2013 Air Quality Progress Report for Suffolk Coastal District Council

In fulfillment of Part IV of the
Environment Act 1995
Local Air Quality Management

December 2013

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Report Reference number	
Date	31 December 2013

Executive Summary

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedances are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

Previous rounds of review and assessment for the district have culminated in the declaration of two AQMAs. The first was declared in 2006 and encompasses several properties on the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge (Woodbridge Junction). The second was declared in 2009 for The Dooley Inn, Ferry Lane, Felixstowe. This is a single property close to the Port of Felixstowe.

This report consists of an air quality update Progress Report which covers the whole district, together with the Action Plan Progress Reports for the AQMAs declared at the two AQMAs.

This Progress Report has identified the need to proceed to a Detailed Assessment for 4 properties located at Long Row, Stratford St Andrew. The Detailed Assessment has been completed and confirms that declaration of an AQMA is necessary at this location. The findings have been sent to Defra for their approval. Once approved, the AQMA will be declared.

Assessment of **biomass combustion** installations within the district has confirmed that a Detailed Assessment is required for Geaters straw burner, West End Nurseries, Lesiton. The Detailed Assessment has been completed and has concluded that the air quality objectives are not likely to be exceeded at nearby receptor locations and **no further action is required**.

The **Action Plan for the Woodbridge Junction AQMA** consists of measures that could be undertaken at the junction to hopefully ease the congestion / reduce the overall traffic flows and therefore in turn reduce the elevated levels of nitrogen dioxide being experienced. Updates on each of the original 20 measures are included in this report. One of the measures has now been removed from the Action Plan as studies have shown it to not be viable, 4 of the measures have now been completed, and one new measure has been added.

The new computerised system for the traffic lights (MOVA) has reduced the extreme queue lengths at each arm of the junction but not the average number of vehicles queuing at the junction. Monitoring results for 2012 show an increase in NO_2 levels over those witnessed in 2011 at most of the sites on the junction, returning to

concentrations seen in 2010 and previous. The highest concentration in 2012 was 44µg/m^3. The MOVA system would therefore appear not to have been successful in reducing NO_2 concentrations at the junction. A number of traffic surveys have been undertaken at the junction during 2013 to allow us to investigate whether different proposals for traffic alterations at the junction would have any impact on NO_2 concentrations within the AQMA. We are currently awaiting the results of a Drive Cycle Analysis and computer modelling for the junction. The results will be sent to Suffolk County Council for assessment one received.

The **Action Plan for the Felixstowe AQMA** consists of 13 measures of which 7 have now been completed, 6 of the measures are the responsibility of Suffolk Coastal District Council (3 of these have been completed) and 7 are the responsibility of the Port of Felixstowe (4 of these have been completed). All other measures which are the responsibility of the Port of Felixstowe have been started and are on-going.

The results of diffusion tube monitoring for 2012 show that **annual mean NO_2 concentrations within the Felixstowe AQMA have fallen below the air quality Objective.** Several more years of monitoring data will be needed to confirm whether this is a true trend.

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Non - Technical Summary

All Councils must assess air quality within their district on a regular basis to see whether levels set by the Government are being exceeded anywhere. If they are, there is then a set procedure to follow which ends in the declaration of an Air Quality Management Area and the production of a long term Action Plan to try and reduce these levels. An air quality report must be produced every year and this is our Progress Report due for 2013. Once every three years the report required is more in-depth and is known as an Updating and Screening Assessment, the last one produced was in 2012.

Historic assessment of air quality in the district has led to 2 areas being identified which are above the levels set by the Government for the pollutant nitrogen dioxide (NO_2). These are; several houses on the road junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge (Woodbridge Junction); and the Dooley Inn, Ferry Lane, Felixstowe (a single property close to the Port of Felixstowe). Both areas have been officially declared as Air Quality Management Areas, Woodbridge in 2006 and Felixstowe in 2009. We have produced Action Plans for both AQMAs and, included in sections 9 and 10 of this report, are the official annual 'Action Plan Progress Reports' required.

The information which needs to be provided in this report is set by Government guidance and consists of;

- monitoring results collected in 2012;
- information on any new sources of pollutants including road traffic, other transport sources (rail, air, shipping), industry, use of solid fuel in biomass boilers and domestic houses and sources where emissions cannot be controlled such as quarries, landfill sites etc.
- On-going planning applications with air quality implications
- Planning Policies
- Transport Plans
- Climate Change Strategies

Monitoring results

In 2012 NO_2 was the only pollutant measured in the district. This was undertaken using 2 different techniques; automatic analyser (1 site at the Woodbridge junction) which measures an average level every 15 minutes, and diffusion tube (43 sites) which measures an average level over a month.

In 2012, levels were measured in 8 areas within the district – Felixstowe, Kesgrave, Melton, Woodbridge, Martlesham, Little Glemham, Farnham and Stratford St. Andrew. The specific locations have been chosen following assessments of air quality (past and present) which have shown they could be at risk of exceeding the Government's set level for nitrogen dioxide.

The results of monitoring show a number of locations where NO_2 is above the set level of 40 $\mu g/m^3$ as an annual mean. With the exception of one site, these locations

are all situated within the declared Air Quality Management Areas in Woodbridge and Felixstowe. Work is on-going at these sites to try and reduce the levels through the Action Plan produced for each area.

