Assistance addressing Natural England's queries regarding air quality impacts of Local Plan

Relating to Thames Basin Heaths SPA, Richmond Park SAC and Wimbledon Common SAC

Reigate and Banstead Borough Council

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Quality information

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Table of Contents

1. Background 5
2. Results 5
Richmond Park SAC 5
Likely Significant Effects 5
Wimbledon Common SAC 5
Likely Significant Effects 6
Appropriate Assessment 6
Thames Basin Heaths SPA 7
Likely Significant Effects 8
Appropriate Assessment 10
Appendix A Air Quality Modelling Methodology 12
Appendix B Modelling Results 14

1. Background

1.1 In response to a 2017 consultation on Local Plan Natural England commented that: '*It would be useful to establish how you came to screen out Wimbledon Common, Richmond Park and the Thames Basin Heaths on air quality impacts [emphasis added] - was this based on the conclusions of the Core Strategy? We note that the Horley site allocation sits at around 14km away from the Ashdown Forest, whereas other site allocations in and around the Banstead area sit around 11-12km away from Wimbledon Common and Richmond Park. It would be helpful to have all of this information clearly laid out and justified in the context of this DMP HRA document*'.

1.2 This memo sets out our investigation of these issues. To support these analyses AECOM calculated the overall trip generation (in 24hr AADT) and trip distribution from Reigate & Banstead Borough Council's proposed growth. Trips were calculated into London for the A3 / A219 at Wimbledon. AECOM also obtained similar data from Surrey County Council for the areas of the country served by the northern and western parts of the M25 for the M25 / A3 interchange at Thames Basin Heaths SPA. Where appropriate, AECOM has also made reference to ecological data regarding the European sites in question and modelling undertaken for the same locations on behalf of Reigate & Banstead Council.

2. Results

Richmond Park SAC

2.1 Richmond Park is designated as an SAC only for its stag beetle population, which is dependent upon mature trees and deadwood during its life stages. The presence of mature trees and deadwood would be affected by habitat management but not by development identified within the Local Plan.

Likely Significant Effects

2.2 The Air Pollution Information System[1] concludes that whilst the woodland habitats which stag beetle inhabit are vulnerable to nitrogen deposition, stag beetles themselves are not vulnerable to nitrogen deposition. The main reason cited is that '*nitrogen deposition is not believed to have a direct, major effect on tree growth in the UK*[2] and thus the cycle of tree growth and death should continue, as should a continued supply of dead wood. Most of the effects of nitrogen deposition on woodlands are on features other than tree growth, such as ground flora diversity/structure, fungi and lichen populations.

2.3 As such it can be concluded that growth in Reigate & Banstead Borough does not have any impact pathways that could interact with the SAC in a manner that would prevent it achieving its conservation objectives for stag beetle.

Wimbledon Common SAC

2.4 Wimbledon Common SAC is partly designated for stag beetle and partly for heathland. Stag beetle is not sensitive to changes in NOx and nitrogen deposition but heathland is sensitive. Areas of recovering heathland are present within 200m of both the A3 and A219.

2.5 Table 1 below presents the change in AADT expected on the A3 within 200m of Wimbledon Common SAC and the A219 within 200m of Wimbledon Common SAC by the end of the Local Plan period due to housing and employment growth in Reigate & Banstead Borough.

[1] http://www.apis.ac.uk/ [accessed 07/03/2018]
[2] http://www.apis.ac.uk/node/965 [accessed 31/10/17]

Table 1. Change in two-Way AADT due to growth in Reigate & Banstead Borough (Wimbledon Common)

Link Name/Description	Change in two-Way AADT due to growth in Reigate & Banstead Borough
A3	196
A219	14

Likely Significant Effects

2.6 It can be seen that the change in flows on the A219 due to growth in Reigate & Banstead will be nugatory, amounting to a total of 14 AADT by the end of the plan period. Such small changes in average flow will lie well within the normal variation (known as the standard deviation or variance) of traffic flows on that road and would not constitute a statistically significant difference in the average.

2.7 On the A3, the forecast change in traffic growth is small but not inherently nugatory, being 196 AADT by the end of the plan period. However, examination of aerial photography and habitat mapping indicates that the closest area of heathland to the A3 is 30m from the roadside. Given both the distance separating the A3 from the nearest area of heathland and the low change in flows attributable to growth in Reigate & Banstead, AECOM's experience of modelling other links suggests that such growth will make a negligible contribution to 'in combination' changes in NOx concentrations and (particularly) nitrogen deposition at that location. Moreover, this is very likely to be within a context of actual NOx concentrations and nitrogen deposition rates by 2033 being significantly better than those in 2017 due to forecast improvements in vehicle emission factors. This is verified by modelling undertaken by AECOM in May 2018. At 30m from the roadside the 'in combination' NOx emissions from traffic growth 'in combination' are forecast to be 3.11 μgm^{-3} (10% of the critical level of 30 μgm^{-3}). Therefore likely significant effects from all traffic growth cannot be dismissed out of hand based purely on whether they fall below 1% of the critical level.

2.8 Ammonia emissions from traffic are not modelled as standard but have been included in AECOM's modelling. At 30m from the roadside, ammonia concentrations are currently 2.24 μgm^{-3} and thus below the critical level for vegetation. They are forecast to remain below the critical level by 2033 notwithstanding traffic growth. Moreover, the contribution of housing and employment growth in Reigate & Banstead is so small that it does not show in the modelling (since ammonia concentrations are only reported to 2 decimal places at most, to avoid false precision). Therefore, it can be concluded that there will be no likely significant effects due to ammonia emissions from Reigate & Banstead-linked traffic, even 'in combination'.

Appropriate Assessment

2.9 Since the NOx emissions 'in combination' exceed 1% of the critical level, further analysis is undertaken. This includes taking into account improvements in emission factors over the plan period and converting NOx concentrations to nitrogen deposition rates (since, for vegetation, NOx concentrations are essentially a proxy for nitrogen deposition rates except at very high concentrations). A single transect was modelled at the point where the A3 is closest to areas of heathland within the SAC (Figure 1).

