40	0.76	0.76	0.00
	50	0.73	0.73	0.00
	60	0.71	0.71	0.00

	70	0.70	0.70	0.00
	80	0.69	0.69	0.00
	90	0.68	0.68	0.00
	100	0.67	0.67	0.00
	125	0.66	0.66	0.00
	150	0.65	0.65	0.00
	175	0.64	0.64	0.00
	200	0.64	0.64	0.00
Receptor 33N – A22 at Wych Cross				
	0	1.39	1.39	0.00
	5	1.06	1.06	0.00
	10	0.92	0.92	0.00
	15	0.85	0.85	0.00
	20	0.80	0.80	0.00
	30	***0.75***	***0.75***	***0.00***
	40	0.72	0.72	0.00

	50	0.70	0.70	0.00
	60	0.69	0.69	0.00
	70	0.67	0.67	0.00
	80	0.67	0.67	0.00
	90	0.66	0.66	0.00
	100	0.65	0.65	0.00
	125	0.64	0.65	0.00
	150	0.64	0.64	0.00
	175	0.63	0.63	0.00
	200	0.63	0.63	0.00

NOx concentrations and nitrogen deposition

Link	Distance From Road (m)	NOx *(note that all data are rounded to 2 decimal places to avoid false precision. Therefore 0.01 is the smallest reportable change and may in fact mean less than 0.01 but greater than 0.004)*			Nitrogen deposition *(note that all data are rounded to 2 decimal places to avoid false precision. Therefore 0.01 is the smallest reportable change and may in fact mean less than 0.01 but greater than 0.004)*		
		2033 Do Something (excluding Brighton and Hove)	2033 Do Something (including Brighton & Hove)	Difference	2033 Do Something (excluding Brighton & Hove)	2033 Do Something (including Brighton & Hove)	Difference
Receptor 38: the A26 at Poundgate							
	0	54.06	54.70	0.64	17.80	17.89	0.08
	5	34.67	35.05	0.38	15.21	15.26	0.05
	10	26.60	26.87	0.27	14.10	14.14	0.04
	15	22.33	22.54	0.21	13.51	13.54	0.03
	20	19.60	19.77	0.17	13.13	13.15	0.02
	30	16.36	16.49	0.12	12.68	12.69	0.02
	40	***14.52***	***14.62***	***0.10***	***12.42***	***12.43***	***0.01***
	50	13.30	13.38	0.08	12.25	12.26	0.01
	60	12.43	12.50	0.07	12.12	12.13	0.01

	70	11.79	11.85	0.06	12.03	12.04	0.01
	80	11.28	11.34	0.05	11.96	11.97	0.01
	90	10.89	10.93	0.05	11.91	11.91	0.01
	100	10.56	10.60	0.04	11.86	11.86	0.01
	125	9.95	9.98	0.03	11.77	11.78	0.00
	150	9.53	9.56	0.03	11.71	11.72	0.00
	175	9.22	9.25	0.02	11.67	11.67	0.00
	200	8.99	9.01	0.02	11.64	11.64	0.00
Receptor 37W: A275							
	0	20.65	20.79	0.14	14.01	14.03	0.02
	5	***15.02***	***15.10***	***0.07***	***13.22***	***13.23***	***0.01***
	10	12.98	13.03	0.05	12.92	12.93	0.01
	15	11.92	11.95	0.04	12.77	12.78	0.01
	20	11.26	11.29	0.03	12.68	12.68	0.00
	30	10.49	10.51	0.02	12.57	12.57	0.00
	40	10.05	10.07	0.02	12.51	12.51	0.00

	50	9.77	9.79	0.01	12.47	12.47	0.00
	60	9.58	9.59	0.01	12.44	12.44	0.00
	70	9.43	9.44	0.01	12.42	12.42	0.00
	80	9.32	9.33	0.01	12.40	12.40	0.00
	90	9.23	9.24	0.01	12.39	12.39	0.00
	100	9.16	9.17	0.01	12.38	12.38	0.00
	125	9.03	9.03	0.00	12.36	12.36	0.00
	150	8.94	8.94	0.00	12.35	12.35	0.00
	175	8.87	8.87	0.00	12.34	12.34	0.00
	200	8.82	8.82	0.00	12.33	12.33	0.00
Receptor 37E: A275							
	0	19.59	19.71	0.13	13.86	13.88	0.02
	5	***14.56***	***14.63***	***0.07***	***13.15***	***13.16***	***0.01***
	10	12.69	12.74	0.05	12.88	12.89	0.01
	15	11.71	11.74	0.04	12.74	12.75	0.01
	20	11.10	11.13	0.03	12.66	12.66	0.00

