Gloucestershire COUNTY COUNCIL

Air Quality and Greenhouse Gas Assessment

A40 Over Roundabout

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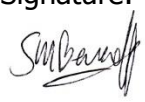
[Enter details of amendment]	Name: Stuart Bennett Signature:  Date: 21/9/2016	Name: Josep Simona Signature:  Date: 21/9/2016	Name: Matt Winter Signature:  Date: 21/09/2016
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Executive summary

Amey has been requested by Gloucestershire County Council (GCC) to implement an improvement to the A40 over roundabout, involving widening on the A417 north and A40 east approaches, widening on the east, south and west circulatory carriageway and the addition of traffic signals to the A417 south and west arms.

This report describes an assessment of the temporary and permanent impacts on air quality and greenhouse gases associated with the Project. A 'simple' level assessment was completed in accordance with the Department for Transport TAG Unit A3 guidelines and the Design Manual for Roads and Bridges (DMRB). Best practice approaches to the assessment of temporary effects on air quality are also employed for the purpose of identifying appropriate mitigation measures.

Temporary effects on local air quality

The findings of the assessment of temporary effects establish that there will be no significant dust effects associated with the construction works. It is recommended that the site-specific mitigation measures based in guidance documents from the Institute of Air Quality Management are included in a Dust Management Plan.

Operational effects on local air quality

This report also assessed the permanent effects of the carriageway widening on local ambient concentrations of NO_2 and PM_{10}. The overall effects of the improvement works on ambient air quality have been determined as being imperceptible and as such no mitigation is deemed necessary for the operational phase of the Project.

Operational effects on regional air quality

A detailed assessment of greenhouse gas emissions was not undertaken because none of the DMRB criteria for assessment were met. No impact on regional air quality is anticipated as a result of the Project. As the primary aim of the A40 Over Improvements aim to reduce congestion by improving the capacity and flow of road traffic using the roundabout the Project will contribute to minimising greenhouse gas emissions. The vehicle kilometres travelled are not expected to change significantly as a result of the Project and optimum traffic flow and speeds are more likely to be achieved as a result of the improvement works. This is consistent with the vision and aims of the LTP3 for an environmentally and financially sustainable transport network.

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1 Introduction

1.1 Background

1.1.1 Amey has been requested by Gloucestershire County Council (GCC) to recommend an improvement to the A40 Over-Roundabout, west of Gloucester. The overall aim of the Project is to reduce queues and delays on the A40 'east-west' and A417 'north-south' approaches through the A40 Over-Roundabout, thus improving vehicle journey times and addressing reliability problems.

1.2 Aims and Objectives

1.2.1 An environmental scoping assessment undertaken by Amey in March 2016 (Ref. 1) identified air quality and greenhouse gas as being an environmental topic requiring further consideration. Therefore, this report describes an assessment of both the temporary (construction) and permanent (operational) effects of the Project on air quality and greenhouse gases (GHG).

1.2.2 The assessment of temporary effects considers the nuisance from dust likely to be released at the construction stage of the proposed Project and recommends mitigation measures. The assessment of permanent effects includes an examination of existing pollutant sources and measured ambient concentrations (in terms of NO_x, NO_2 and PM_{10}) in the vicinity of the proposed Project and the assessment of the effects of the Project on air pollutants from the operational road traffic.

1.2.3 The assessment forms part of the appraisal process, which is intended to inform the business case for the Project. Therefore, the assessment has been completed in accordance with the Department for Transport (DfT) Transport Analysis Guidance Unit A3 Environmental Impact Appraisal (Ref. 2).

1.3 Project Works

1.3.1 The proposed improvement works (the Project) include road widening to provide an extra lane to the A40 westbound and A417 Southbound approaches and the circulatory carriageway. Project works also include widening of the embankments and the construction of retaining walls. It is anticipated that activities associated with these construction works will cause the release of dust and particulate matter with the potential to impact upon local sensitive receivers on an intermittent basis throughout the construction period. During operations, the Project has the potential to change the exposure of local sensitive receivers to releases of exhaust gas emissions from traffic using the roundabout and supporting road network.

2 Regulatory and Policy Framework

2.1 European Directive 2008/50/EC

2.1.1 The 2008 ambient air quality and cleaner air for Europe directive (Ref. 3) sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). As well as having direct effects, these pollutants can combine in the atmosphere to form ozone, a harmful air pollutant (and potent greenhouse gas) which can be transported great distances by weather systems.

2.1.2 The 2008 directive replaced nearly all the previous EU air quality legislation and transcribed into law in England through the Air Quality Standards Regulations 2010 (Ref. 4).

2.2 Environment Act 1995

2.2.1 Under Part IV of the Environment Act 1995 (Ref. 5), the UK Government is required to produce a National Air Quality Strategy (AQS) which was last reviewed and published in 2007. The strategy sets out the UK's air quality objectives and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. It prescribes air quality objectives for ten pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, polycyclic aromatic hydrocarbons, nitrogen dioxide, sulphur dioxide, particles – PM_{10} and $PM_{2.5}$ and ozone).

2.2.2 Part IV of the Environment Act 1995 requires local authorities in the UK to review air quality in their area and designate Air Quality Management Areas (AQMA) if improvements are necessary. Where an AQMA is designated, local authorities are also required to work towards the Strategy's objectives prescribed in regulations for that purpose. An air quality action plan describing the pollution reduction measures must then be put in place. These plans contribute to the achievement of air quality limit values at local level.

2.3 National Planning Policy Framework

2.3.1 The National Planning Policy Framework (NPPF) was published on 27 March 2012 and sets out the Government's planning policies for England and how these are expected to be applied (Ref. 6). The purpose of the NPPF is to help achieve sustainable development, understood as positive growth.

2.3.2 Section 109 states that the planning system should contribute to and enhance the natural and local environment by, among others, preventing new development from contributing to unacceptable levels of air pollution.

2.3.3 Section 124 states that planning policies should sustain compliance with and contribute towards EU limit values and national objectives for pollutants, taking into account the presence of air quality management areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in an AQMA is consistent with the local Air Quality Action Plan.

2.4 Local Policy Framework

2.4.1 The Project site lies within the Gloucester City Council (GCC) boundary. However, as the A40 forms the boundary between GCC and Tewkesbury Borough Council (TBC) the potential local air quality impact area includes part of both council areas. Therefore, TBC work closely with GCC to achieve the aims of the Gloucestershire AQS.

2.4.2 TBC submitted an Air Quality Action Plan (AQAP) to Defra in 2011 (Ref. 7). The key recommendations in the plan which would improve air quality were related to road traffic and were:

- Reduce overall traffic by 5%; and
- Remove all heavy goods vehicles (HGV) exceeding 7.5t

2.4.3 The aims of the Project are also closely aligned with the AQS for Gloucestershire (Ref. 8) which has the following objectives:

- Review and improve the key mechanisms and structures in place regionally to deliver air quality improvements
- Review and reduce the main constraints and barriers to improving air quality locally
- Reduce air pollution to the lowest level that can be reasonably achieved in line with European directives, and to achieve a minimum of 10% improvement on the basic objectives
- Maintain air quality and prevent deterioration of air quality where already satisfactory
- Reduce emissions of CO_2 emitted by road transport through local air quality management initiatives and policies to reduce overall traffic volumes and congestion across Gloucestershire

- Consider subsequent reviews of the AQS in conjunction with annual reviews of Gloucestershire Local Transport Plan (LTP3) (Ref 9).