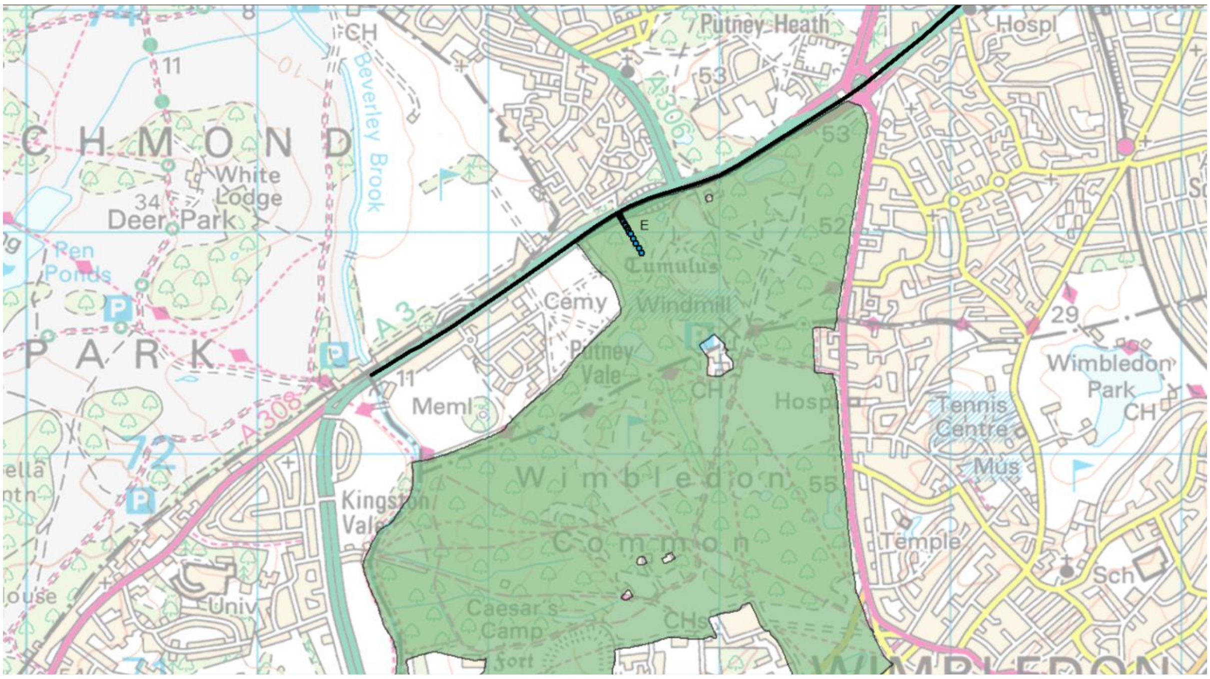

Figure 1. Modelled transects from the A3 into Wimbledon Common SAC

2.10 The emissions from traffic growth are more than offset by a large reduction in emissions from existing traffic due to improvements in emission factors. As a result there is expected to be a net 13.83 μgm^{-3} *reduction* in NOx concentrations at this location by 2033, notwithstanding traffic growth. Moreover, the contribution of Reigate & Banstead housing/employment growth to the additional emissions is a negligible 0.06 μgm^{-3} (0.2% of the critical level).

2.11 This translates into an even smaller change in nitrogen deposition (since the majority of emitted NOx is not deposited at the roadside). Even allowing for nitrogen from traffic-related ammonia emissions (something that is normally ignored in traffic assessments), the 'in combination' nitrogen deposition from all traffic growth to 2033 is a small 0.24 kgN/ha/yr (2.4% of the lowest part of the critical load range for heathland) at 30m from the roadside. The contribution of housing and employment growth in Reigate & Banstead is so small that it does not show in the modelling (since nitrogen deposition rates are only reported to 2 decimal places to avoid false precision). Moreover, nitrogen deposition at this location currently falls *below* the critical load for heathland (being 9.2 kgN/ha/yr at the roadside[3]) and, as with NOx, when improvements in vehicle emission factors are taken into consideration a net *improvement* in nitrogen deposition of 0.64 kgN/ha/yr is anticipated at 30m from the roadside by 2033, as opposed to a net reduction.

2.12 It can therefore be concluded with confidence that no adverse effects will arise on Wimbledon Common SAC due to housing and employment growth in Reigate & Banstead to 2033, even 'in combination' with other plans and projects.

Thames Basin Heaths SPA

2.13 The Thames Basin Heaths SPA is designated for its populations of woodlark, Dartford warbler and nightjar. The presence of these species is governed by the presence of suitable habitat such as heathland and managed plantation[4]. Unmanaged plantation/permanent woodland is not suitable for any of the SPA species. An area of the Thames Basin Heaths SPA lies adjacent to the junction of the M25 and A3 around

[3] This low deposition rate is due to a number of factors including a relatively low %HDV rate (2.7%) and the fact that the road is within London so has a different fleet breakdown compared to motorways, urban or rural roads outside of London (e.g. more petrol than diesel cars, more motorcycles and a greater proportion of buses and coaches contributing to the heavy duty vehicle fleet rather than lorries).

[4] Most managed plantations are managed on a 50-60 year cycle of felling and replanting as part of standard Forestry Commission practice. Generally, new plantation is suitable for nesting woodlark for the first six years before the tree growth becomes too dense and the birds move elsewhere to nest, while new plantation is suitable for nightjar for its first twenty years.

M25 junction 10. This is the part of the SPA most likely to experience a change in flows due to growth in Reigate & Banstead given the strategic regional importance of the A3 and M25 corridors.

2.14 All three species (particularly nightjar and woodlark) are disturbance sensitive. Evidence from nightjar, woodlark and Dartford warbler surveys undertaken at Chobham Common along the M3 corridor by 2Js Ecology (data from 2007-2012) indicate that, even where suitable habitat was present, Dartford warbler territories were not found within 70m of the motorway and nightjar and woodlark territories were even more distant (the closest nightjar/woodlark territory in the data provided was 200m from the M3, with the majority being more than 500m from the motorway, despite ample suitable habitat much closer). More recent monitoring surveys undertaken by AECOM for the M3 Smarter Motorways project support this pattern. This observation is further supported by data collated by EPR Ltd who assembled bird survey data for the SPA around the M25/A3 junction that covered the period 2010-2014[5]. These data indicated that the nearest SPA bird territories to either road were approximately 300m from the roadside. There is therefore strong reason to believe that nightjar, woodlark and Dartford warbler (particularly the first two species) would be unlikely to successfully establish nesting territories within 200m of the A3 dual carriageway or M25 motorway even if the habitat was suitable[6]. This is probably partly a function of habitat distribution (since the majority of the habitat within 200m of the A3/M25 junction is mature plantation, bracken and permanent woodland) and partly a noise-related displacement effect of the very large volume of traffic movements in this area meaning that the birds settle in more tranquil locations [7]. This is **not** to imply that the parts of the SPA close to the A3/M25 junction do not serve an important function, not least by buffering and protecting those areas of the SPA which do support bird territories. However, it is important context when considering the likelihood of motorway/dual carriageway roadside atmospheric pollution negatively affecting the ability of the SPA to support the relevant bird species and thus the integrity of the SPA[8].

2.15 Table 2 below presents the change in AADT expected on the M25 in the vicinity of Junction 10 and on the A3 south of Junction 10 by the end of the Local Plan period due to housing and employment growth in Reigate & Banstead Borough.

Table 2. Change in two-Way AADT due to growth in Reigate & Banstead Borough (Thames Basin Heaths)

Link Name/Description	Change in two-Way AADT due to growth in Reigate & Banstead Borough
M25 east of M25 J10	3,166
M25 west of M25 J10	2,383
A3 south of M25 J10	878

Likely Significant Effects

2.16 It can be seen that the forecast change in flows on the A3 is small but not negligible. The change in flows expected on the M25 is unsurprisingly greater and is highest on the section of M25 east of Junction 10. It should be noted that proportionally-speaking these increases in traffic movement are not large. For example, existing two-way traffic flows on the M25 in this location are in the region of 170,000 AADT.