	30	10.39	10.41	0.02	12.56	12.56	0.00
	40	9.99	10.00	0.02	12.50	12.50	0.00
	50	9.73	9.74	0.01	12.46	12.46	0.00
	60	9.54	9.56	0.01	12.43	12.44	0.00
	70	9.41	9.42	0.01	12.41	12.41	0.00
	80	9.31	9.32	0.01	12.40	12.40	0.00
	90	9.23	9.23	0.01	12.39	12.39	0.00
	100	9.16	9.17	0.01	12.38	12.38	0.00
	125	9.04	9.04	0.00	12.36	12.36	0.00
	150	8.96	8.96	0.00	12.35	12.35	0.00
	175	8.90	8.90	0.00	12.34	12.34	0.00
	200	8.85	8.86	0.00	12.33	12.34	0.00
Receptor 34 – A22 at Nutley							
	0	36.37	36.42	0.06	16.42	16.42	0.01
	5	25.03	25.06	0.03	14.86	14.87	0.01
	10	20.00	20.02	0.02	14.17	14.17	0.00

	15	17.28	17.30	0.02	13.79	13.79	0.00
	20	15.56	15.58	0.01	13.54	13.55	0.00
	30	13.54	13.56	0.01	13.26	13.26	0.00
	40	12.39	12.40	0.01	13.10	13.10	0.00
	50	11.64	11.65	0.01	12.99	12.99	0.00
	60	11.11	11.12	0.01	12.92	12.92	0.00
	70	10.71	10.72	0.01	12.86	12.86	0.00
	80	10.41	10.41	0.00	12.82	12.82	0.00
	90	10.16	10.16	0.00	12.78	12.78	0.00
	100	9.97	9.97	0.00	12.75	12.76	0.00
	125	9.60	9.60	0.00	12.70	12.70	0.00
	150	9.35	9.35	0.00	12.67	12.67	0.00
	175	9.16	9.16	0.00	12.64	12.64	0.00
	200	9.02	9.02	0.00	12.62	12.62	0.00
Receptor 33 – A22 at Wych Cross							
	0	27.92	27.93	0.01	15.00	15.00	0.00

	5	***19.79***	***19.80***	***0.01***	***13.87***	***13.87***	***0.00***
	10	16.42	16.43	0.01	13.40	13.40	0.00
	15	14.63	14.63	0.01	13.15	13.15	0.00
	20	13.49	13.49	0.00	12.99	12.99	0.00
	30	12.14	12.14	0.00	12.80	12.80	0.00
	40	11.36	11.36	0.00	12.69	12.69	0.00
	50	10.86	10.86	0.00	12.62	12.62	0.00
	60	10.50	10.50	0.00	12.57	12.57	0.00
	70	10.23	10.23	0.00	12.53	12.53	0.00
	80	10.01	10.01	0.00	12.50	12.51	0.00
	90	9.84	9.84	0.00	12.48	12.48	0.00
	100	9.71	9.71	0.00	12.46	12.46	0.00
	125	9.45	9.45	0.00	12.43	12.43	0.00
	150	9.27	9.27	0.00	12.40	12.40	0.00
	175	9.13	9.13	0.00	12.38	12.38	0.00
	200	9.03	9.03	0.00	12.37	12.37	0.00