2.4.4 The draft Joint Core Strategy for Gloucester, Cheltenham and Tewkesbury 2014 (Ref. 10) has yet to be adopted. It contains Strategic objective number 9 that relates to air quality, which states that:

2.4.5 "Promote development that contributes to a healthy population by:

- …..Ensuring that environmental quality and air quality is protected"

2.4.6 The LTP3 sets out a vision for transport in the future as:

- "Providing a safe and sustainable transport network within Gloucestershire."

Where sustainable means a transport network which is both environmentally and financially sustainable.

2.4.7 The LTP3 sets out the transport strategy for the County from 2011 to 2026. Policy P5e states that:

- "Through the planning process, developers and scheme promoters will be required to undertake assessments to determine if their development or scheme will be subject to or create poor air quality or noise in excess of the thresholds as advised by Government and to commit to mitigating those effects."

2.5 Environmental Protection Act 1990

2.5.1 Section 79 of the Environmental Protection Act (EPA) 1990 (Ref. 11) states that where a statutory nuisance is shown to exist, the Local Authority must serve an abatement notice. Statutory nuisances are defined as:

- any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance
- any accumulation or deposit which is prejudicial to health or a nuisance.

3 Baseline Conditions

3.1 Background Air Quality

3.1.1 TBC and GCC have responsibility for the review and assessment of local air quality in the vicinity of the Project.

3.1.2 TBC has declared one Air Quality Management Area (AQMA) for an exceedance of the NO_2 annual mean air quality objective.

3.1.3 TBC does not maintain any continuous monitoring sites in the borough. Furthermore, the the passive diffusion tube monitoring sites it operates are at such a distance that they are considered representative of local air quality conditions at the Project.

3.1.4 GCC has also declared AQMAs on Priory Road, Barton Street and Painswick Road in Gloucester which are the closest AQMAs to the Project. Changes in traffic flows resulting from the Project have the potential to impact on the Priory Road these AQMA which is located 1.5km to the south-east of the Project site.

3.1.5 GCC operates a roadside continuous monitoring site on Barton Street in Gloucester which monitors for NO_2. It also operates passive diffusion tube monitoring across the council area. However, all of the monitoring sites operate at such a distance that they are considered unrepresentative of local air quality conditions at the Project site.

3.1.6 In the absence of locally representative data, background concentrations of NO_x, NO_2 and PM_{10} were obtained from the latest DEFRA pollutant background maps (Ref. 12). These maps provide a modelled background pollutant concentration for Ordnance Survey 1km×1km grid square in the UK.

3.1.7

3.1.9 Table 3.1 shows the expected background concentrations in the area of the Project projected from Defra's background maps for 2013. These are reported for NO_x, NO_2 and PM_{10}. The background maps for NO_x concentrations can be obtained for each individual sectors such as motorways, trunk roads, industrial and rail. However, the total background NO_x concentration is presented in order to present a worst case scenario.

Table 3.1: Background concentrations for NO_x, NO_2 and PM_{10} (381500 219500)

Year	NO_x ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)
2016	19.9	14.2	15.2
2018	17.9	12.9	14.9
2025	13.9	10.3	14.5

3.1.10

3.1.12 Table 3.1 shows that background concentrations of NO_2 and PM_{10} are under the annual AQS objectives of 40 $\mu g/m^3$ (Table 5:2) and can be considered typical of this area of Gloucestershire. It also show that if net traffic growth is zero, concentrations will improve because of a forecast increase in the penetration of lower emission vehicles in the fleet in future years and reduction in background concentrations.

3.2 Road Traffic

3.2.1

3.2.2

3.2.3 Table 3.2 reports the Annual Average Daily Traffics in 24 hours (AADT,24h) for base year 2016, the first year of operation 2018 and the future assessment year 2025. The traffic data used in the assessment were Automatic Traffic Counts (ATC) conducted by the Department for Transport on the A40 west of the Over Roundabout in March 2016 (Ref. 13). Counts are also available for the Over Causeway but as the modification to this road is more than 200m from any sensitive receptors, it was excluded from the assessment.

3.2.4 It is not anticipated that the Project will result in any increase in AADT and as such the Do-Minimum and Do-Something scenarios for both 2018 and 2025 utilise the same AADT growth.

3.2.5 For the assessment years 2018 and 2025, a TEMPRO v7.0 (Ref. 14) traffic growth forecast was used in the absence of a traffic model. This forecast links TEMPRO into the National Roads Traffic Forecast. The baseline traffic counts, growth factors and estimated counts for each assessment year are shown in Table 3.8. In the absence of traffic composition data, the percentage of HGVs was assumed to be 5% for all years which represents a conservative approach.

3.2.6 Highways England INTERIM ADVICE NOTE 185/15 (Ref. 15) details a methodology that can be employed to calculate link speeds. However as the note states "The published version of the DMRB air quality spreadsheet model (v1.03c) cannot be used to calculate emissions and concentrations in congested conditions." As this Project has been determined to require a simple assessment using v1.03c, the published national speed limits (60 mph (95 kph)) have been used for each link, these speeds are detailed in the

3.2.7

3.2.8 Table 3.2.

Table 3.2: Traffic flows used in the assessment of permanent effects

Site ID / Road Name	AADT,24h			HGVs (%)	Average speed (kph)
	2016	2018 (2.6%)	2025 (12.6%)		
Count ID 14016 A40 West (eastbound)	18,657	19,147	21,015	5	95
Count ID 24016 A40 West (westbound)	21,790	22,362	24,544	5	95

3.2.9 The Project will result in a change to the alignment of the Over Roundabout to the north (A417) and west (A40). It is assumed that this widening will include a new lane of 3.65m in width (Ref 16). In order to represent this in the DMRB screening calculations the centreline of the nearest point of the A40 was moved 3.65m towards the sensitive receptors. This is considered to be a highly conservative approach given that only small sections of these roads linking into the roundabout will actually be widened.

3.2.10

3.2.11 Table 3.3 below shows the distance of the selected receptors to the centreline of the relevant affected roads in the Study Area. Appendix B presents the location of these selected receptors. These locations are considered to be representative worst case receptors and have been chosen to demonstrate any beneficial or adverse impacts of the Project on local air quality.