The other site is situated at **Stratford St. Andrew** on a row of 4 houses whose doors open onto the pavement of the A12. Monitoring was undertaken in 2012 using a set of 3 diffusion tubes at this location for increased accuracy. The results have shown that the level (at 42µg/m^3) is above the objective set by the Government and a more Detailed Assessment of the site is required. A Detailed Assessment has been undertaken by consultants TRL on behalf of the Council. **The results confirm that the nitrogen dioxide levels are above the set annual mean Objective, and concludes that an Air Quality Management Area (AQMA) should be declared.** Suffolk Coastal's Cabinet has met and approved that we need to declare an AQMA for the 4 houses at Long Row, Main Road, Stratford St Andrew. The findings have been sent to Defra for their approval, once this is obtained we will undertake the legal process to declare the AQMA.

Road traffic and other transport sources

There are no new sources of road traffic or other transport sources (air, rail, shipping) in the district since the 2012 air quality report.

Industry

There are 2 new or newly authorised industrial premises on the district since our last assessment. Emissions from these sites have been investigated and are not large enough to cause exceedance of any of the set levels and no further investigations are needed.

There are 2 sites within the district, which could emit levels of NO_2 and PM_{10} that would cause the Objectives to be breached. Emissions from these sites for 2012 have been studied and there are no exceedances of the Objectives.

Commercial and Domestic sources

There were 2 outstanding sites with biomass boilers burning solid fuel on the district which had not been assessed due to lack of information. These are located in Heveningham and Leiston. They have now been assessed, this included a more Detailed Assessment for the one situated in Leiston, and are not likely to exceed the Objectives so no further action is required.

There are no areas within the district with sufficient use of solid fuel in houses to cause any levels to be exceeded.

Uncontrolled emissions

There are no new industrial sites in the district with uncontrolled emissions (such as quarries, landfill sites) since our last assessment

Action Plan Progress Report for the Woodbridge Junction

The **Action Plan for the Woodbridge Junction AQMA** consists of 20 measures that could be undertaken at the junction to hopefully ease the congestion / reduce the overall traffic flows and therefore in turn reduce the elevated levels of nitrogen dioxide being experienced. The measures can be split into 2 types; 'on the ground works' (mainly to be undertaken by Suffolk County Council (SCC) with Suffolk Coastal District Council input) and more 'softer measures' to be undertaken mainly by Suffolk Coastal District Council (SCDC).

Updates on each of the measures are included in this report. One of the measures (install a right hand turning lane at the traffic lights on Melton Hill) has now been removed from the Action Plan, as studies have shown it to not be viable, four of the measures have now been completed and one new measure has been added for investigation (remove the ability of traffic to go straight on from Melton Hill).

The 'on the ground works' started with the installation of a new computerised system (MOVA) to the traffic lights whose aim is to reduce congestion and therefore queue lengths. This has reduced the extreme queue lengths at each arm of the junction but not the average number of vehicles queuing at the junction. Monitoring results for 2012 show an increase in NO_2 levels over those witnessed in 2011 at most of the sites on the junction, returning to levels seen in 2010 and before. The MOVA system would therefore appear not to have been successful in reducing NO_2 levels.

A number of traffic surveys have been undertaken at the junction and in Woodbridge during 2013 to allow us to look at a number of proposals for traffic alterations at the junction and see whether they would have any impact on NO_2 concentrations. Four different scenarios are to be computer modelled; removing the option to turn right from the direction of Melton Hill; removing the option to continue straight on from the direction of Melton Hill; moving the car parking currently opposite the Council Offices; and removing the parking currently opposite the Council Offices. We are currently awaiting the results of these investigations. Once received they will be sent to Suffolk County Council for their comments.

The 'softer measures' include contacting bus companies that use the junction to see whether they can use a cleaner fleet in Woodbridge, travel plans for schools and businesses and investigating improving cycling/walking links in the town. There has not been much additional progress on these softer measures since the 2012 report.

Updates for each measure can be seen in the table in section 9 of this report.

Action Plan for the Dooley Inn, Ferry Lane, Felixstowe

This Air Quality Management Area (AQMA) was declared in 2009. The Action Plan consists of 13 measures to try and reduce nitrogen dioxide levels in the area, of which seven have now been completed. Six measures are the responsibility of Suffolk Coastal District Council (three of these have been completed) and seven are the responsibility of the Port of Felixstowe (four of these have been completed). All other measures which are the responsibility of the Port of Felixstowe have been started and are on-going.

Updates for each measure can be seen in the table in section 10 of this report.

The monitoring results for 2012 show that **nitrogen dioxide levels within the Felixstowe AQMA have fallen below the air quality Objective** (highest recorded at 36µg/m^3). Several more years of monitoring data will be needed to confirm whether this is a true trend and whether we can in fact revoke the AQMA in the future.

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1 Introduction

1.1 Description of Local Authority Area

Suffolk Coastal is a diverse district incorporating thirty miles of coast, expansive areas of countryside, much of which still forms a working landscape, five market towns including Woodbridge, the resort and port of Felixstowe as well as many villages. The district supports over 4,000 businesses, including large employers like the Port of Felixstowe, BT and Sizewell Power Station, as well as a high proportion of small and medium sized businesses that are vital to the local economy. Tourism is also a major driver for the local economy. Much of the district is within the Haven Gateway that is identified for significant growth.

The main source of emissions, within the majority of the district, is road traffic. Within the town of Felixstowe, emissions from and associated with the Port of Felixstowe are a large source of pollutants. While the quality of our air is generally very good and well within the limits set by Government for the protection of human health, there are now three areas within the district where levels of pollution give rise for concern. As such, two Air Quality Management Areas (AQMAs) have been declared in the District, one in Woodbridge (road traffic related) and the other in Felixstowe (associated with emissions from and associated with the Port of Felixstowe). The third are of concern is a small stretch of the A12 at Stratford St Andrew. Air quality investigations are currently underway.