2.17 In 2016 air quality modelling was undertaken for the A3/M25 junction by AECOM in order to support the Guildford Local Plan. This modelling used the strategic model produced by Surrey County Council for the various Surrey local authorities and is reported in the HRA of the Guildford Local Plan, which has now been submitted for Examination. The analysis not only modelled the contribution of growth in Guildford

[5] EPR. 2015. Wisley Airfield. Information for Habitats Regulations Assessment. Report to support a planning application by Wisley Property Investments Ltd.
[6] Moreover, it would seem unlikely that habitat close to the M25 or A3 would be successfully put to heathland in the future, due to a combination of difficulty creating heathland in this area of dense woodland and the low desirability of removing the tree belt which currently shelters the rest of the SPA from the M25 and A3.
[7] Several studies have identified that bird territory densities generally (almost regardless of species) are much lower close to very busy roads than at greater distances. This has been attributed to several causes ranging from actual disturbance to the masking of calls by traffic noise.
[8] Note that there is no reason to assume that conventional single carriageway roads would deter nesting to the same extent. The effect appears to be particularly associated with major dual carriageways and motorways carrying very high constant volumes of traffic throughout the day and night.

Borough but also modelled the effects of growth in Guildford Borough 'in combination' with housing and employment growth in surrounding authorities. The modelling concluded:

1. That the contribution to NOx arising from 'in combination' traffic growth from all sources would exceed 1% of the critical level throughout the modelled 200m transects along both the M25 and A3.
2. However, when expected improvements in vehicle emission factors and background NOx and nitrogen deposition rates over the same time period are taken into account, NOx concentrations and nitrogen deposition rates along the M25 and A3 in 2033 are expected to be significantly lower than the baseline, even allowing for the forecast 'in combination' increase in traffic growth. In other words, a net reduction in NOx concentrations and nitrogen deposition is forecast.
3. Moreover, total nitrogen deposition rates are forecast to drop below the critical load for heathland (10 kgN/ha/yr) beyond 50m from the roadside. No nitrogen deposition effect at all (from either existing or future traffic) would therefore be expected beyond 50m from the M25 or A3 by 2033.

2.18 AECOM undertook updated modelling in May 2018 explicitly for the Reigate & Banstead Local Plan. This updated modelling also, as a precaution, took into account ammonia emissions from traffic even though this is not part of the standard suite of pollutants for such modelling.

2.19 A total of six transects were modelled (Figure 2), one south into the SPA from the M25 westbound, one south into the SPA from the M25 eastbound, two into the SPA to the west of the A3 and two into the SPA to the east of the A3.

Figure 2. Modelled transects from the M25 and A3 into Thames Basin Heaths SPA

2.20 The results broadly support the conclusion of the work undertaken for Guildford Local Plan, although the modelled numerals differ due to methodological differences such as the inclusion of ammonia emissions and the use of a deliberately high verification factor of 3 for this modelling.

2.21 Unsurprisingly, given the major nature of these roads and the large volume of total traffic growth expected to 2033, the existing pollutant concentrations considerably exceed the critical levels for both ammonia (3 μgm^{-3}) and NOx (30 μgm^{-3}) throughout all modelled transects. In addition, the 'in combination' change in both ammonia emissions and NOx concentrations (column DS-ProjBL) exceeds 1% of the critical level for both pollutants throughout both transects. That said the critical levels are based on protecting relatively subtle vegetation characteristics. In this case the ability of the SPA to support nightjar, woodlark and Dartford warbler is based more on broad habitat structure and appropriate management than fine details of botanical species richness or small changes in percentage grass cover. Moreover, it must be borne in mind that the vast majority of habitat along the modelled transects is unsuitable for nesting SPA birds due to the particular habitats present.

2.22 Since the 1% of the critical level metric for both ammonia and NOx is exceeded 'in combination' further analysis is undertaken and is presented in the following appropriate assessment.

Appropriate Assessment

2.23 It is the broad structure of the vegetation that is relevant to the ability of the area to support SPA birds. Therefore, ammonia concentrations and NOx concentrations in the abstract are less important to the SPA than the effect these have on nitrogen deposition rates. If the areas within the modelled transects did consist of suitable habitat for nesting then a large net increase in nitrogen deposition rate could potentially affect their ability to support SPA birds by increasing the habitat management burden. Note, however, than since the habitat isn't currently suitable for SPA birds, this is a somewhat hypothetical scenario.

2.24 The rest of this analysis starts by considering nitrogen deposition within 200m of the M25 and A3, and the effect that traffic growth may have, before returning to the sensitivities of the three SPA bird species when considering what effect nitrogen deposition within 200m of the road may have on the ability of the SPA to support the three species for which it is designated.

2.25 The baseline modelled nitrogen deposition rate within 20-30m of the roadside (depending on transect) currently exceeds the minimum part of the critical load range for heathland or plantation woodland of 10 kgN/ha/yr[9]. The 'in combination' nitrogen deposition within this area attributable to traffic growth ranges from 2-2.5 kgN/ha/yr at the roadside, to 1-1.5 kgN/ha/yr at 20m from the roadside, depending on transect. This is clearly well over 1% of the critical load but that metric is merely intended as an indicator of whether full dispersion modelling would be required. AECOM undertakes such modelling as a matter of course since there are few instances in which emissions/deposition rates due to total traffic growth over long timescales fall below 1% of the critical level/load. The contribution of housing and employment in Reigate & Banstead is small, being 0.25 kgN/ha/yr (2.5% of the critical load) at the most affected location.

2.26 However, notwithstanding the large additional nitrogen attributable to traffic growth, improvements in vehicle emission factors over the same timescale nonetheless mean that a net *reduction* in nitrogen deposition of between 0.96 kgN/ha/yr and 0.65 kgN/ha/yr (depending on transect) is forecast by 2033 even at the roadside of the M25 and A3. This is despite the fact that AECOM's modelling makes only a cautious allowance for improvements of 0.75% per annum in background nitrogen deposition rate over the period to 2033[10]. This means that, even if heathland was restored to this part of the SPA, it is expected that the overall management burden would reduce to 2033 rather than increase, despite growth in the volume of traffic. Most importantly, the modelling shows that total nitrogen deposition rates are forecast to have fallen below the critical load by 15-30m from the roadside (depending on link) by 2033 such that atmospheric nitrogen (irrespective of source) should cease having an influence on vegetation composition/structure at all except within a narrow band along both the A3 and M25. If the area was turned to managed plantation then the process of clearing and maintaining working forestry would have a much greater effect on the ability of the area to support SPA birds than nitrogen deposition.

2.27 Moreover, it should be borne in mind that the modelling undertaken to inform this conclusion is 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 of halving the recommended rate of improvement, which could therefore prove to underestimate

[9] On APIS the lowest part of the critical load range for coniferous woodland is 5 kgN/ha/yr. However, this is set to protect the botanical characteristics of natural coniferous forest where it supports significant lichen populations. In this case it is the broad structure of artificial coniferous plantation that is relevant to its ability to support SPA birds, such that 10 kgN/ha/yr is appropriate.