Table 3.3: Air quality representative receptors and distance to the considered links

ID	Address	Link ID	Distance(m) To A40 Without Project	Distance(m) To A40 With Project
SR1	The Wharf House	14016 24016	76.4 94.2	72.7 90.5
SR2	A40 Highnam (1)	14016 24016	68.5 49.4	64.8 45.7
SR3	A40 Highnam (2)	14016 24016	40.7 26.7	37.7 23.0

4 Assessment of Temporary Effects

4.1 Dust Generating Activities

4.1.1 Fill material will be imported onto the site for the embankment widening and re-profiling works. In addition excess material, generated from the widening of the carriageways will be exported from site using the surrounding road network. Whilst construction activities are taking place it is likely these materials will be stockpiled on site for short periods of time. These works can be seen in Appendix B Statutory Undertakers Composite Layout.

4.1.2 The dust and particulate matter generating activities for each Project stage with the potential to release dust and particulates, expected on and off-site are shown in Table 4:1.

Table 4:1 Dust generating activities for the project

Project Stage	Project Activity
General	Emission of particles from rigid wagon and non-road mobile machine exhausts
	Recirculation of dust from the wheels of rigid wagons on the site
	Recirculation of dust from the wheels of rigid wagon and non-road mobile machine on-site
	Wind erosion from material stockpiles
	Operation of plant and aggregate equipment
Demolition	None
Earthworks	Embankment widening
	Filling
	Stockpiling
Construction	None
Trackout	Heavy Duty Vehicles importing and exporting material from site

4.2 Sensitive Receptors

4.2.1 The Institute of Air Quality Management (IAQM) provides guidance on assessing the risk of dust impacts (IAQM Guidance) (Ref.17) which requires consideration of:

- the sensitivity of the area (determined from the sensitivity of receptors and the number of receptors); and
- the scale and nature of the works (waste processing stage), which determines the potential dust emission magnitude at that construction stage.

An assessment is only undertaken if there are sensitive receptors, which could be potentially affected by construction dust. Table 4:2 shows the screening criteria to determine if these sensitive receptors exist.

Table 4:2 Construction dust screening criteria

Receptor type	Screening criteria
A 'human receptor' within	350m of the boundary of the site
	50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)
An 'ecological receptor' within	50m of the boundary of the site; or
	50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)

4.2.2 Receptors with the potential to be impacted by nuisance dust and inhalable particulates from the Project were identified using an address list provided by the Ordnance Survey. Appendix B (Assessment of Temporary Air Quality Effects) shows the receptors identified as sensitive to dust impacts up to 350 m from the Project site boundary.

4.2.3 A review of the Multi-Agency Geographic Information for the Countryside maps managed by Natural England (Ref. 18) shows there is a Local Nature Reserve (Alney Island) within 50 m of the Project. Alney Island is located to the South of the site and is classed as an Urban Fringe Local Nature Reserve (LNR). It consists of mainly neutral wet grassland and flood meadows with associated broadleaf trees, which could be affected by dust generating activities. As Alney Island LNR is a local designation with dust sensitive features it has been classified as a low sensitive ecological receptor in accordance with the IAQM Guidance.

4.2.4 All receptors identified in the assessment are considered high sensitivity receptors (Appendix A) because they are either residential or commercial properties which are considered highly sensitive receptors where:

- users can reasonably expect enjoyment of a high level of amenity
- the appearance, aesthetics or value of their property would be diminished by soiling
- the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of the land.

4.3 Dust Sources

4.3.1 The dust sources relating to the specific activities required to complete the Project are shown in Table 4:3.

Table 4:3 Potential Dust Sources

Project Stage	Project Activity
General	Emission of particles from rigid wagon and non-road mobile machine exhausts
	Recirculation of dust from the wheels of rigid wagons on the site
	Recirculation of dust from the wheels of rigid wagon and non-road mobile machine on-site
	Wind erosion from material stockpiles
	Operation of plant and aggregate equipment
Demolition	None
Earthworks	Embankment widening
	Filling
	Stockpiling
Construction	None
Trackout	Heavy Duty Vehicles exporting material from site

4.3.2 The pathway-receptor route for all the dust releases is atmospheric dispersion either primary from the dust/particulate source such as wind erosion from stockpiles or after tracking onto the public highway on the wheels of vehicles.

4.4 Risk Assessment

4.4.1 At present there are no statutory United Kingdom or European Union standards relating to the assessment and control of dust nuisance. The emphasis of the regulation and control of dust is therefore on the adoption of good working practices on site.

4.4.2 A qualitative assessment has been undertaken to assess the risk of impacts at local off-site sensitive receptors from the Project.

4.4.3 The outcomes of the risk assessment are used to identify appropriate mitigation measures, which are commensurate to the risk.

4.4.4 In accordance with the IAQM Guidance, a dust assessment is only undertaken if there are sensitive receptors which could be potentially affected by construction dust. The counts of key sensitive receptor relative to their distance from the site centre, are shown in Table 4:4.

Table 4:4 Sensitive Receptors within the study area for temporary effects

Cumulative Distance Bands (m)	Number of Receptors			
	Residential	Community	Commercial	Ecological
0-20	0	0	0	1
0-50	0	0	0	1
0-100	0	0	1	1
0-200	11	0	1	1
0-350	36	0	1	1

4.4.5 In the IAQM Guidance, receptor counts are combined with their distance from the source to assess the sensitivity of the area to dust impacts. The definition of the sensitivity of the area to impacts from dust soiling and to human health and ecology is based on the definitions shown in Appendix A.

4.4.6 The resulting definitions of sensitivity for this site are shown in Table 4:5.

Table 4:5 Definition of the Sensitivity of the Site

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust soiling		Low		Low
Human health		Low		Low
Ecological		Low		Low

4.4.7 The sensitivity assessment is combined with the anticipated dust emissions magnitude to determine the overall risk of impacts occurring. The magnitude of the site is based on the definitions shown in Appendix A.

4.4.8 The resulting magnitudes are shown in Table 4:6.

Table 4:6 Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	
Earthworks	Large
Construction	
Trackout	Small

4.4.9 Table 4:7 shows the final assessment of the risk of impacts from dust soiling and to human health and ecology to the area surrounding the Project.

Table 4:7 Dust Risk to Define Site Specific Mitigation

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust soiling		Low		Negligible
Human health		Low		Negligible
Ecological		Low		Negligible

4.4.10 In accordance with the IAQM Guidance, the risk definitions inform the management and mitigation measures are required for the Project to minimise the risk of impacts at local sensitive receptors.

4.5 Management Measures

4.5.1 Table 4:7 shows the risk of dust impacts to sensitive receptors for the Project during Demolition, Earthwork, Construction and Trackout. Mitigation and management measures will be applied to the Project commensurate to these risks. The mitigation and management measures aim to minimise dust generation from site activities and where dust emissions are unavoidable prevent atmospheric dispersion of dust which is the main source-receptor pathway.