1.2 Purpose of Progress Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in England** are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre µg/m^3 (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in England

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m^3	Running annual mean	31.12.2003
	5.00 µg/m^3	Annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m^3	Annual mean	31.12.2004
	0.25 µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

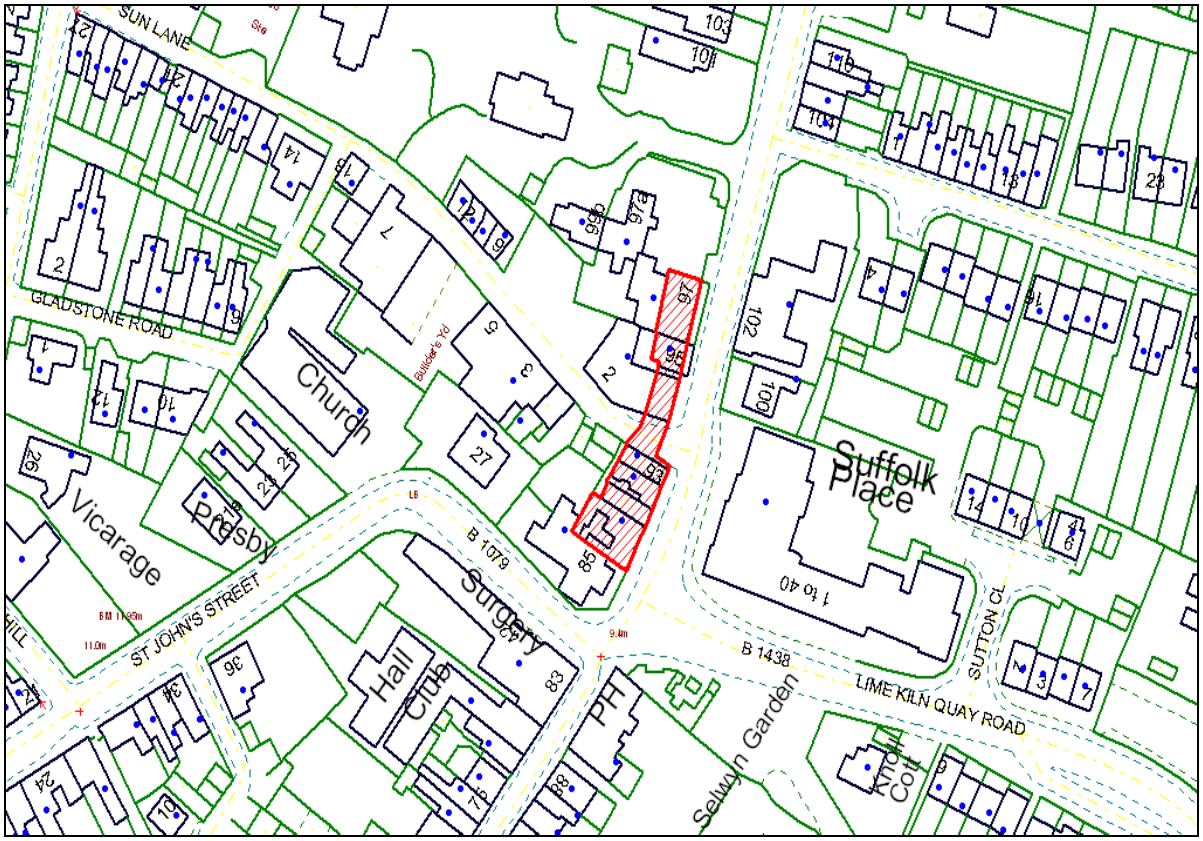
1.4 Summary of Previous Review and Assessments

Suffolk Coastal has completed four rounds of review and assessment and this report is the second to be produced in the fifth round. The findings of the review and assessment reports completed to date are summarised in Tables 1.4a – 1.4d and key findings are outlined below:

The first round of review and assessment was completed in 2001. No AQMAs were declared as part of the first round.