Receptor 6b_37_33 – Junction of A22 and A275							
	0	30.34	30.45	0.11	15.27	15.29	0.02
	5	25.83	25.91	0.08	14.68	14.69	0.01
	10	23.36	23.42	0.06	14.36	14.37	0.01
	15	21.77	21.82	0.05	14.15	14.16	0.01
	20	20.55	20.60	0.05	13.98	13.99	0.01
	30	18.72	18.76	0.04	13.73	13.73	0.00
	40	17.30	17.34	0.04	13.53	13.53	0.00
	50	16.19	16.22	0.03	13.37	13.37	0.00
	60	15.31	15.34	0.03	13.25	13.25	0.00
	70	14.62	14.64	0.03	13.15	13.15	0.00
	80	14.03	14.06	0.02	13.07	13.07	0.00
	90	13.54	13.56	0.02	13.00	13.00	0.00
	100	13.13	13.15	0.02	12.94	12.94	0.00
	125	12.26	12.28	0.02	12.82	12.82	0.00

	150	11.63	11.64	0.02	12.73	12.73	0.00
	175	11.15	11.16	0.01	12.66	12.66	0.00
	200	10.77	10.78	0.01	12.61	12.61	0.00
Receptor 6b - A22 at Royal Ashdown Forest Golf Course							
	3	23.79	23.79	0.00	14.39	14.39	0.00
	8	18.65	18.65	0.00	13.68	13.68	0.00
	13	16.13	16.13	0.00	13.32	13.32	0.00
	18	14.62	14.62	0.00	13.11	13.11	0.00
	23	13.63	13.63	0.00	12.97	12.97	0.00
	33	***12.40***	***12.40***	***0.00***	***12.79***	***12.79***	***0.00***
	43	11.65	11.65	0.00	12.69	12.69	0.00
	53	11.16	11.16	0.00	12.62	12.62	0.00
	63	10.80	10.80	0.00	12.57	12.57	0.00
	73	10.54	10.54	0.00	12.53	12.53	0.00
	83	10.33	10.33	0.00	12.50	12.50	0.00

	93	10.17	10.17	0.00	12.48	12.48	0.00
	103	10.03	10.03	0.00	12.46	12.46	0.00
	128	9.78	9.78	0.00	12.42	12.42	0.00
	153	9.60	9.60	0.00	12.40	12.40	0.00
	178	9.47	9.47	0.00	12.38	12.38	0.00
	203	9.37	9.37	0.00	12.36	12.36	0.00
Receptor 6aSW – A22 at Royal Ashdown Forest Golf Course							
	0	37.56	37.56	0.00	15.94	15.94	0.00
	5	24.17	24.17	0.00	14.26	14.26	0.00
	10	***19.24***	***19.24***	***0.00***	***13.63***	***13.63***	***0.00***
	15	16.67	16.67	0.00	13.30	13.30	0.00
	20	15.07	15.07	0.00	13.10	13.10	0.00
	30	13.24	13.24	0.00	12.86	12.86	0.00
	40	12.21	12.21	0.00	12.73	12.73	0.00
	50	11.55	11.55	0.00	12.64	12.64	0.00

	60	11.08	11.08	0.00	12.58	12.58	0.00
	70	10.75	10.75	0.00	12.54	12.54	0.00
	80	10.49	10.49	0.00	12.50	12.50	0.00
	90	10.29	10.29	0.00	12.48	12.48	0.00
	100	10.12	10.12	0.00	12.46	12.46	0.00
	125	9.82	9.82	0.00	12.42	12.42	0.00
	150	9.62	9.62	0.00	12.39	12.39	0.00
	175	9.47	9.47	0.00	12.37	12.37	0.00
	200	9.36	9.36	0.00	12.36	12.36	0.00
Receptor 6aSE – A22 at Royal Ashdown Forest Golf Course							
	0	44.51	44.51	0.00	16.79	16.79	0.00
	5	28.25	28.25	0.00	14.78	14.78	0.00
	10	22.28	22.28	0.00	14.02	14.02	0.00
	15	19.18	19.18	0.00	13.62	13.62	0.00
	20	17.25	17.25	0.00	13.38	13.38	0.00