[10] Nitrogen deposition rates nationally fell by 13% (0.65% per annum) between 1988 and 2008 according to data published by the Centre for Ecology and Hydrology. A declining trend in oxidised nitrogen deposition has also been observed within the 5km grid-square in which Wisley Common is situated, according to data available on APIS. For example deposition to forest in the grid-square dropped by 5 kgN/ha/yr (0.5% per annum) between 2005 and 2015, with a particularly steep decline of 10% (1 kgN/ha/yr) per annum between 2013 and 2015. The allowance AECOM makes is therefore in line with observed national and local trends, uplifted slightly to allow for the initiatives to improve emissions that have been introduced since 2008 and which will be expanded over the plan period. In particular, these include the further roll out of the Euro6/VI emissions standard, which only became mandatory in 2015.

improvements in NOx and nitrogen deposition and over-estimate the NOx emissions and nitrogen deposition attributable to traffic growth.

- This modelling takes no account of the Government's 2017 announcement to ban the sale of new petrol and diesel cars by 2040, or the possibility that this date may be brought forward. In practice this policy may result in replacement of aspects of the vehicle fleet by non-diesel or petrol vehicles at a date materially earlier than 2040 and this would have a significant effect on reducing NOx and ammonia emissions from traffic.
- To account for dispersion model bias, the predicted road contribution output from the model was adjusted by a factor of 3 for both NH_3 and NO_2 to produce the results reported in Appendix A, with consequential effects on the nitrogen and acid deposition rates. The basis for this factor is from recent professional experience having verified models for other studies undertaken on behalf of Tandridge District Council in East Sussex. However, for Thames Basin Heaths SPA it represents an intentionally conservative adjustment factor in lieu of site-specific NO_2 or NH_3 monitoring data with which to verify the model. It could therefore prove to be an overestimate of emissions, particularly for NO_2 (and thus nitrogen deposition) as a factor of 1.5 has traditionally been more frequently used outside urban areas.

2.28 In summary, given that:

- Nitrogen deposition rates are forecast to *improve* to 2033 notwithstanding traffic growth and therefore the management burden to keep any areas of heathland suitable for SPA birds is likely to *decrease* rather than increase;
- Nitrogen deposition rates are expected to have fallen below the critical load for heathland or managed plantation woodland by 2033 beyond 30m from the roadside; and
- Areas of SPA within 30m (and potentially 200m) of the A3 dual carriageway and M25 motorway are unlikely to ever support nightjar, woodlark or Dartford warbler territories even if they were restored to heathland and managed appropriately.

2.29 It is considered that a conclusion of 'no adverse effect' on the integrity of the Thames Basin Heaths SPA is alone or 'in combination' with other project and plans can be drawn with considerable confidence.

Appendix A Air Quality Modelling Methodology

Vehicle exhaust emissions generally only have a local effect within approximately 200m of the centreline of the road. 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.

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.

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 atmosphere, the nitrogen deposition rate below which we are confident effe cts 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 ($kgNha^{-1}yr^{-1}$).

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 consistency with modelling being undertake n for Tandridge District Council for Ashdown Forest SAC, they have been included in AECOM's modelling, both in terms of atmospheric concentrations and as a source of nitrogen.

Using 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)[11] for the assessment of impacts on sensitive designated ecosystems due to highways works[12]. Background data for NOx and NO_2 were sourced from the Department of Environment, Food and Rural Affairs (Defra) background maps[13]. Background data for ammonia was sourced from the UK Air Pollution Information System (APIS) website.

The DMRB does not provide a method for forecasting ammonia emissions from traffic. A method has therefore been devised for this modelling in order to be consistent with the modelling undertaken at Ashdown Forest SAC.

To account for dispersion model bias, the predicted road contribution output from the model was adjusted by a factor of **3** for both NH_3 and NO_2 to produce the results reported in Appendix A, with consequential effects on the nitrogen and acid deposition rates. The basis for this factor is from recent professional experience having verified models for other studies undertaken on behalf of Tandridge District Council in East Sussex. However, it represents an intentionally conservative adjustment factor in lieu of site-specific NO_2 or NH_3 monitoring data with which to verify the model. It could therefore prove to be an overestimate, particularly for NOx (and thus nitrogen deposition).

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

[11] Design Manual for Roads and Bridges, HA207/07, Highways Agency
[12] DMRB advocates a nitrogen deposition velocity of 0.1 cms^{-1} and that velocity is therefore used in AECOMs modelling.
[13] Air Quality Archive Background Maps. Available from: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

and deposition rates is in line with the Institute of Air Quality Management (IAQM) position[14] as well as that of central government[15]. Background nitrogen deposition rates were sourced from the Air Pollution Information System (APIS) website[16]. Although in recent years 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[17]. There is also an improving trend for nitrogen deposition, although the rate of improvement has been much lower than for NOx[18]. 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.

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.

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, which utilises traffic data in the form of 24-hour Annual Average Daily Traffic (AADT), %HDV and average speed. The tables in Appendix B present the calculated changes in ammonia and NOx concentration and nitrogen deposition 'in combination' (i.e. the difference between Do Something and the 2017 Base case) and the role played by Local Plan development compared to that which would occur in any case over the plan period (i.e. the difference between Do Something and Do Minimum). It also shows the 'Projected Baseline'. This is the modelled NOx concentrations in the hypothetical scenario of no traffic growth to 2033 but allowing for improvements in vehicle emissions for the existing traffic and an associated reduction in background nitrogen deposition. It is presented such that the additional NOx emissions due to traffic growth can be visually separated from the reduction in NOx concentrations due to the improving baseline.

[14] http://www.iaqm.co.uk/text/position_statements/vehicle_NOx_emission_factors.pdf

[15] 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

[16] Air Pollution Information System (APIS) www.apis.ac.uk

[17] 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]

[18] Total nitrogen deposition (i.e. taking account of both reduced and oxidised nitrogen, ammonia and NOx) decreased by 13% between 1988 and 2018. This is an improvement of 0.65% per annum on average.