4.5.2 The proposed mitigation measures for the project are shown in Table 4:8 to **Error! Reference source not found.**.

Key to tables:

✓ **Highly Recommended**

✗ **Not required**

D **Desirable**

Table 4:8 Site specific mitigation measures on temporary (construction) dust emissions

Mitigation measure	Recommendation
Communications	
1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	✗
2. Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	✓
3. Display the head or regional office contact information	✓
4. Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in the IAQM Guidance. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM10 continuous monitoring and/or visual inspections.	**D**
Site Management	
5. Record all dust and air quality complaints, identify cause(s), take appropriate measures	✓

Mitigation measure	Recommendation
to reduce emissions in a timely manner, and record the measures taken.	
6. Make the complaints log available to the local authority when asked.	✓
7. Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	✓
8. Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.	✖
Monitoring	
9. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.	**D**
10. Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked	✓
11. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	✓
12. Agree dust deposition, dust flux, or real-time PM10 continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	✖
Preparing and maintaining the site	
13. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	✓
14. Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	✓
15. Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period	**D**
16. Avoid site runoff of water or mud.	✓
17. Keep site fencing, barriers and scaffolding clean using wet methods.	**D**
18. Remove materials that have a potential to produce dust from site as	**D**

Mitigation measure	Recommendation
soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	
19. Cover, seed or fence stockpiles to prevent wind whipping.	**D**
Operating vehicle/machinery and sustainable travel	
20. Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable	✓
21. Ensure all vehicles switch off engines when stationary – no idling vehicles.	✓
22. Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	✓
23. Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)	**D**
24. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	✗
25. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	✗
Operations	
26. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems	✓
27. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate	✓
28. Use enclosed chutes and conveyors and covered skips.	✓
29. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	✓
30. Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	**D**
Waste management	
31. Avoid bonfires and burning of waste materials.	✓

Measures Specific to Earthworks	**Low**

Mitigation measure	**Recommendation**
Mitigation Measure	**Recommendation**
36. Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable	✘
37. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as is practicable.	✘
38. Only remove the cover in small areas during work and not all at once.	✘

Measures Specific to Trackout	**Negligible**
Mitigation Measure	**Recommendation**
43. Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	**D**
44. Avoid dry sweeping of large areas.	**D**
45. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	**D**
46. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	✘
47. Record all inspections of haul routes and any subsequent action in a site log book.	**D**
48. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	✘
49. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	**D**
50. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	✘
51. Access gates to be located at least 10m from receptors where possible.	✘

4.6 Project Specific Best Practice

4.6.1 The following best practice measures which are specific to the Project will also be taken:

- Wheel washes will operate at the site exits to minimise trackout emissions.
- The use of stockpiles and their height will be minimised. Where possible, fill materials will be added straight to the embankment to minimise the need for

stockpiling. Grading, smoothing and compaction will be an on-going process during the Project.

5 Assessment of Permanent Effects

5.1 Local air quality

5.1.1 This section assesses the potential permanent effects on air quality that any traffic associated with the operation of the Project may have on local concentrations of NO_2 and PM_{10}.

Methodology

5.1.2 The assessment follows the guidance stated in the Design Manual for Roads and Bridges (DMRB) Volume 11 'Environment Assessment' Section 3 'Environmental Assessment Techniques' Part 1 'HA 207/07 Air quality' (DMRB 11.3.1) (Ref. 19) for the potential air quality effects from the project that occur during the operational use of the site. The magnitude of this impact and significance of this change has been assessed in accordance with the Interim Advice Note (IAN 174/13) Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA207/07) (Ref. 20).

5.1.3 The air quality assessment for a road scheme has two main elements. The first of these is the estimation of roadside air pollution concentrations, referred to as local impacts, associated with new or modified road schemes. The second is an estimation of total annual emissions arising from a road scheme, referred to as regional impacts.

5.1.4 This assessment is in accordance with the Simple assessment methodology detailed in DMRB HA 207/07 which states that an air quality assessment of local impacts should be undertaken if a proposed scheme results in any of the following criteria being met:

- road alignment will change by 5m or more; or
- daily traffic flows will change by 1000 AADT or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- daily average speed will change by 10km/hr or more; or
- peak hour speed will change by 20km/hr or more.

5.1.5 A regional assessment is required if affected roads are those that are expected to have:

- a change of more than 10% in AADT; or
- a change of more than 10% to the number of heavy duty vehicles; or
- a change in daily average speed of more than 20 km/hr.

5.1.6 No significant changes to traffic flows, composition or speed are anticipated as a result of the Project. Therefore, the traffic increases represented for the opening and assessment year scenarios is a result of natural growth on the network. Indeed the improvement measures have the potential to improve traffic flow which could have a beneficial impact on vehicle emissions. However, as some sections of the carriageway will be widened by one carriageway width (approximately 3.65m) which could potentially mean widening beyond the 5m threshold. As a result, it was decided to complete a simple DMRB assessment for the three closest sensitive receptors.

5.1.7 This assessment considers the air quality climate:

- Baseline condition;
- With the Project, referred to as the Do-Something scenario; and
- Without the Project, referred to as the Do-Minimum scenario.

5.1.8 In order to forecast the magnitude of possible impacts, scenarios were assessed for opening year 2018 and assessment year 2025. Assessment year 2025 was chosen because the DMRB screening tool and the growth factors applied to automatic traffic counts are only available to 2025. Therefore, 2025 allowed the temporal alignment of DMRB screening spreadsheet, the NO_x to NO_2 calculator and the growth factors used to predict future traffic flows. A baseline scenario was also assessed using the ATCs for 2016 and the existing road alignment.

5.1.9 DMRB also recommends a base case or verification year be assessed. However, this was not possible because local monitoring data is not available to make a comparison.

5.1.10 Table 5:1 shows the assessment scenario and assessment years on air quality for the Project.

Table 5:1 Assessment scenarios and assessment years for the operation of the project

Assessment scenarios	Assessment year
Baseline	2016
Do-Minimum	2018
Do-Something	2018
Do-Minimum	2025
Do-Something	2025

5.1.11 For road traffic sources, the pollutants of particular concern are oxides of nitrogen (NO_x and NO_2) and particulate matter (PM_{10}), which are the most likely pollutants to exceed or approach Air Quality Strategy objectives (i.e. UK AQS objectives) and the EU limit values. Nitrogen dioxide (NO_2) and particulate matter (PM_{10}) are of concern in relation to human health, whereas oxides of nitrogen (NO_x) are of concern in relation to vegetation and ecosystems. There are no designated ecological receptors in relevant proximity to the Project and as such NO_x and nitrogen deposition rates have not been assessed.

5.1.12 Table 5:2 lists the key traffic related air quality thresholds, which are the same for the UK AQS objectives and the EU limit values.

Table 5:2 Objectives for key traffic related pollutants

Pollutant	Air Quality threshold	Measured as
Nitrogen Dioxide (NO_2)	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean
	40 $\mu g/m^3$	Annual mean
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	Daily mean
	40 $\mu g/m^3$	Annual mean

5.1.13 Modelled air pollutants have some element of residual uncertainty, referred to as Measure of Uncertainty (MoU). This is due to inherent uncertainty in air quality monitoring, modelling and the traffic data used in the assessment

5.1.14 This report uses the approach to describe the MoU stated in DMRB, which at the same time is based around Defra's published advice in TG(16) (Ref. 21) on the desirability of achieving 10% verifications (between modelled and monitored concentrations) where concentrations are close to or above the air quality threshold.