	30	14.99	14.99	0.00	13.09	13.09	0.00
	40	13.73	13.73	0.00	12.92	12.92	0.00
	50	12.93	12.93	0.00	12.82	12.82	0.00
	60	12.38	12.38	0.00	12.75	12.75	0.00
	70	11.98	11.98	0.00	12.70	12.70	0.00
	80	11.67	11.67	0.00	12.66	12.66	0.00
	90	11.43	11.43	0.00	12.63	12.63	0.00
	100	***11.24***	***11.24***	***0.00***	***12.60***	***12.60***	***0.00***
	125	10.88	10.88	0.00	12.55	12.55	0.00
	150	10.62	10.62	0.00	12.52	12.52	0.00
	175	10.43	10.43	0.00	12.50	12.50	0.00
	200	10.28	10.28	0.00	12.48	12.48	0.00
Receptor 6aNE – A22 at Royal Ashdown Forest Golf Course							
	0	36.44	36.44	0.00	15.83	15.83	0.00
	5	24.64	24.64	0.00	14.35	14.35	0.00

	10	19.88	19.88	0.00	13.74	13.74	0.00
	15	17.33	17.33	0.00	13.41	13.41	0.00
	20	15.73	15.73	0.00	13.21	13.21	0.00
	30	13.81	13.81	0.00	12.96	12.96	0.00
	40	12.70	12.70	0.00	12.82	12.82	0.00
	50	11.96	11.96	0.00	12.72	12.72	0.00
	60	11.45	11.45	0.00	12.65	12.65	0.00
	70	11.06	11.06	0.00	12.60	12.60	0.00
	80	10.76	10.76	0.00	12.56	12.56	0.00
	90	10.52	10.52	0.00	12.53	12.53	0.00
	100	10.33	10.33	0.00	12.51	12.51	0.00
	125	9.96	9.96	0.00	12.46	12.46	0.00
	150	9.71	9.71	0.00	12.43	12.43	0.00
	175	9.53	9.53	0.00	12.40	12.40	0.00
	200	9.39	9.39	0.00	12.39	12.39	0.00
Receptor 33N – A22 at Wych Cross							

	0	26.86	26.88	0.02	14.84	14.84	0.00
	5	19.07	19.08	0.01	13.76	13.76	0.00
	10	15.91	15.92	0.01	13.32	13.32	0.00
	15	14.23	14.23	0.01	13.08	13.08	0.00
	20	13.16	13.17	0.01	12.93	12.93	0.00
	30	***11.91***	***11.91***	***0.00***	***12.75***	***12.75***	***0.00***
	40	11.19	11.19	0.00	12.65	12.65	0.00
	50	10.72	10.72	0.00	12.58	12.58	0.00
	60	10.38	10.39	0.00	12.54	12.54	0.00
	70	10.14	10.14	0.00	12.50	12.50	0.00
	80	9.95	9.95	0.00	12.48	12.48	0.00
	90	9.80	9.80	0.00	12.45	12.45	0.00
	100	9.68	9.68	0.00	12.44	12.44	0.00
	125	9.45	9.45	0.00	12.40	12.41	0.00
	150	9.30	9.30	0.00	12.38	12.38	0.00
	175	9.18	9.18	0.00	12.37	12.37	0.00

	200	9.10	9.10	0.00	12.35	12.35	0.00

Appendix B Modelling ammonia emissions from traffic

Data Sources

The ammonia modelling has used 2015 road transport emission factors from the National Atmospheric Emissions Inventory website (NAEI, latest available data). This document produces average ammonia emission factors for various types of transport and environments in grams per kilometre (g/km). The NAEI road transport emission factors include average speed throughout the UK and the speeds used to derive these g/km emission rates may be different to the speeds used in the air quality model but this is a known limitation of the ammonia modelling.

Concentration data for the ammonia modelling from AQC transects has been made available in the partially redacted report however the coordinates of the monitoring locations have not been provided. All of the images and data relating the transects and location of the NH_3 sensors has been redacted save for the NO_2 monitored data maps (Figures A1.35 and A1.36 on pages 242/243 of AQC report). This NO_2 monitoring map has been used this to identify the location of the transects as both NO_2 and NH_3 were monitored on the transects. The transects have been identified from the following information:

- Transect 4 ends in monitoring location T18 and is near one of the AECOM modelled roads although NH_3 was not measured on this transect;
- Transect 1 is the only transect extending west as stated on page 14 of the AQC report;
- Transect 2 is opposite transect one as on page 88 it states "*The pattern of fall-off is much steeper for Transect 1 than for Transect 2 , which may reflect the influence of prevailing wind direction on roadside concentrations*"; and
- Transect 3 has "*relatively lower traffic volumes than the roads beside the other transects*" so must be located in isolation away from the other transects.