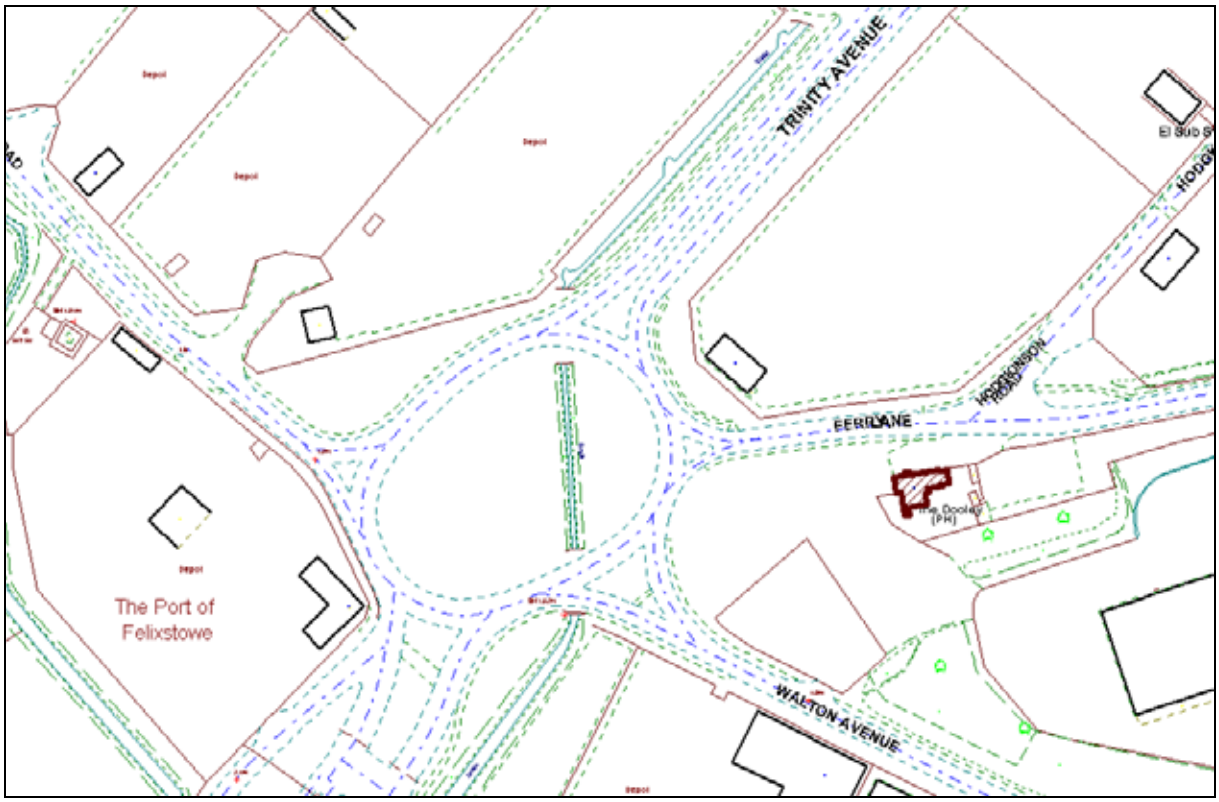
The second round of review and assessment was completed in 2005. This round concluded that there was a potential risk of the air quality objectives for nitrogen dioxide (NO_2), particulate matter with an aerodynamic diameter of less than 10 microns (PM_{10}) and sulphur dioxide (SO_2) being exceeded within the Suffolk Coastal district. Following completion of a Detailed Assessment; no AQMA was required on the A1214 at the junction of Bell Lane in Kesgrave; an **AQMA was declared for exceedence of the annual mean NO_2 objective concentration at Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge in March 2006.** The AQMA boundary is shown in Figure 1.4a below. A copy of the AQMA Order can be seen in Appendix A.

Figure 1.1a Map showing the boundary of the AQMA declared at the junction of Lime Kiln Quay Road, Thoroughfare and St. John's Street in Woodbridge.



The third round of review and assessment consisted of an Updating and Screening Assessment, a Detailed Assessment, a Progress Report and a Further Assessment Report for the AQMA declared at the Woodbridge Junction. The 2006 Updating and Screening Assessment identified a potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 resulting from emissions from activities on and associated with the Port of Felixstowe. The Further Assessment for the Woodbridge Junction AQMA confirmed the boundary extent was correct, advised that a NOx reduction of 16.4% was necessary to eliminate exceedance and that the key was to reduce queuing and heavy duty vehicles. Following completion of a Detailed Assessment for Adastral Close and Ferry Lane in Felixstowe an **AQMA was declared in 2009 for exceedence of the annual mean NO_2 objective concentration in the vicinity of the Dooley Inn Public House on Ferry Lane, Felixstowe**. The AQMA boundary is shown in Figure 1.4b below. A copy of the AQMA Order can be seen in Appendix B.

Figure 1.1b Map showing the boundary of the AQMA declared at The Dooley Inn, Ferry Lane, Felixstowe.



The fourth round of review and assessment consisted of an Updating and Screening Assessment, Progress Reports, and a Further Assessment and Draft Air Quality Action Plan for the Ferry Lane, Felixstowe AQMA. The Further Assessment report confirmed the findings of the 2008 Detailed Assessment; with exceedence of

the NO_2 annual average objective predicted at the Dooley Inn PH, and that the existing AQMA boundary is appropriate. Source apportionment found that the main NOx contribution is from container handling and vehicle activities in the Port, together with emissions from Heavy Duty Vehicles on roads outside the Port boundary. The final Action Plan was completed and can be viewed at:

http://www.suffolkcoastal.gov.uk/assets/Documents/District/Air-quality/FelixstoweFerryLaneAQAPSeptember2012.pdf

No new areas of concern were identified in the Progress Reports.

The fifth round of review and assessment was started in 2012 with the Updating and Screening Assessment. This did not identify the need to proceed to a Detailed Assessment for any pollutant. It advised that;

- Results of NO_2 monitoring at Stratford St. Andrew show one site with levels above the Air Quality Objective of 40µg/m^3. A further year of monitoring will be undertaken to determine whether it is necessary to proceed to a Detailed Assessment.
- Work is continuing in order to identify the required information in order to undertake a screening assessment of 2 biomass combustion installations within the district.

The Air Quality Action Plan Progress Report was included for the AQMA declared at the Woodbridge Junction which provided updates on work to date on the Action Plan implementation.
The Final Action Plan for the AQMA at Ferry Lane in Felixstowe was included which recommends 13 measures for implementation.