5.1.15

5.1.16 Table 5:3 shows the magnitude of change criteria in relation to the MoU stated in DMRB. A change of less than 1% of the objective is considered imperceptible. As the objective for both NO_2 and PM_{10} is 40 µg/m^3, a change has to be more than 0.4 µg/m^3 to be perceptible.

Table 5:3 Magnitude of impact criteria

Magnitude of impact of the change in concentration	Value of change in annual average NO_2 and PM_{10}
Large (>4)	Greater than full MoU value of 10% of the air quality objective (4 $\mu g/m^3$)
Medium (>2 to 4)	Greater than half of the MoU (2 $\mu g/m^3$), but less than the full MoU (4 $\mu g/m^3$) of 10% of the air quality objective
Small (>0.4 to 2)	More than 1% of objective (0.4 $\mu g/m^3$) and less than half of the MoU i.e. 5% (2 $\mu g/m^3$). The full MoU is 10% of the air quality objective (4 $\mu g/m^3$)
Imperceptible (≤0.4)	Less than or equal to 1% of objective (0.4 $\mu g/m^3$)

5.1.17 Under The Highways Agency IAN 174/13, where the outcome of the assessment indicates that either all modelled concentrations are above the air quality thresholds (Table 5:2) or any changes above the air quality thresholds where the change is perceptible (

5.1.18 Table 5:3), then the scheme effect is likely to be significant for local air quality.

5.1.19 If any of the air quality objectives are likely to be exceeded in either the Do-Minimum scenario or the Do-Something scenario in any of the years in which they apply, the guidelines in

5.1.20 Table 5:3 above are used in order to classify the magnitude of the impact.

5.1.21

5.1.22 Table 5:4 is used to determine the significance of effect depending on the number of receptors exceeding the air quality thresholds and the magnitude of impact.

Table 5:4 Guideline to number of properties constituting a significant effect

	Number of receptors with:	
Magnitude of impact in Annual Average NO_2 or PM_{10} ($\mu g/m^3$)	**Worsening of air quality objective already above objective or creation of a new exceedance**	**Improvement of an air quality objective already above objective or the removal of an existing exceedance**
Large (>4)	1 to 10	1 to 10
Medium (>2 to 4)	10 to 30	10 to 30
Small (>0.4 to 2)	30 to 60	30 to 60

5.1.23 The calculations have been undertaken with the 'DMRB Screening method v1.03c' of July 2007. The method to convert roadside NO_x to NO_2 within the DMRB model was based on measurements made between 1999 and 2001. Evidence from 2009 shows that the proportion of primary NO_2 in vehicle exhaust has increased (supposedly due to a higher proportion of diesel vehicles) (Ref. 22). This means that the relationship between NO_x and NO_2 at the roadside has changed from that currently used in the DMRB model.

5.1.24 In order to take into account the changes in NO_2/NO_x ratios when using the DMRB Screening Model the guidance on Defra's website was followed to model NO_2 for 2016, 2018 and 2025 using a NO_x to NO_2 conversion spreadsheet.

5.1.25 Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. However, in the absence of local monitoring data against which to correct the road contribution to total NO_x, a verification was not possible.

Study area

5.1.26 In line with DMRB HA207/07, the study area for permanent air quality effects is defined by a buffer 200m either side of the centre line of the affected roads. Appendix B shows the Study Area and sensitive receptors in 50m bands up to 200m.

5.1.27 There are a total of 11 residential and 1 commercial receptor within 200m of affected road as shown in Drawing 2 in Appendix B and Table 5:5. All residential receptors are assigned a high sensitivity to changes in air quality.

Table 5:5 Sensitive receptors within the study area for Operational effects

Distance bands (m)	Number of receptors			
	Residential	**Community**	**Commercial**	**Ecological**
0-50	0	0	0	0
50-100	0	1	1	0
100-150	4	0	0	0
150-200	7	0	0	0
Total	**11**	**0**	**1**	**0**

5.1.28 Representative receptor locations have been selected at the affected roads of the Project. These are tabulated in

5.1.29 Table 3.3. Each receptor is considered representative of other properties located on that particular section of road.

Impact Assessment

5.1.30 A simple assessment of air quality within 200m of the affected roads around the Project has been undertaken, in order to assess the impact of the new scheme on the immediate surroundings and within the wider network considered to be "affected".

5.1.31 For each appropriate section, speeds, ADDTs of LDVs and HDVs and distance of the receptor from the centreline are detailed and the pollutant emissions are calculated.

5.1.32 It is not anticipated that additional vehicle movements are expected on the highway as a direct result of the Project, as such the key parameter that has changed is the distance between the existing and proposed centreline to relevant receptors. As detailed in the methodology; in order to present a worst case assessment it has assumed that the entire carriageway and the associated AADT will be moved by 3.65m.

5.1.33 A comparison of the predicted NO_2 concentrations at selected receptors for the "Do-Minimum" (DM) and "Do-Something" (DS) scenarios for the years 2018 and 2025 is presented in

5.1.35 Table 5:6 and Table 5:7 below. The change in pollutant concentrations is assessed against the DMRB magnitude of impact criteria detailed in

5.1.36 Table 5:3.

Table 5:6 Predicted concentrations of NO_2 for opening year 2018

ID	AQMA Y/N	2016	DM 2018	DS 2018	Change	Impact I/S/M/L
		µg/m³	µg/m³	µg/m³	µg/m³	
SR1	N	16.7	15.4	15.6	+0.2	Imperceptible
SR2	N	18.9	17.6	18.0	+0.4	Imperceptible
SR3	N	22.6	21.3	22.0	+0.7	Imperceptible

Table 5:7 Predicted concentration of NO_2 for assessment year 2025

ID	AQMA Y/N	2016	DM 2025	DS 2025	Change	Impact I/S/M/L
		µg/m³	µg/m³	µg/m³	µg/m³	
SR1	N	16.7	12.8	13.0	+0.2	Imperceptible
SR2	N	18.9	15.0	15.4	+0.4	Imperceptible
SR3	N	22.6	18.8	19.5	+0.8	Imperceptible

5.1.37 A comparison of the predicted PM_{10} concentrations at selected receptors for the DM and DS scenarios for the years 2018 and 2025 is presented in Table 5:8 and

5.1.38 Table 5:9 below. The change in pollutant concentrations is assessed against the DMRB impact criteria outlined in

5.1.39 Table 5:3 and

5.1.40 Table 5:4.

Table 5:8 Predicted concentration of PM_{10} for base and opening year 2018

ID	AQMA Y/N	2016	DM 2018	DS 2018	Change	Impact I/S/M/L
		µg/m³	µg/m³	µg/m³	µg/m³	
SR1	N	15.7	15.4	15.5	+0.1	Imperceptible
SR2	N	16.2	15.9	16.0	+0.1	Imperceptible
SR3	N	17.1	16.8	16.9	+0.2	Imperceptible

Table 5:9 Predicted concentration of PM_{10} assessment year 2025

ID	AQMA Y/N	2016	DM 2025	DS 2025	Change	Impact I/S/M/L
		µg/m³	µg/m³	µg/m³	µg/m³	
SR1	N	15.7	15.1	15.1	+0.05	Imperceptible
SR2	N	16.2	15.6	15.7	+0.1	Imperceptible
SR3	N	17.1	16.5	16.7	+0.2	Imperceptible

5.1.41 A comparison is made between predicted concentrations with and without the Project in place and how these relate to the AQOs (Table 5:2). None of the sensitive receptors are predicted to exceed the Air Quality Objective for NO_2 or PM_{10} in the baseline year (2016) opening year (2018) and assessment year (2025) both with and without the Project.