The AECOM model does not have a modelled link next to transect 3 therefore only transects 1 and 2 have been used to verify NH_3 predictions.

The coordinates for the NH_3 monitoring locations on transect 1 and 2 have been approximated as the specific coordinates for the monitored locations have been redacted. The approximate locations have been confirmed in Google Earth as the measurements sites are visible. These have been informed by the angle from the road in the NO_2 monitoring figure, distance from the road in the AQC report and given a height of 2m as the AQC report states that all ALPHA NH_3 models were at 2m.

A background concentration of 0.6 ug/m^3 has been used from the NH_3 DELTA samplers in the AQC report which states that these were background locations.

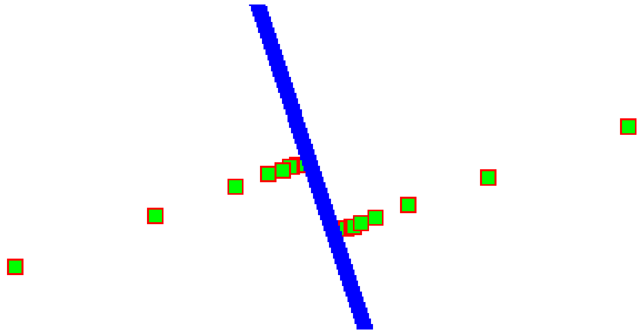
The NH_3 measurement data in transects 1 and 2 as used in the verification are presented in Table 2.

Table 2. Ammonia Monitoring

Transect	Distance from Road (m)	Measured Concentration ($\mu g/m^3$)
Transect 1	1.7	1.7
	2.5	1.3
	5.0	0.9
	10	0.9
	22	0.7
	100	0.6
Transect 2	1.7	1.4
	2.5	1.3
	5.0	1.0
	10	0.9
	22	0.7
	100	0.8

Source: AQC report- Ashdown Forest SAC, Air Quality Monitoring and Modelling, October 2017

Transects 1 and 2 are represented in the ADMS-Roads model as follows, with Transect 1 to the west, upwind of the road, and Transect 2 to the east, down wind of the road.



If the road was a notable source of ammonia it would be anticipated that Transect 2, as the downwind transect, would have higher concentrations than Transect 1. Whereas the measurement data shows the opposite trend at the closest points, with slightly higher ammonia concentrations upwind and identical concentrations at 5m.

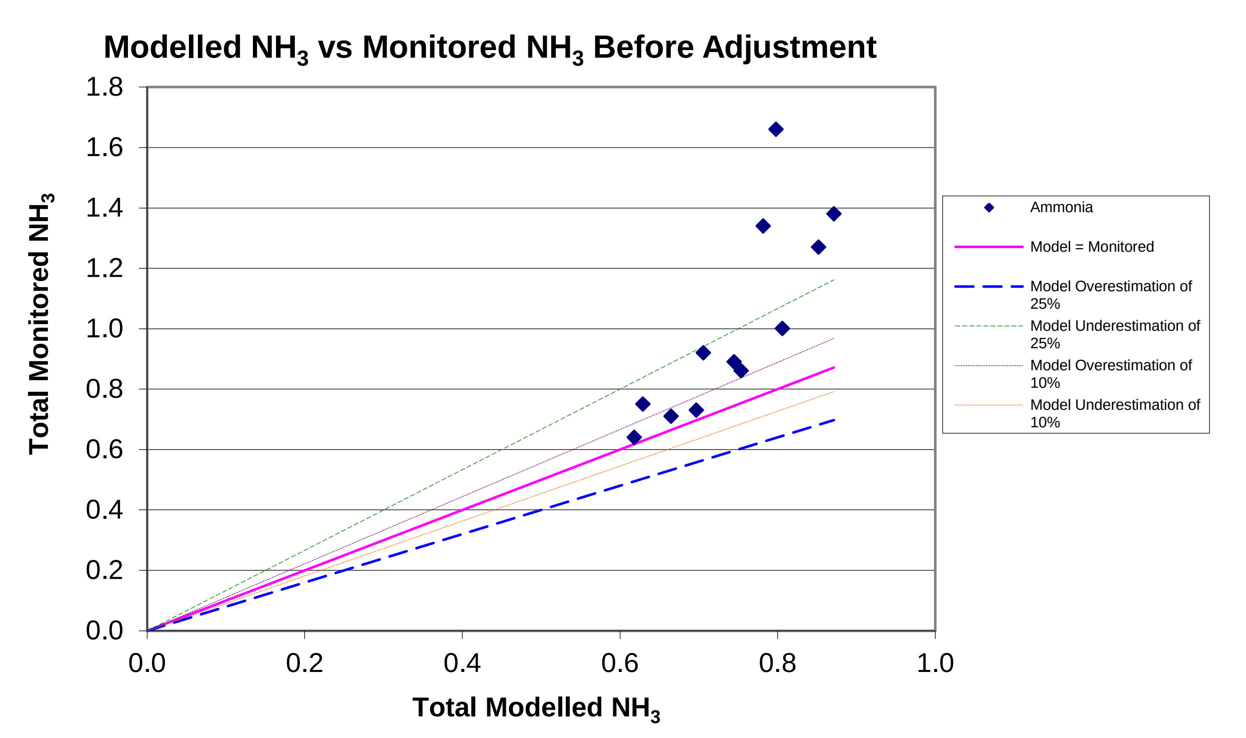
It can also be seen that concentrations of ammonia are very similar to measured background ammonia concentrations of 0.6 $\mu g/m^3$ beyond 20m from the road. Any ammonia emissions due to the road are therefore considered to be observable in the measured data, but the patterns are less clear than would be expected from key road traffic pollutants (i.e. NOx), even at the measurement points within 5m of the road and they are largely imperceptible beyond 20m.