Appendix B Modelling Results

Wimbledon Common SAC

Distance From Road (m)	Annual Mean NH_3 (ug/m^3)							Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)						
	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	Change (DS-DM)	Change (DS-ProjBL)	Change (DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	Change (DS-DM)	Change (DS-ProjBL)	Change (DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	Change (DS-DM)	Change (DS-ProjBL)	Change (DS-BL)
0	3.06	3.04	3.21	3.21	0.00	0.18	0.16	164.73	94.64	107.65	107.89	0.25	13.25	-56.84	9.20	6.76	7.59	7.60	0.02	0.84	-1.60
5	2.63	2.62	2.72	2.72	0.00	0.11	0.09	105.36	62.59	70.44	70.59	0.15	8.01	-34.77	6.37	4.63	5.17	5.18	0.01	0.55	-1.19
10	2.47	2.46	2.54	2.54	0.00	0.08	0.07	82.87	50.63	56.52	56.64	0.11	6.00	-26.23	5.21	3.79	4.21	4.22	0.01	0.43	-0.99
15	2.38	2.37	2.43	2.43	0.00	0.07	0.05	69.90	43.77	48.53	48.62	0.09	4.85	-21.28	4.51	3.29	3.64	3.65	0.01	0.36	-0.86
20	2.32	2.31	2.36	2.36	0.00	0.06	0.05	61.28	39.22	43.22	43.30	0.08	4.08	-17.99	4.03	2.96	3.26	3.26	0.01	0.30	-0.77
30	2.24	2.23	2.28	2.28	0.00	0.04	0.04	50.44	33.50	36.55	36.61	0.06	3.11	-13.83	3.41	2.53	2.76	2.77	0.00	0.24	-0.64
40	2.19	2.19	2.22	2.22	0.00	0.04	0.03	43.81	30.01	32.48	32.53	0.05	2.52	-11.28	3.02	2.27	2.46	2.46	0.00	0.20	-0.56
50	2.16	2.16	2.19	2.19	0.00	0.03	0.02	39.33	27.65	29.73	29.77	0.04	2.12	-9.56	2.75	2.09	2.25	2.25	0.00	0.17	-0.50
60	2.14	2.13	2.16	2.16	0.00	0.03	0.02	36.07	25.94	27.73	27.76	0.04	1.83	-8.31	2.55	1.95	2.10	2.10	0.00	0.14	-0.45
70	2.12	2.12	2.14	2.14	0.00	0.02	0.02	33.59	24.63	26.21	26.24	0.03	1.61	-7.35	2.40	1.85	1.98	1.98	0.00	0.13	-0.42
80	2.11	2.10	2.12	2.12	0.00	0.02	0.02	31.65	23.61	25.01	25.04	0.03	1.43	-6.61	2.28	1.77	1.89	1.89	0.00	0.11	-0.39
90	2.10	2.09	2.11	2.11	0.00	0.02	0.02	30.07	22.78	24.05	24.07	0.03	1.29	-6.00	2.18	1.71	1.81	1.81	0.00	0.10	-0.37
100	2.09	2.08	2.10	2.10	0.00	0.02	0.01	27.58	20.93	22.08	22.11	0.03	1.17	-5.47	2.11	1.66	1.75	1.76	0.00	0.10	-0.35
125	2.07	2.07	2.08	2.08	0.00	0.01	0.01	25.15	19.65	20.59	20.61	0.02	0.96	-4.54	1.95	1.56	1.64	1.64	0.00	0.08	-0.31
150	2.06	2.05	2.07	2.07	0.00	0.01	0.01	23.45	18.76	19.55	19.57	0.02	0.81	-3.89	1.84	1.49	1.55	1.56	0.00	0.07	-0.28
175	2.05	2.05	2.06	2.06	0.00	0.01	0.01	22.21	18.10	18.78	18.80	0.02	0.70	-3.41	1.76	1.44	1.49	1.50	0.00	0.06	-0.26
200	2.04	2.04	2.05	2.05	0.00	0.01	0.01	21.26	17.60	18.20	18.22	0.01	0.61	-3.04	1.70	1.40	1.45	1.45	0.00	0.05	-0.25

Thames Basin Heaths SPA

Receptor A

	Annual Mean NH_3 (ug/m^3)							Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)						
Distance From Road (m)	**BL Baseline**	**Proj BL Proj Baseline**	**DM (Base 2033)**	**DS (Scn1 2033)**	**(DS-DM)**	**Change (DS-ProjBL)**	**(DS-BL)**	**BL Baseline**	**Proj BL Proj Baseline**	**DM (Base 2033)**	**DS (Scn1 2033)**	**(DS-DM)**	**Change (DS-ProjBL)**	**(DS-BL)**	**BL Baseline**	**Proj BL Proj Baseline**	**DM (Base 2033)**	**DS (Scn1 2033)**	**(DS-DM)**	**Change (DS-ProjBL)**	**(DS-BL)**
0	6.38	6.14	6.94	7.04	0.09	0.90	0.66	192.86	115.13	131.52	133.41	1.89	18.28	-59.45	19.03	15.89	18.08	18.33	0.25	2.44	-0.70
5	5.22	5.02	5.65	5.72	0.07	0.70	0.51	153.45	92.70	105.49	106.95	1.46	14.25	-46.50	15.46	12.82	14.56	14.76	0.20	1.94	-0.70
10	4.53	4.37	4.89	4.95	0.06	0.58	0.42	130.34	79.60	90.27	91.48	1.21	11.88	-38.87	13.32	11.00	12.47	12.64	0.17	1.64	-0.68
15	4.07	3.93	4.38	4.43	0.05	0.50	0.36	114.66	70.72	79.95	80.99	1.04	10.27	-33.67	11.85	9.75	11.04	11.18	0.15	1.43	-0.67
20	3.74	3.61	4.01	4.05	0.05	0.44	0.32	103.23	64.26	72.44	73.36	0.92	9.09	-29.87	10.76	8.83	9.98	10.11	0.13	1.28	-0.65
30	3.27	3.16	3.49	3.53	0.04	0.36	0.26	87.42	55.33	62.06	62.80	0.74	7.47	-24.61	9.23	7.55	8.50	8.61	0.11	1.06	-0.62
40	2.96	2.87	3.15	3.18	0.03	0.31	0.22	76.88	49.39	55.15	55.78	0.63	6.39	-21.10	8.19	6.69	7.51	7.60	0.09	0.91	-0.59
50	2.74	2.66	2.90	2.93	0.03	0.27	0.19	69.33	45.14	50.20	50.75	0.55	5.61	-18.58	7.43	6.07	6.79	6.87	0.08	0.81	-0.56
60	2.57	2.50	2.72	2.74	0.02	0.24	0.17	63.62	41.92	46.46	46.94	0.48	5.02	-16.68	6.86	5.59	6.25	6.32	0.07	0.72	-0.54
70	2.44	2.37	2.57	2.59	0.02	0.22	0.16	59.14	39.40	43.52	43.96	0.44	4.56	-15.18	6.40	5.22	5.82	5.88	0.06	0.66	-0.52
80	2.33	2.27	2.45	2.47	0.02	0.20	0.14	55.52	37.36	41.15	41.55	0.40	4.19	-13.97	6.03	4.92	5.47	5.53	0.06	0.61	-0.50
90	2.24	2.19	2.36	2.38	0.02	0.19	0.13	52.52	35.67	39.18	39.55	0.36	3.88	-12.97	5.72	4.67	5.18	5.23	0.05	0.56	-0.48
100	2.17	2.12	2.28	2.29	0.02	0.17	0.12	50.01	34.26	37.54	37.88	0.34	3.62	-12.13	5.45	4.46	4.94	4.99	0.05	0.52	-0.47
125	2.03	1.99	2.12	2.13	0.01	0.15	0.11	45.19	31.54	34.38	34.66	0.29	3.13	-10.52	4.95	4.06	4.47	4.51	0.04	0.45	-0.44
150	1.93	1.89	2.01	2.02	0.01	0.13	0.09	41.72	29.58	32.11	32.35	0.25	2.77	-9.37	4.58	3.76	4.13	4.17	0.04	0.40	-0.42
175	1.85	1.82	1.92	1.93	0.01	0.12	0.08	39.10	28.11	30.39	30.61	0.22	2.50	-8.50	4.31	3.54	3.87	3.91	0.03	0.36	-0.40
200	1.79	1.76	1.86	1.87	0.01	0.11	0.08	37.05	26.95	29.04	29.24	0.20	2.29	-7.81	4.09	3.37	3.67	3.70	0.03	0.33	-0.39