5.1.42 The highest concentrations are predicted at SR3 which is closest to the A40 and the lowest at SR1 which is the furthest away.

5.1.43 At the three sensitive receptors the change is imperceptible for NO_2 and PM_{10} and in 2018 and 2025.

5.1.44 When the results are considered alongside Highways England IAN 174/13, it can be reasonably concluded that the significance of the permanent impacts of the Project can be scoped out. This is because the predicted concentrations with and without the Project both in the first year of operation and the future year of operation are well below the respective air quality objectives for both NO_2 and PM_{10}.

5.1.45 The assessment results do not indicate whether any changes in traffic flows resulting from the Project will impact on air quality in the Priory Road AQMA because the air quality assessment was not based on a detailed regional traffic model.

Proposed mitigation

5.1.46 Due to imperceptible impacts on concentrations of both NO_2 and PM_{10} within the Project area no mitigation for the permanent effects of the Project on local air quality are deemed necessary.

Residual effects

5.1.47 The permanent effect of the Project on local air quality within the study area is classified as insignificant.

5.2 Regional air quality

5.2.1 GHG emissions from the Project have been assessed using a qualitative desk based approach. The assessment outlines the estimated changes and associated benefits to GHG emissions relating to the Project.

5.2.2 To determine if GHG emissions from surface transport will alter as a result of the changes in traffic, the DMRB HA/207 was used. DMRB HA/207 provides criteria which can be used to determine whether there are any 'affected' roads. Roads in a scheme proposal are deemed affected and worthy of further assessment of potential regional impacts if the following criteria are met:

- A change of more than 10% in AADT.
- A change of more than 10% to the number of heavy duty vehicles.
- A change in daily average speed of more than 20 km/hr.

5.2.3 It was decided not to undertake detailed assessment of GHG emissions because none of the criteria are forecast to be met. GHG emissions were therefore scoped out and a regional assessment of air quality impacts considered unnecessary.

5.2.4 The key drivers of carbon dioxide (CO_2) emissions are:

- Type of vehicle
- Vehicle occupancy
- Journey speed
- Total distance travelled.

5.2.5 As the primary aim of the A40 Over Improvements aim to reduce congestion by improving the capacity and flow of road traffic using the roundabout the Project will contribute to minimising CO_2 emissions.

5.2.6 The vehicle kilometres travelled are not expected to change significantly as a result of the Project and optimum traffic flow and speeds are more likely to be achieved as a result of the improvement works. This is consistent with the vision and aims of the LTP3 for an environmentally and financially sustainable transport network.

Importantly the proposed Project will help deliver key measures within the Gloucester AQAP and will help reduce journey times in and out of Gloucester town centre.

6 Summary

6.1 Summary of significant effects

Temporary (during construction)

6.1.1 The potential adverse effects of PM_{10} on human health are expected to be negligible. The potential adverse effects of dust soiling on people and on ecological receptors are low and through mitigation become negligible.

Permanent (during operation)

6.1.2 The predicted levels for NO_2 at the three assessment locations do not exceed the annual mean Air Quality Objective (AQO) both with and without the Project. In addition, the impact of the proposed Project on these levels has been assessed as being imperceptible for NO_2 and PM_{10}, and as such the permanent effects of the Project are considered insignificant.

6.1.3 As noted in the methodology section the simple level DMRB assessment undertaken has made a number of conservative assumptions and it is reasonable to suggest that the modifications will result in lower concentrations than those predicted above because of improvements to traffic flows. Importantly the proposed Project will help deliver the key measures within the Gloucester AQAP and will help reduce journey times in and out of Gloucester town centre.

6.1.4 As the primary aim of the A40 Over Improvements aim to reduce congestion by improving the capacity and flow of road traffic using the roundabout the Project will contribute to minimising CO_2 emissions.

6.1.5 The vehicle kilometres travelled are not expected to change significantly as a result of the Project and optimum traffic flow and speeds are more likely to be achieved as a result of the improvement works. This is consistent with the vision and aims of the LTP3 for an environmentally and financially sustainable transport network.

6.2 Summary of mitigation measures

Temporary (during construction)

6.2.1 It is recommended that the site specific mitigation measures identified in be included in a DMP.

Permanent (during operation)

6.2.2 Mitigation is not necessary for the operational phase of the Project in terms of ambient air quality and GHG emissions.

7 References

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Ref 20. THE HIGHWAYS AGENCY. *Draft IAN 174/13. Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality.'* 2013.

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Ref 22. DEPARTMENT FOR ENVIRONMENT FOOD AND RURAL. *Trends in Primary Nitrogen Dioxide in the UK*. 2007.

Appendix A - Dust Risk Assessment Supplementary Tables

The dust emission magnitude is based on the scale of the anticipated works and is classified as Small, Medium or Large.

Assessment of Dust emission magnitude (after Table 1 IAQM (2016))

The total footprint of the site is approximately 36,161m^2 and based on the estimated volume of imported embankment fill (35,000m^3), it is assumed that there will be 2 heavy duty (>3.5t) vehicle movements to and from the site per day for the 6 month construction period.

This information has been used to classify the magnitude of activities is below.

Activity	IAQM example definition	Magnitude
Demolition	• n/a	n/a
Earthworks	• Total site area >10,000m^3 • Potentially dusty soil type e.g. clay which will be prone to suspension when dry due to particle size • >10 heavy earth moving vehicles active at any one time • Formation of bunds > 8 m in height • Total material moved > 100,000 tonnes	Large
Construction	n/a	n/a
Trackout	• <10 HDV (>3.5t) outward movements in any one day • Surface material with low potential for dust release • Unpaved road length <50 m	Small

Sensitivities of People to Dust and Soiling Effects (after Box 6 IAQM (2016)