The monitoring also shows an increase in ammonia concentrations at 100m on Transect 2, compared to closer points. This indicates that there is likely to be another source of ammonia in the vicinity of the monitoring and shows that other sources of ammonia may be more important locally than the road network.

Verification

Ammonia emissions were input based on a representative vehicle split for rural England in 2015 using data on vehicle fleet from the Emission Factor Toolkit published by Defra, and maintaining the light duty vehicle/heavy duty vehicle (LDV/HDV) split in the traffic data provided, using hot exhaust emission factors only from the NAEI 2015 road transport emission factors.

Plotting monitored vs modelled total NH_3 concentrations before any correction showed two clear patterns of behaviour with four points notably out of agreement with the rest of the dataset. These four points are the two closest points of each transect (at 1.7 and 2.5m) where concentrations are notably higher along with higher adjustment factors.



Using these input data an adjustment factor of **2.94** was calculated, with an RMSE of 0.2.

The adjustment of the ammonia model highlights that the ammonia model is less accurate close to the road source (e.g. at 1.7-2.5m from the road source). This supports the above observations of the measured ammonia concentrations that concentrations are most notably higher than background concentrations very close to the roads, as there is a larger under prediction at these verification locations closer to the road source. This under prediction doesn't appear to be due to canyoning effects as it is fairly open at this location. The resultant verification factor, if applied elsewhere, is therefore conservative as these closest points are included within the overall factor derived above.

Therefore, any ammonia predictions beyond this distance are likely to overestimate ammonia contributions, and beyond 20m, unless the road source is a much larger road than here, ammonia road contributions may not in reality be discernible at the ecosystem compared to normal ammonia background concentrations.

Assessment

Modelling has also been carried out to predict concentrations of ammonia and the influence of ammonia on nitrogen deposition rates using the methodology outlined above with the following assumptions for the assessment year:

- 2033 with and without the local plan traffic flows;
- 2023 traffic fleet mix (in keeping with NOx predictions);
- 2015 ammonia emission rates (as projected rates are not available from the NAEI); and
- Measured background concentration of 0.6 µg/m^3 (as projected concentrations are not available).

The contribution of ammonia to total nitrogen deposition was calculated using a deposition rate for ammonia of 0.02 m/s, taken from the CERC ADMS-Roads User Guide.

Even with the addition of ammonia as another source of nitrogen within the nitrogen deposition calculations, small rates of deposition are still predicted with a maximum change in deposition rate of 0.2 becoming 0.3 kg N ha^{-1} yr^{-1} at the edge of the road.

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