Table 1.4a Main findings from the first round of air quality review and assessment

Report and reference	Main outcomes
Report on the First Stage review and assessment of air quality in Suffolk Coastal (SCDC, 1999)	Negligible risk of exceedence of the air quality objectives for benzene and 1,3-butadiene, no further action needs to be taken. The risk of exceedence of the air quality objectives for lead, carbon monoxide (CO), NO_2, PM_{10} and SO_2 is such that a second stage review and assessment will need to be undertaken to determine the risk more precisely.
Report on the Second Stage review and assessment of air quality in the Suffolk Coastal District (SCDC, 2000)	Negligible risk of exceedence of the air quality objectives for lead and CO and further review and assessment is not necessary at this time. Significant risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at relevant locations and further review and assessment is necessary.
Report on the Third Stage review and assessment of air quality in the Suffolk Coastal District (SCDC, 2001)	Negligible risk of exceedence of the air quality objectives and further assessment not necessary at this time for: NO_2 from traffic using the A14 trunk road and traffic using High Road West, Felixstowe. PM_{10} from: traffic using the A1152 (specifically the crossroads of the A1152 and B1438 at Melton); traffic using High Road West, Felixstowe; traffic using the Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge; and the combined emission 'footprint' of White Mountain Roadstone Limited, A12 traffic, Foxhall Four Quarry and Foxhall Landfill Site. Insufficient information to date and therefore further review and assessment required for: SO_2 and PM_{10} emissions from shipping at the Port of Felixstowe. PM_{10} emissions from the combined emission 'footprint' of Roadworks (1952) Limited and Sinks Pit Quarry. Risk of NO_2 air quality objectives being exceeded and further review and assessment required for: Emissions from traffic using the A1152 (specifically the crossroads of the A1152 and B1438 at Melton) Emissions from traffic using Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge.
Air quality review and assessment Stage 3 (AEA Technology, 2001)	Unlikely risk of exceedence of the air quality objectives for NO_2 at the Melton and Woodbridge road junctions and an AQMA is not required.

Table 1.4b Main findings from the second round of air quality review and assessment

Report and reference	Main outcomes
Report on the Updating and Screening Assessment of air quality in the Suffolk Coastal District (SCDC, 2003)	Unlikely risk of exceedence of the air quality objectives for CO, benzene and 1,3-butadiene. No further assessment necessary. Potential risk of exceedence of the air quality objectives for lead, NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary.
Report on the Detailed Assessment and Continued Updating and Screening Assessment of air quality in the Suffolk Coastal District (SCDC, 2004)	Unlikely risk of exceedence of the air quality objectives for lead and no further assessment is necessary. Unlikely risk of exceedance of the air quality objectives for NO_2 on the A1214 at the Bell Lane junction in Kesgrave confirmed by Detailed Assessment – no AQMA required. Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary for: Emissions of NO_2 from traffic using the junction of Lime Kiln Quay Road/The Thoroughfare St John's Street junction, Woodbridge. Emissions of NO_2, PM_{10} and SO_2 from activities on and associated with the Port of Felixstowe, incorporating assessment of emissions generated by the Bathside Bay and FSR planning applications if they are granted permission.
Progress Report: Air Quality in the Suffolk Coastal District (SCDC, 2005)	Outlines the findings of detailed modelling undertaken as part of the FSR planning application: No risk of exceedence of the air quality objective for PM_{10} at receptors from emissions resulting from activities on and associated with the Port of Felixstowe. No further review and assessment necessary. Exceedence of the air quality objective for annual average NO_2 in 2005 at receptor locations situated in The Downs (close to the Port of Felixstowe Road) and Spriteshall Lane (close to Dock Spur roundabout). *NO_2 diffusion tube monitoring undertaken in 2004 does not correspond with the above modelling results. Seven new diffusion tube sites established at the start of 2005 to obtain further information for receptor locations close to the Port of Felixstowe and along the A14.* Exceedence of the air quality objective for annual average NO_2 predicted for the end of 2005 at the Dooley Inn, Ferry Lane. Two new NO_2 diffusion tube sites established on the building. At the end of 2005, SCDC to determine if declaration of an AQMA is necessary for receptor locations near to the Port of Felixstowe and/or along the A14 based on 12 months of monitoring information from the new NO_2 diffusion tube sites in Felixstowe and the Trimleys. The findings to be reported in the next updating and screening assessment.
Detailed Assessment of the Woodbridge Junction (AEA Technology, 2005)	**Declaration of an AQMA for the annual average objective for NO_2 is required for Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge.**

Declaration of AQMA at the Woodbridge Junction (SCDC, 2006)	**AQMA declared for Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge in March 2006.** Copy of AQMA boundary included in Map 1.4a and AQMA Order attached in Appendix A.

Table 1.4c Main findings from the third round of air quality review and assessment

Report and reference	Main outcomes
Report on the Updating and Screening Assessment of air quality in the Suffolk Coastal District (SCDC, 2006)	Unlikely risk of exceedence of the air quality objectives for CO, benzene, 1,3-butadiene and lead, no further assessment necessary. Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations resulting from emissions from activities on and associated with the Port of Felixstowe. A Detailed Assessment is required to investigate these emissions.
Further Assessment Report for Woodbridge Junction AQMA (AEA Technology, 2007)	Confirmed AQMA boundary is correct. Reduction of NOx by 16.4% necessary to eliminate exceedances. Source apportionment concludes that queuing and Heavy Duty Vehicle reductions will be key to improve air quality.
Air quality review and assessment: Detailed Assessment for Adastral Close and Ferry Lane, Felixstowe (SCDC, 2008a)	AQMA declaration for SO_2 not required. AQMA declaration for PM_{10} not required. Exceedence of the annual average objective for NO_2 at the Dooley Inn, Ferry Lane, Felixstowe (modelling indicated that this the only relevant receptor location at which the objective was not met). Risk of exceedence of the annual average objective for NO_2 at fifteen properties at the west end of Adastral Close in 2010 and beyond following the FSR. Source apportionment studies indicated that container handling operations by rubber tyred gantry (RTG) crane and internal movement vehicles (IMVs) will potentially make the greatest contribution to oxides of nitrogen (NO_X) concentrations in 2010 both at Adastral Close and the Dooley Inn, Ferry Lane. Declaration of an AQMA for the annual average objective for NO_2 is required for the Dooley Inn, Ferry Lane, Felixstowe.
Progress Report: air quality in the Suffolk Coastal District (SCDC, 2008b)	Work on production of the draft Action Plan for the Lime Kiln Quay Road/Thoroughfare/St John's Street junction, Woodbridge is continuing. Public consultation will be undertaken following Defra's approval of the completed draft. Public Consultation on the findings of the 2008 Detailed Assessment (SCDC, 2008a) for Ferry Lane, Felixstowe is to be undertaken following approval of the report by Defra. No new areas of concern identified.
Declaration of AQMA at Ferry Lane, Felixstowe (SCDC, 2009)	**AQMA declared for the Dooley Inn PH, Ferry Lane, Felixstowe in March 2009.** Copy of AQMA boundary included in Map 1.4b and AQMA Order attached in Appendix B.