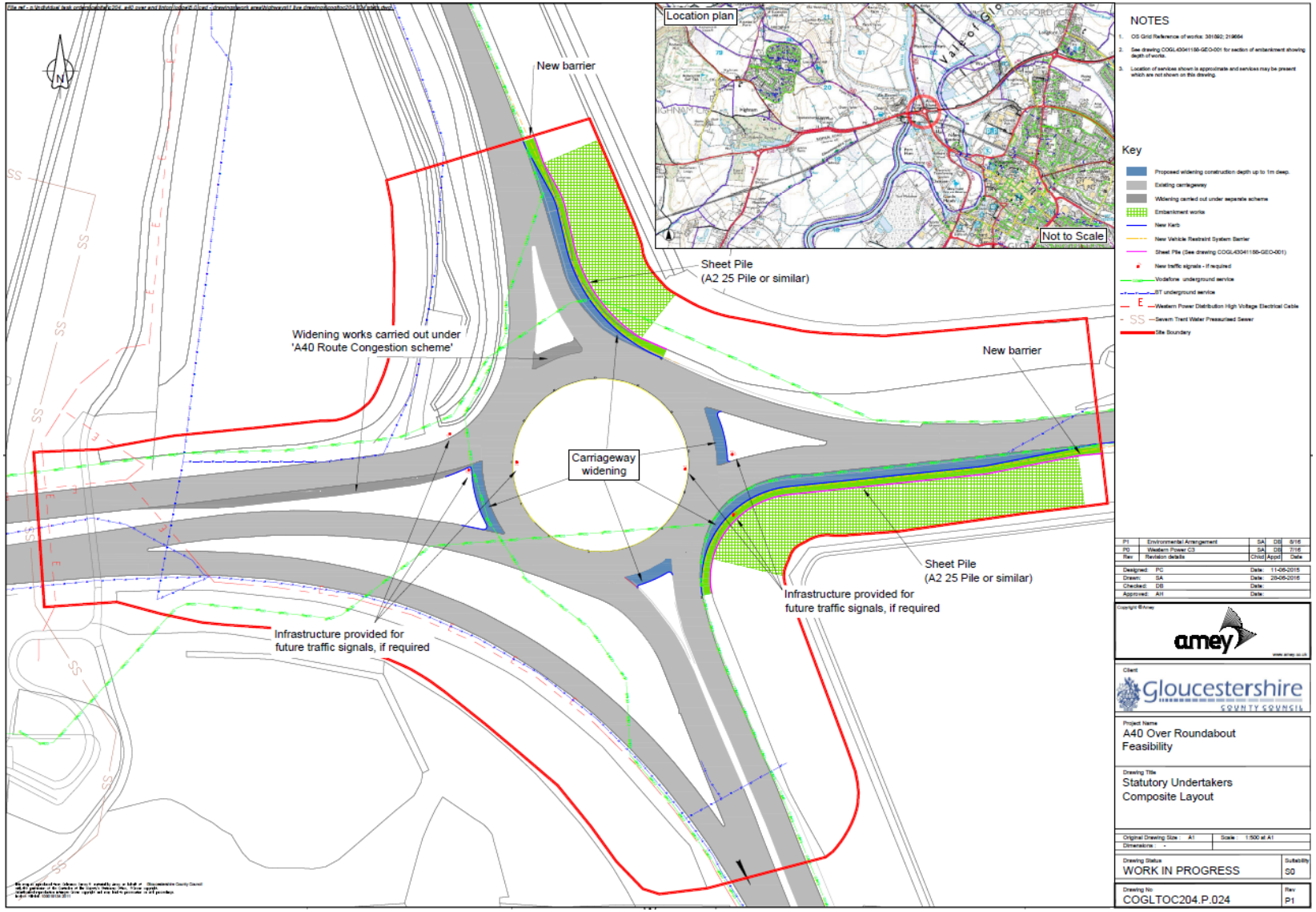
High sensitivity receptor – surrounding land where:

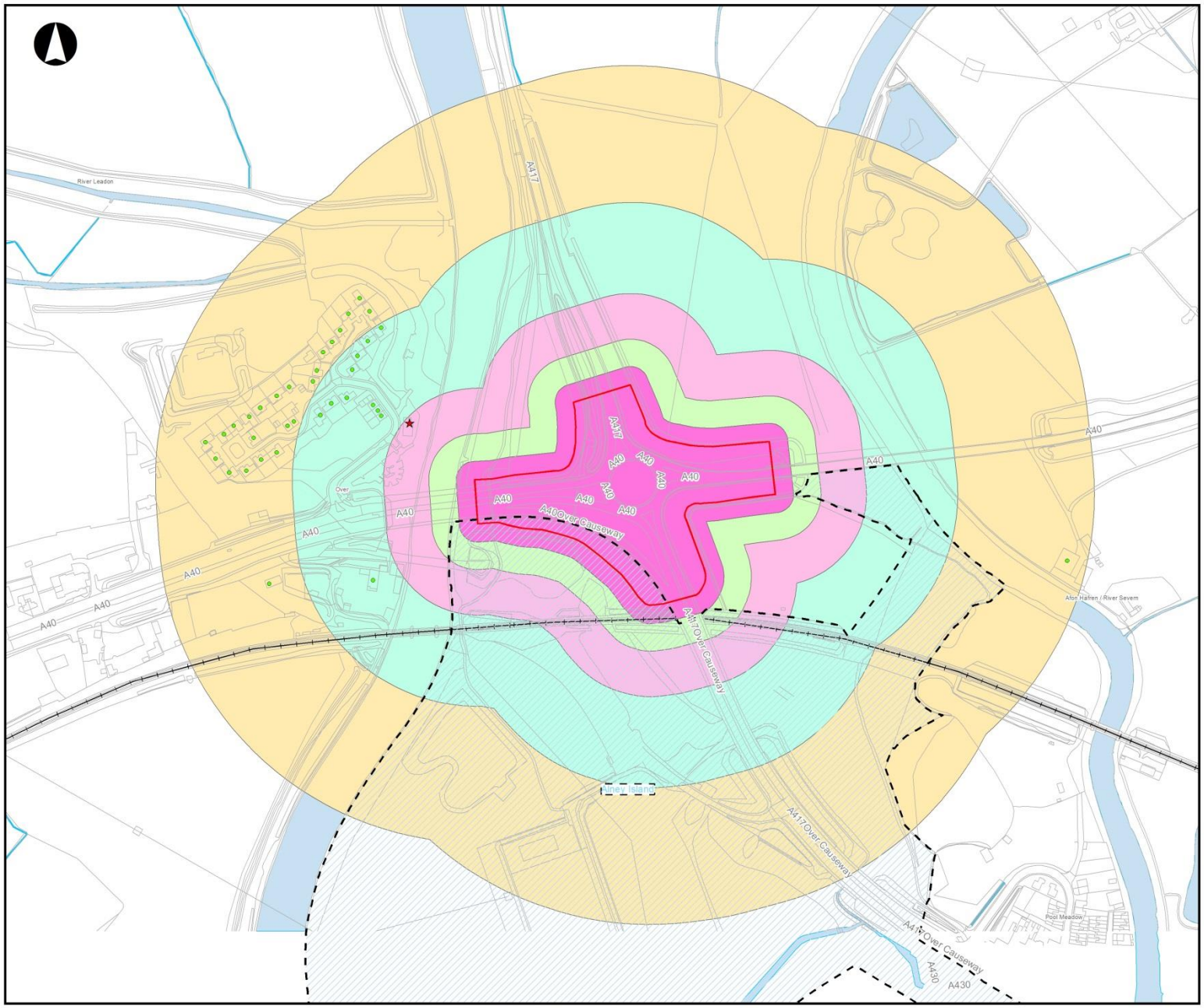
- **Users can reasonably expect enjoyment of a high level of amenity**
- **The appearance, aesthetics or value of their property would be diminished by soiling**
- **The people or property would reasonably be expected to be present continuously or at least regularly for extended periods, as part of the normal; pattern of use of the land**
- **Indicative examples include dwellings, museums and other culturally important collections, medium and long term carp parks and showrooms**