Receptor B_w

	Annual Mean NH_3 (ug/m^3)							Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)						
Distance From Road (m)	**BL Baseline**	**Proj BL Proj Baseline**	**DM (Base 2033)**	**DS (Scn1 2033)**	**(DS-DM)**	**Change (DS-ProjBL)**	**(DS-BL)**	**BL Baseline**	**Proj BL Proj Baseline**	**DM (Base 2033)**	**DS (Scn1 2033)**	**(DS-DM)**	**Change (DS-ProjBL)**	**(DS-BL)**	**BL Baseline**	**Proj BL Proj Baseline**	**DM (Base 2033)**	**DS (Scn1 2033)**	**(DS-DM)**	**Change (DS-ProjBL)**	**(DS-BL)**
0	5.59	5.43	6.11	6.15	0.04	0.73	0.56	202.01	124.94	142.88	143.83	0.95	18.90	-58.18	17.75	14.82	16.81	16.92	0.11	2.10	-0.83
5	4.37	4.24	4.74	4.77	0.03	0.53	0.40	149.78	93.64	106.62	107.32	0.70	13.68	-42.46	13.66	11.31	12.80	12.88	0.08	1.57	-0.78
10	3.78	3.67	4.08	4.10	0.02	0.43	0.32	124.22	78.44	88.98	89.56	0.57	11.11	-34.66	11.61	9.56	10.80	10.87	0.07	1.31	-0.74
15	3.41	3.31	3.66	3.68	0.02	0.37	0.28	108.31	69.02	78.04	78.53	0.50	9.51	-29.78	10.30	8.46	9.54	9.60	0.06	1.14	-0.71
20	3.15	3.06	3.38	3.39	0.02	0.33	0.24	97.18	62.44	70.38	70.83	0.44	8.39	-26.35	9.37	7.68	8.64	8.69	0.05	1.02	-0.68
30	2.81	2.74	2.99	3.01	0.02	0.27	0.20	82.42	53.73	60.25	60.62	0.37	6.89	-21.80	8.12	6.63	7.44	7.48	0.05	0.85	-0.63
40	2.59	2.52	2.75	2.76	0.01	0.24	0.17	72.96	48.15	53.77	54.09	0.32	5.94	-18.87	7.29	5.96	6.66	6.70	0.04	0.74	-0.59
50	2.43	2.38	2.58	2.59	0.01	0.21	0.16	66.35	44.26	49.24	49.53	0.29	5.27	-16.82	6.71	5.48	6.11	6.15	0.04	0.67	-0.57
60	2.32	2.27	2.45	2.46	0.01	0.19	0.14	61.44	41.37	45.87	46.14	0.27	4.77	-15.30	6.27	5.12	5.70	5.73	0.03	0.61	-0.54
70	2.23	2.18	2.35	2.36	0.01	0.18	0.13	57.63	39.12	43.26	43.51	0.25	4.39	-14.12	5.93	4.85	5.38	5.41	0.03	0.56	-0.52
80	2.16	2.12	2.27	2.28	0.01	0.17	0.12	54.60	37.34	41.19	41.42	0.23	4.08	-13.18	5.66	4.62	5.12	5.15	0.03	0.53	-0.50
90	2.10	2.06	2.21	2.22	0.01	0.16	0.12	52.11	35.88	39.48	39.70	0.22	3.83	-12.41	5.43	4.44	4.91	4.94	0.03	0.50	-0.49
100	2.05	2.02	2.15	2.16	0.01	0.15	0.11	50.04	34.66	38.06	38.27	0.21	3.62	-11.77	5.24	4.29	4.74	4.77	0.03	0.47	-0.48
125	1.96	1.93	2.05	2.06	0.01	0.13	0.10	46.09	32.33	35.35	35.55	0.19	3.22	-10.55	4.88	4.00	4.40	4.43	0.03	0.43	-0.45
150	1.90	1.87	1.98	1.99	0.01	0.12	0.09	43.27	30.66	33.42	33.60	0.18	2.93	-9.68	4.62	3.79	4.16	4.18	0.02	0.39	-0.43
175	1.85	1.82	1.93	1.93	0.01	0.11	0.08	41.15	29.41	31.96	32.13	0.17	2.72	-9.02	4.42	3.63	3.98	4.00	0.02	0.36	-0.42
200	1.81	1.78	1.88	1.89	0.01	0.11	0.08	39.49	28.42	30.82	30.97	0.16	2.55	-8.51	4.26	3.51	3.83	3.86	0.02	0.35	-0.41

Receptor B_e

	Annual Mean NH_3 (ug/m^3)							Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)						
Distance From Road (m)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)
0	6.27	6.09	6.89	6.93	0.04	0.83	0.66	231.28	142.62	163.32	164.41	1.09	21.79	-66.88	19.99	16.76	19.03	19.15	0.12	2.38	-0.85
5	4.95	4.81	5.40	5.43	0.03	0.62	0.48	174.62	108.66	123.98	124.80	0.82	16.14	-49.82	15.62	13.01	14.74	14.83	0.09	1.82	-0.79
10	4.25	4.14	4.62	4.64	0.03	0.51	0.39	144.67	90.80	103.27	103.94	0.67	13.14	-40.73	13.25	10.99	12.42	12.50	0.08	1.51	-0.75
15	3.81	3.70	4.12	4.14	0.02	0.43	0.33	125.45	79.36	89.99	90.57	0.58	11.21	-34.88	11.71	9.67	10.92	10.98	0.07	1.31	-0.72
20	3.49	3.39	3.76	3.78	0.02	0.38	0.29	111.73	71.20	80.52	81.03	0.51	9.83	-30.70	10.58	8.71	9.82	9.88	0.06	1.17	-0.70
30	3.05	2.98	3.27	3.29	0.02	0.31	0.23	93.09	60.12	67.66	68.08	0.42	7.96	-25.01	9.03	7.40	8.32	8.37	0.05	0.97	-0.66
40	2.77	2.70	2.95	2.97	0.01	0.27	0.20	80.90	52.88	59.26	59.62	0.36	6.74	-21.28	7.98	6.53	7.32	7.36	0.05	0.83	-0.62
50	2.57	2.51	2.73	2.74	0.01	0.23	0.17	72.24	47.74	53.29	53.61	0.32	5.87	-18.63	7.23	5.90	6.60	6.64	0.04	0.74	-0.59
60	2.42	2.36	2.56	2.57	0.01	0.21	0.15	65.73	43.88	48.80	49.09	0.29	5.21	-16.64	6.65	5.43	6.05	6.09	0.04	0.66	-0.56
70	2.30	2.25	2.43	2.44	0.01	0.19	0.14	60.65	40.87	45.31	45.57	0.26	4.70	-15.08	6.20	5.06	5.62	5.66	0.04	0.60	-0.54
80	2.20	2.16	2.32	2.33	0.01	0.17	0.13	56.58	38.46	42.51	42.75	0.24	4.29	-13.83	5.83	4.76	5.28	5.31	0.03	0.55	-0.52
90	2.13	2.08	2.23	2.24	0.01	0.16	0.12	53.24	36.48	40.21	40.44	0.23	3.95	-12.80	5.53	4.51	5.00	5.03	0.03	0.51	-0.50
100	2.06	2.02	2.16	2.17	0.01	0.15	0.11	50.45	34.83	38.29	38.50	0.22	3.67	-11.94	5.27	4.31	4.76	4.79	0.03	0.48	-0.49
125	1.94	1.90	2.02	2.03	0.01	0.13	0.09	45.16	31.71	34.66	34.85	0.19	3.14	-10.31	4.78	3.92	4.31	4.33	0.03	0.42	-0.45
150	1.85	1.82	1.93	1.93	0.01	0.12	0.08	41.85	29.94	32.53	32.70	0.17	2.76	-9.14	4.44	3.64	3.99	4.01	0.02	0.37	-0.43
175	1.79	1.76	1.86	1.86	0.01	0.11	0.08	39.12	28.33	30.66	30.82	0.16	2.49	-8.30	4.18	3.44	3.75	3.78	0.02	0.34	-0.41
200	1.74	1.71	1.80	1.81	0.01	0.10	0.07	37.04	27.11	29.24	29.39	0.15	2.28	-7.65	3.99	3.28	3.57	3.60	0.02	0.31	-0.39