Table 1.4d Main findings from the fourth round of air quality review and assessment

Report and reference	Main outcomes
Report on the Updating and Screening Assessment of air quality in the Suffolk Coastal District (SCDC, 2009)	No new areas of concern identified within the district, no Detailed Assessment required. Work continuing to obtain information on biomass combustion plant within the district. Work ongoing on Woodbridge AQMA Action Plan and Further Assessment for AQMA declared at Ferry Lane, Felixstowe.
Draft Air Quality Action Plan for Woodbridge Junction (AEA Technology, 2009)	Draft Action Plan produced for full Public Consultation. Action Plan considered 79 options to improve air quality and recommends 20 of these for implementation.
Progress Report: air quality in the Suffolk Coastal District (SCDC, 2010)	No new areas of concern identified within the district, no Detailed Assessment required. Work continuing to obtain information on biomass combustion plant within the district. Work ongoing on Woodbridge AQMA Final Action Plan and Further Assessment for AQMA declared at Ferry Lane, Felixstowe.
Further Assessment Report for Ferry Lane, Felixstowe AQMA (TRL, 2010)	Confirmed the findings of the 2008 Detailed Assessment, with exceedence of the NO_2 annual average objective predicted at the Dooley Inn public house. No further concern regarding Adastral Close properties – monitoring is ongoing there. A modelling assessment concluded that the existing AQMA boundary is appropriate. Source apportionment found main contribution from container handling and vehicle activities in the Port together with emissions from Heavy Duty Vehicles on roads outside the Port boundary.
Final Air Quality Action Plan for Woodbridge Junction (AEA Technology, 2011)	Includes results of Public Consultation which initiated changes to 5 of the 20 measures. Implementation Plan included for all 20 measures adopted.
Progress Report: air quality in the Suffolk Coastal District (SCDC, 2011)	No new areas of concern identified within the district, no Detailed Assessment required. Assessment still required for 4 pieces of biomass combustion plant within the district. Air Quality Action Plan Progress Report included for the AQMA declared at the Woodbridge Junction.
Draft Air Quality Action Plan for Ferry Lane, Felixstowe (TRL, 2011)	Draft Action Plan produced for full Public Consultation. Action Plan considered 26 options to improve air quality and recommends 13 of these for implementation.
Final Air Quality Action Plan for Ferry Lane, Felixstowe (TRL, 2012)	Includes results of Public Consultation which has not initiated any changes to the 13 measures for implementation.

Report on the Updating and Screening Assessment of air quality in the Suffolk Coastal District (SCDC, 2012)	No new areas of concern identified within the district, no Detailed Assessment required. NO_2 concentrations on the A12 at Stratford St. Andrew are above the objective level, a further year of data to be collected to determine whether Detailed Assessment is required. Work continuing to obtain information on 2 biomass combustion installations within the district. Work ongoing on Woodbridge AQMA Action Plan. Final Action Plan for AQMA declared at Ferry Lane, Felixstowe now completed and approved by Defra.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

In 2012 an automatic analyser measuring oxides of nitrogen continued monitoring at the junction of Lime Kiln Quay Road, Thoroughfare, St. John's Street and Melton Hill in Woodbridge (Woodbridge Junction) within the declared Air Quality Management Area.

Further detail regarding the site is provided in Table 2.1 overleaf. The location of the analyser is shown in Figure 2.1 below. Details of Quality Assurance/ Quality Control carried out for the analyser is provided in Appendix C.

Figure 2.1 Location of the Automatic NOx analyser, AQMA, and NO_2 diffusion tubes sited at the Woodbridge Junction