Sensitivity of the Area to Dust Soiling Effects on People and Property (after Table 2 IAQM (2016)

Receptor Sensitivity	Number of receptors	Distance from the source (m)			
		< 20	< 50	<100	< 350
High	**>100**	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	**>1**	Medium	Low	Low	Low
Low	**>1**	Low	Low	Low	Low

Appendix B – Drawings





Legend

- Commercial property
- Residential receptor
- Railway track
- Running water
- Site boundary
- Surface water
- Local nature reserve
- 0-20m Buffer
- 0-50m Buffer
- 0-100m Buffer
- 0-200m buffer
- 0-350m Buffer

0-20m Buffer
Residential = 0
Community = 0
Commercial =0

0-50m Buffer
Residential = 0
Community = 0
Commercial =0

0-100m Buffer
Residential = 0
Community = 0
Commercial =1

0-200m Buffer
Residential = 11
Community = 0
Commercial =1

0-350m Buffer
Residential = 36
Community = 0
Commercial =1

Metres
0 45 90 180

Scale : **1:3,800**
Grid Ref: 381872,219668
Lat/Long: 51.8752828230899,-2.26472913050647
Tile Ref: SO818196

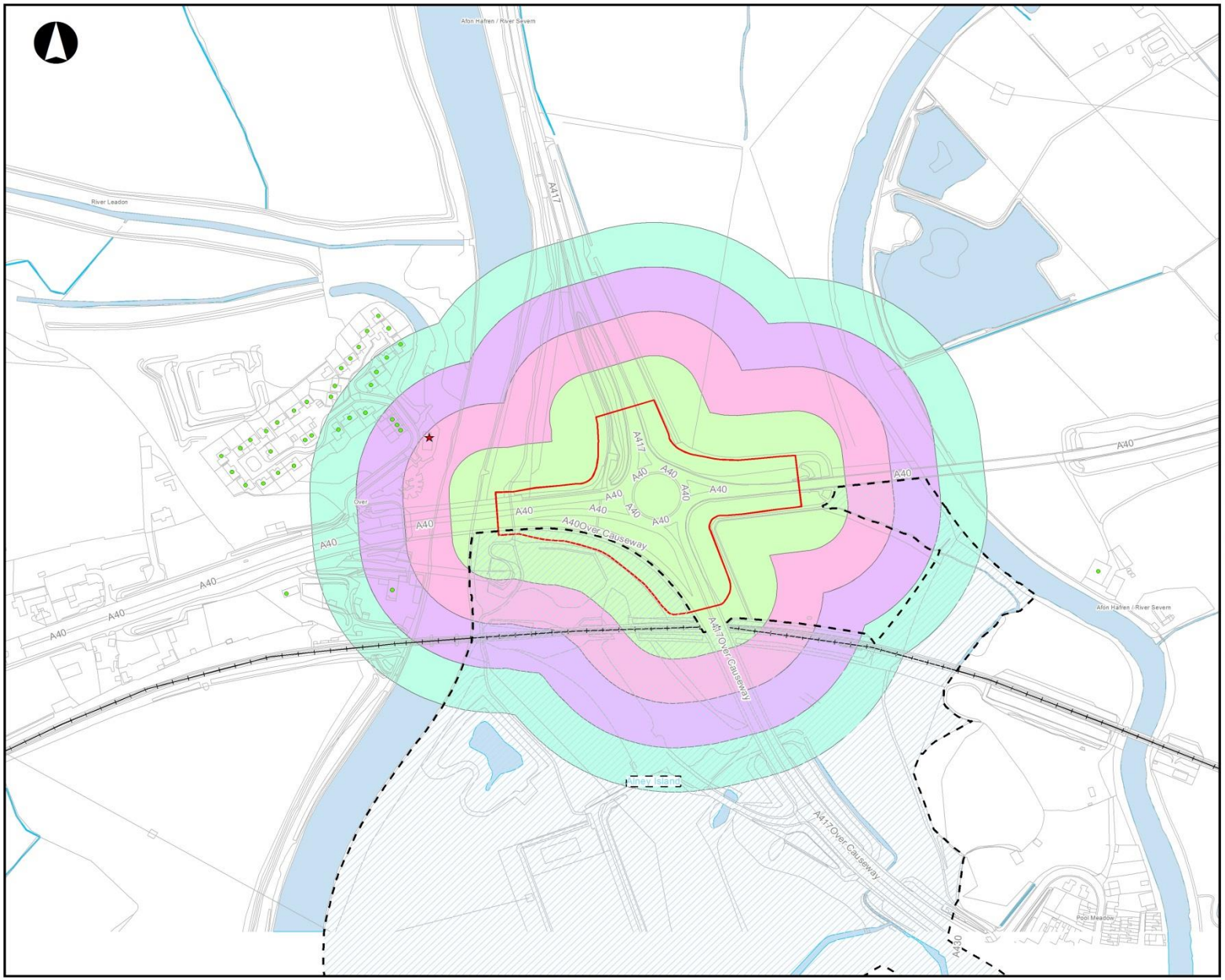
Rev	Size	Date	Drawn	Design	Chkd	Appd
R01	A3	21-09-16	JC	JC	NR	SB

Client :
Gloucester Councty Council
Shire Hall
Westgate Street
Gloucester
GL1 2TG

Project name:
A40 Over Roundabout Improvement

Drawing Title
Assessment of Temporary Air Quality Effects

Amey
International design hub
Colmore plaza, 5th floor
20 Colmore Circus Queensway
Birmingham
B4 6AT



Legend

- Commercial property
- Residential receptor
- Railway track
- Running water
- Site boundary
- Local nature reserve
- Surface water
- 0-50m Buffer
- 50-100m Buffer
- 100-150m Buffer
- 150-200m buffer

0-50m Buffer
Residential = 0
Community = 0
Commercial =0

150-200m buffer
Residential = 7
Community = 0
Commercial = 0

50-100m Buffer
Residential = 0
Community = 0
Commercial =1

100-150m Buffer
Residential = 4
Community = 0
Commercial =0

Metres
0 45 90 180

Scale : **1:3,800**
Grid Ref: 381872,219668
Lat/Long: 51.8752828230899,-2.2647291050647
Tile Ref: SO818196

Rev	Size	Date	Drawn	Design	Chkd	Appd
R01	A3	21-09-16	JC	JC	NR	SB

Client :
Gloucester Councty Council
Shire Hall
Westgate Street
Gloucester
GL1 2TG

Project name:
A40 Over Roundabout Improvement

Drawing Title
Assessment of Permanent Air Quality Effects

Amey
International design hub
Colmore plaza, 5th floor
20 Colmore Circus Queensway
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B4 6AT