Receptor C_w

	Annual Mean NH_3 (ug/m^3)							Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)						
Distance From Road (m)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)
0	6.36	6.24	7.04	7.08	0.04	0.84	0.72	236.67	147.44	168.47	169.55	1.08	22.11	-67.11	20.34	17.22	19.50	19.62	0.12	2.40	-0.72
5	5.07	4.96	5.57	5.60	0.03	0.63	0.53	181.07	113.63	129.45	130.27	0.82	16.64	-50.80	16.05	13.50	15.26	15.35	0.09	1.85	-0.71
10	4.34	4.25	4.74	4.76	0.03	0.52	0.43	149.77	94.70	107.57	108.24	0.67	13.55	-41.53	13.59	11.36	12.83	12.90	0.08	1.54	-0.69
15	3.86	3.78	4.19	4.22	0.02	0.44	0.36	129.12	82.24	93.17	93.74	0.57	11.50	-35.38	11.94	9.93	11.20	11.26	0.07	1.33	-0.68
20	3.51	3.44	3.80	3.82	0.02	0.38	0.31	114.30	73.32	82.84	83.34	0.50	10.02	-30.96	10.73	8.89	10.01	10.07	0.06	1.18	-0.66
30	3.05	2.98	3.28	3.29	0.02	0.31	0.25	94.25	61.27	68.90	69.30	0.40	8.03	-24.95	9.06	7.47	8.38	8.43	0.05	0.96	-0.63
40	2.74	2.69	2.93	2.95	0.01	0.26	0.20	81.17	53.42	59.80	60.15	0.34	6.73	-21.02	7.94	6.52	7.30	7.34	0.04	0.82	-0.60
50	2.53	2.48	2.69	2.70	0.01	0.22	0.17	71.95	47.90	53.41	53.70	0.30	5.81	-18.24	7.14	5.85	6.53	6.57	0.04	0.71	-0.57
60	2.37	2.32	2.51	2.52	0.01	0.20	0.15	65.08	43.79	48.65	48.91	0.26	5.12	-16.17	6.53	5.35	5.96	5.99	0.03	0.64	-0.54
70	2.25	2.20	2.37	2.38	0.01	0.18	0.14	59.76	40.61	44.97	45.20	0.24	4.59	-14.56	6.06	4.96	5.50	5.53	0.03	0.57	-0.52
80	2.15	2.11	2.26	2.27	0.01	0.16	0.12	55.53	38.09	42.03	42.25	0.22	4.16	-13.28	5.67	4.65	5.14	5.17	0.03	0.52	-0.50
90	2.07	2.03	2.17	2.18	0.01	0.15	0.11	52.07	36.02	39.64	39.84	0.20	3.82	-12.23	5.36	4.39	4.85	4.87	0.03	0.48	-0.48
100	2.00	1.97	2.10	2.11	0.01	0.14	0.10	49.20	34.31	37.65	37.84	0.19	3.53	-11.36	5.10	4.18	4.60	4.63	0.03	0.45	-0.47
125	1.88	1.85	1.96	1.96	0.01	0.12	0.09	43.77	31.08	33.90	34.06	0.16	2.99	-9.70	4.59	3.77	4.14	4.16	0.02	0.39	-0.44
150	1.79	1.76	1.86	1.86	0.01	0.10	0.08	39.97	28.82	31.28	31.42	0.14	2.60	-8.55	4.24	3.49	3.81	3.83	0.02	0.34	-0.41
175	1.72	1.70	1.79	1.79	0.01	0.09	0.07	37.16	27.15	29.35	29.48	0.13	2.32	-7.69	3.98	3.28	3.56	3.58	0.02	0.30	-0.39
200	1.67	1.65	1.73	1.74	0.01	0.09	0.06	35.02	25.89	27.87	27.99	0.12	2.11	-7.03	3.77	3.12	3.38	3.40	0.02	0.28	-0.38

Receptor C_e

	Annual Mean NH_3 (ug/m^3)							Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)						
Distance	BL	Proj BL	DM	DS		Change		BL	Proj BL	DM	DS		Change		BL	Proj BL	DM	DS		Change	
From Road	Baselin	Proj	(Base	(Scn1	(DS-	(DS-	(DS-	Baselin	Proj	(Base	(Scn1	(DS-	(DS-	(DS-	Baselin	Proj	(Base	(Scn1	(DS-	(DS-	(DS-BL)