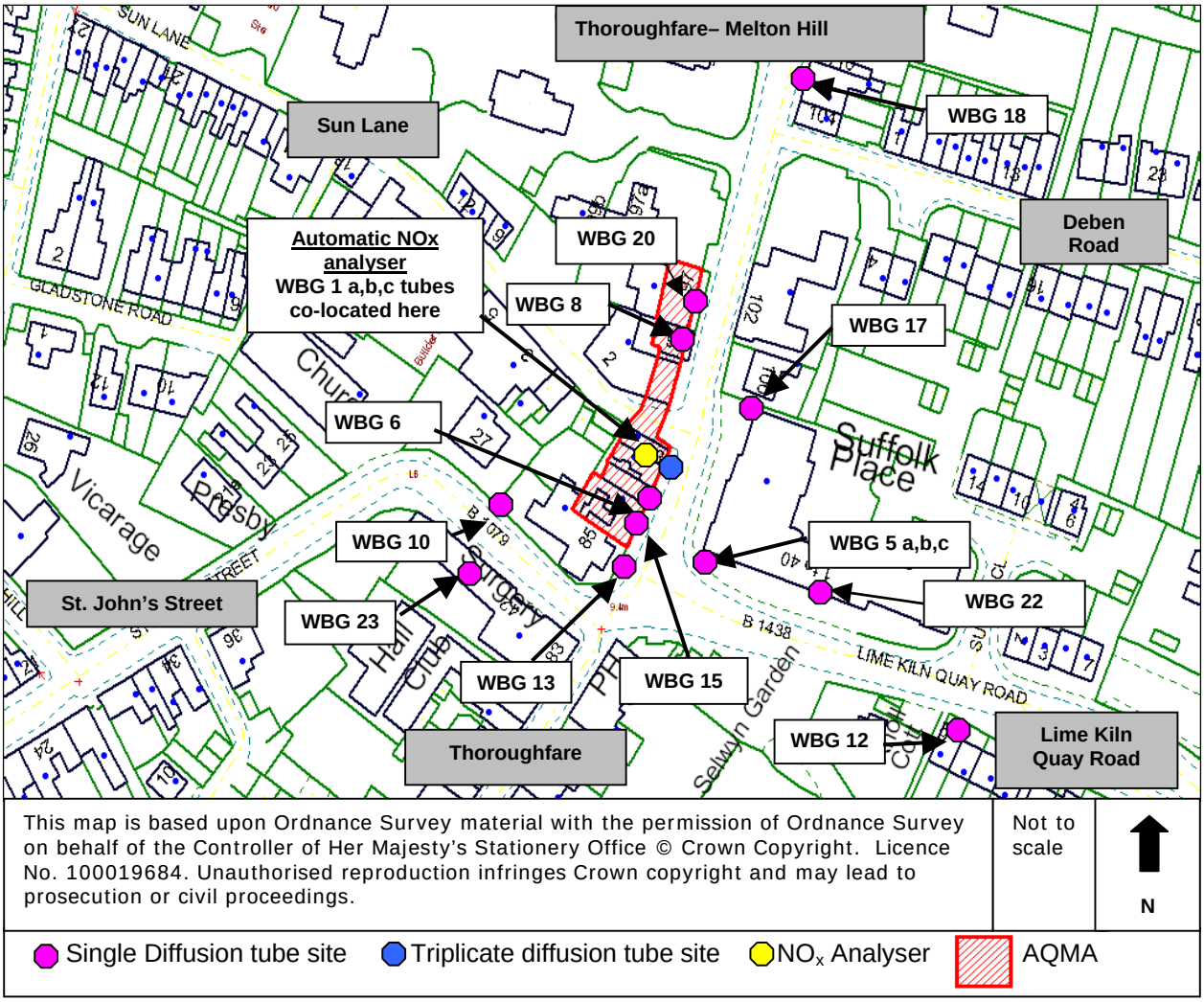


Table 2.1 Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m)	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
WBG 1	Woodbridge Junction	Kerbside	X 62759	Y 24926	2.6	Nitrogen dioxide (NO_2)	Yes	ozone chemi.-luminescence	Yes (0.1m)	1m	Yes

2.1.2 Non-Automatic Monitoring Sites

During 2012 there were 3 new monitoring sites added within the district, bringing the total number of sites to 42. One of the 2012 sites was also triplicated. All sites measure concentrations of NO_2 using passive diffusion tubes which are exposed on a monthly basis. Further details regarding each monitoring site are provided in Table 2.2 below and their locations can be seen on the map in Figure 2.2.

The 3 new monitoring sites were located as follows;

- **Stratford St. Andrew 2** – Road Sign opposite 1-5 Long Row, Main Road, Stratford (on the Northern side of the road)
- **Stratford St. Andrew 3 & 5** – Stratford St Andrew 3 was located at a roadside site on the 'Slippery Road' Sign near the garage, Main Road, Stratford (on the Northern side of the road). This site was found to be inappropriate due to vegetation growing nearby and so was moved in April 2012 to become Stratford St Andrew 5 located again on the Northern side of the road on the 'Great Glemham' Sign, Main Road, Stratford (opposite 1-5 Long Row). As only 3 months worth of data were gathered for STA 3 we have not presented any data.
- **Stratford St. Andrew 4** – Roadside site, Lowestoft Street Sign on bend, Main Road, Stratford (on the Southern side of the road)

The monitoring site which was triplicated as of 2012 was;