(m)	e	Baseline	2033)	2033)	DM)	ProjBL)	BL)	e	Baseline	2033)	2033)	DM)	ProjBL)	BL)	e	Baseline	2033)	2033)	DM)	ProjBL)	
0	5.18	4.97	5.61	5.64	0.03	0.67	0.46	186.09	113.96	130.64	131.50	0.86	17.55	-54.59	16.44	13.53	15.39	15.48	0.10	1.95	-0.96
5	4.15	3.99	4.46	4.49	0.02	0.50	0.33	141.91	87.94	100.36	101.01	0.65	13.07	-40.91	12.97	10.59	12.01	12.09	0.07	1.50	-0.88
10	3.57	3.44	3.82	3.84	0.02	0.40	0.27	116.93	73.32	83.31	83.84	0.53	10.52	-33.09	10.94	8.89	10.06	10.12	0.06	1.23	-0.82
15	3.19	3.08	3.40	3.42	0.02	0.34	0.22	100.55	63.77	72.17	72.61	0.44	8.84	-27.94	9.59	7.76	8.76	8.82	0.05	1.05	-0.77
20	2.92	2.82	3.10	3.11	0.02	0.29	0.19	88.88	56.97	64.24	64.62	0.39	7.65	-24.25	8.60	6.95	7.83	7.87	0.05	0.92	-0.73
30	2.56	2.48	2.70	2.71	0.01	0.23	0.15	73.28	47.92	53.66	53.97	0.31	6.05	-19.31	7.25	5.85	6.56	6.60	0.04	0.74	-0.66
40	2.32	2.26	2.44	2.45	0.01	0.19	0.13	63.24	42.10	46.86	47.12	0.26	5.02	-16.11	6.36	5.14	5.73	5.76	0.03	0.63	-0.60
50	2.16	2.10	2.26	2.27	0.01	0.17	0.11	56.21	38.04	42.11	42.34	0.22	4.30	-13.88	5.73	4.63	5.15	5.18	0.03	0.54	-0.55
60	2.04	1.99	2.13	2.14	0.01	0.15	0.10	51.01	35.03	38.60	38.80	0.20	3.76	-12.22	5.26	4.26	4.71	4.74	0.03	0.48	-0.52
70	1.95	1.90	2.03	2.03	0.01	0.13	0.09	46.99	32.71	35.88	36.05	0.18	3.35	-10.93	4.89	3.97	4.37	4.40	0.02	0.43	-0.49
80	1.87	1.83	1.95	1.95	0.01	0.12	0.08	43.80	30.86	33.73	33.89	0.16	3.02	-9.91	4.59	3.74	4.10	4.12	0.02	0.39	-0.46
90	1.81	1.78	1.88	1.88	0.01	0.11	0.07	41.20	29.36	31.97	32.12	0.15	2.76	-9.08	4.35	3.55	3.88	3.90	0.02	0.36	-0.44
100	1.76	1.73	1.82	1.83	0.01	0.10	0.07	39.04	28.11	30.51	30.65	0.14	2.53	-8.39	4.14	3.39	3.70	3.72	0.02	0.33	-0.43
125	1.67	1.64	1.72	1.72	0.00	0.08	0.06	34.96	25.75	27.75	27.86	0.12	2.12	-7.09	3.75	3.09	3.35	3.36	0.02	0.28	-0.39
150	1.60	1.58	1.64	1.65	0.00	0.07	0.05	32.08	24.09	25.80	25.91	0.10	1.82	-6.17	3.48	2.88	3.10	3.12	0.01	0.24	-0.36
175	1.55	1.53	1.59	1.59	0.00	0.06	0.05	29.94	22.84	24.35	24.45	0.09	1.60	-5.49	3.27	2.72	2.92	2.93	0.01	0.21	-0.34
200	1.51	1.49	1.55	1.55	0.00	0.06	0.04	28.28	21.88	23.23	23.32	0.08	1.43	-4.97	3.11	2.59	2.77	2.78	0.01	0.19	-0.33

Receptor D

	Annual Mean NH_3 (ug/m^3)							Annual Mean NOx (ug/m^3)							Annual Mean Total N Dep (kg N/ha/yr)						
Distance From Road (m)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)	BL Baseline	Proj BL Proj Baseline	DM (Base 2033)	DS (Scn1 2033)	(DS-DM)	Change (DS-ProjBL)	(DS-BL)
0	6.88	6.62	7.51	7.58	0.07	0.96	0.71	200.58	120.10	137.05	138.42	1.37	18.32	-62.16	20.14	16.95	19.30	19.49	0.19	2.54	-0.65
5	5.68	5.48	6.18	6.24	0.06	0.76	0.55	162.48	98.39	111.88	112.96	1.08	14.57	-49.52	16.56	13.87	15.76	15.92	0.15	2.05	-0.64
10	4.96	4.79	5.37	5.42	0.05	0.64	0.46	139.39	85.27	96.65	97.56	0.91	12.29	-41.83	14.36	11.98	13.59	13.72	0.13	1.75	-0.64
15	4.46	4.31	4.82	4.86	0.04	0.55	0.40	123.36	76.18	86.09	86.88	0.79	10.70	-36.48	12.81	10.65	12.07	12.18	0.11	1.53	-0.63
20	4.09	3.95	4.40	4.44	0.04	0.49	0.35	111.51	69.46	78.29	78.99	0.70	9.53	-32.52	11.65	9.66	10.93	11.04	0.10	1.37	-0.62
30	3.57	3.45	3.83	3.86	0.03	0.40	0.29	94.90	60.06	67.37	67.95	0.58	7.88	-26.96	10.01	8.26	9.33	9.41	0.08	1.15	-0.59
40	3.22	3.12	3.44	3.46	0.03	0.34	0.25	83.73	53.74	60.03	60.52	0.49	6.78	-23.21	8.88	7.32	8.23	8.31	0.07	0.99	-0.57
50	2.97	2.88	3.16	3.18	0.02	0.30	0.22	75.65	49.18	54.72	55.16	0.43	5.98	-20.50	8.05	6.63	7.44	7.50	0.06	0.88	-0.55
60	2.77	2.70	2.95	2.97	0.02	0.27	0.19	69.53	45.73	50.71	51.10	0.39	5.37	-18.44	7.42	6.10	6.83	6.89	0.06	0.79	-0.53
70	2.62	2.55	2.78	2.80	0.02	0.25	0.17	64.72	43.01	47.55	47.90	0.35	4.89	-16.82	6.92	5.69	6.35	6.40	0.05	0.72	-0.51
80	2.50	2.44	2.64	2.66	0.02	0.22	0.16	60.84	40.82	45.01	45.33	0.32	4.51	-15.51	6.51	5.35	5.96	6.01	0.05	0.66	-0.50
90	2.40	2.34	2.53	2.55	0.02	0.21	0.15	57.64	39.02	42.91	43.21	0.30	4.19	-14.43	6.17	5.07	5.64	5.69	0.04	0.62	-0.48
100	2.32	2.26	2.44	2.46	0.01	0.19	0.14	54.96	37.51	41.16	41.43	0.28	3.92	-13.53	5.89	4.84	5.37	5.42	0.04	0.58	-0.47
125	2.16	2.11	2.26	2.28	0.01	0.17	0.12	49.84	34.62	37.80	38.04	0.24	3.41	-11.80	5.34	4.39	4.86	4.89	0.04	0.50	-0.44
150	2.04	2.00	2.14	2.15	0.01	0.15	0.11	46.20	32.58	35.42	35.63	0.21	3.05	-10.57	4.94	4.08	4.49	4.52	0.03	0.45	-0.42
175	1.96	1.92	2.04	2.05	0.01	0.13	0.10	43.49	31.05	33.65	33.84	0.19	2.78	-9.65	4.65	3.84	4.21	4.24	0.03	0.40	-0.41
200	1.89	1.86	1.97	1.98	0.01	0.12	0.09	41.40	29.88	32.28	32.46	0.18	2.58	-8.94	4.42	3.65	4.00	4.03	0.03	0.37	-0.39

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