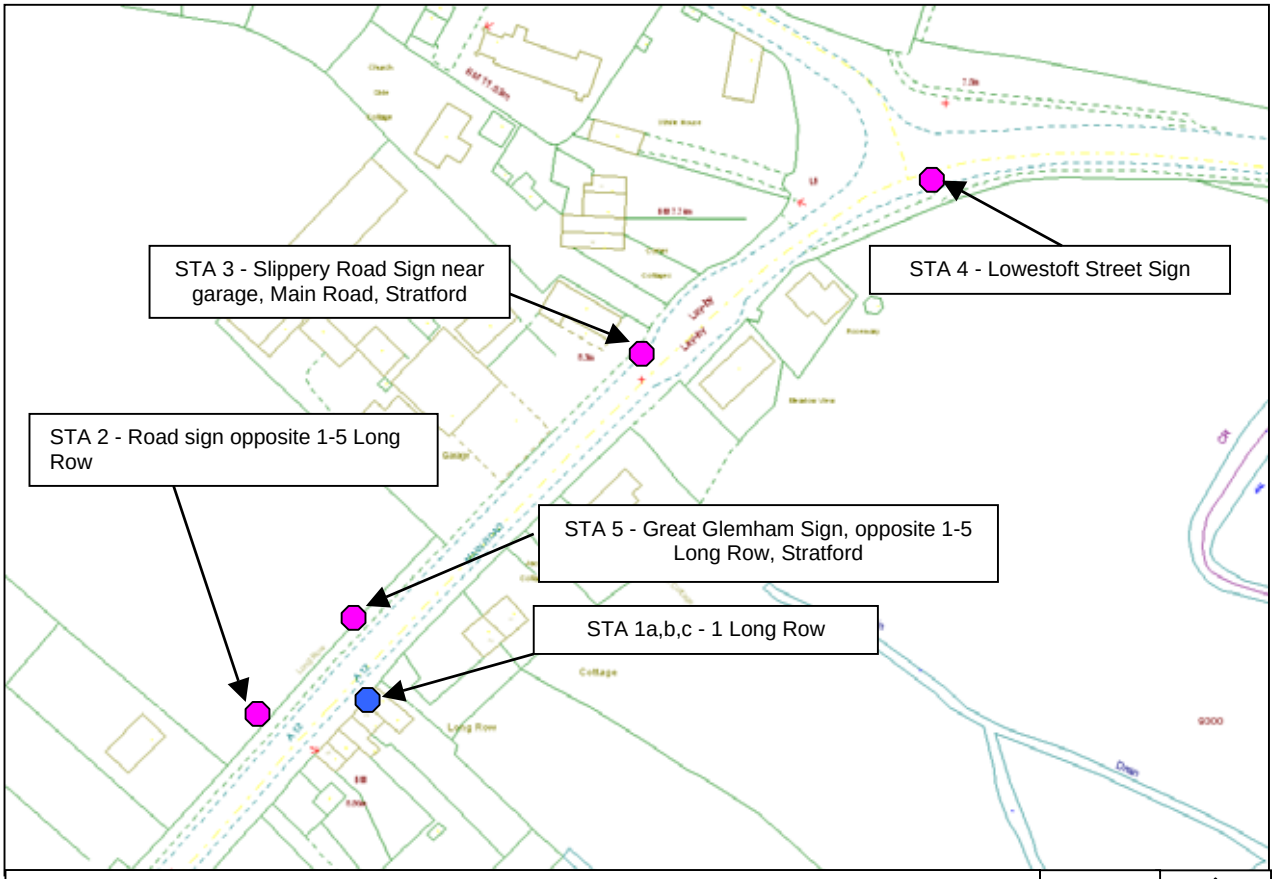
- **Stratford St. Andrew 1** – Roadside site, 1 Long Row, main Road, Stratford St. Andrew (on the Southern side of the road)

The new monitoring sites at **Stratford St. Andrew** were all located to provide additional information along this stretch of the A12 trunk road following elevated NO_2 concentrations recorded at Stratford St Andrew 1 (STA 1) in 2011. They were not necessarily located at receptor locations as we wanted to obtain information on NO_2 levels spatially in the area. STA 1 was triplicated during 2012, due to the elevated NO_2 concentrations recorded in 2011, in order to increase the accuracy of results recorded. The monitoring site was originally put in place in order to inform the planning application process for the Sizewell C power station.

Diffusion tubes can over or under read and the annual average obtained needs to be corrected to take account of laboratory bias thus improving accuracy. This can be done either by using a combined 'national' bias adjustment factor for the laboratory, or calculated from a co-location study with a continuous analyser carried out locally by the authority. For this reason diffusion tubes are co-located in triplicate alongside the automatic monitoring site in Woodbridge so that a local bias adjustment factor can be obtained for this location.

Information regarding the analytical laboratory, Quality Assurance/ Quality Control and bias adjustment factors are provided in Appendix C. Maps showing all diffusion tube sites are provided in Appendix D.

Figure 2.2 Map showing 2012 diffusion tube monitoring sites in Stratford St. Andrew



Not to scale

N

Single Diffusion tube site Triplicate Diffusion tube site

Table 2.2 Details of Non- Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
FLX 12 a,b,c	Felixstowe 12	Roadside	63036	23489	2.30	NO_2	No	N	Y	5m	Yes
FLX 14	Felixstowe 14	Industrial Site	62860	23284	2.00	NO_2	No	N	Y	n/a	No
FLX 17	Felixstowe 17	Roadside	62881	23632	2.00	NO_2	No	N	Y	31m	Yes
FLX 20	Felixstowe 20	Industrial / Roadside	62867	23398	2.00	NO_2	No	N	Y	54m	Yes
FLX 21	Felixstowe 21	Urban Background	62925	23443	2.30	NO_2	No	N	N 9m	n/a	n/a
FLX 22	Felixstowe 22	Industrial	62917	23344	1.80	NO_2	No	N	Y	n/a	Yes
FLX 23	Felixstowe 23	Roadside	62854	23659	2.00	NO_2	No	N	Y	25m	Yes
FLX 24	Felixstowe 24	Roadside	62834	23462	2.50	NO_2	No	N	Y	32m	Yes
FLX 26 a,b,c	Felixstowe 26	Industrial / Roadside	62796	23423	3.40	NO_2	Yes	N	Y	75m from roundabout	Yes
FLX 27 a,b,c	Felixstowe 27	Industrial / Roadside	62795	23424	2.80	NO_2	Yes	N	Y	75m from roundabout	No
FLX 29	Felixstowe 29	Industrial	62871	23289	2.00	NO_2	No	N	Y	n/a	No
FLX 31 a,b,c	Felixstowe 31	Industrial	62863	23279	2.00	NO_2	No	N	Y	n/a	Yes
FLX 32 a,b,c	Felixstowe 32	Industrial	62883	23287	2.00	NO_2	Yes	N	Y	75m from roundabout	No
FLX 33	Felixstowe 33	Roadside	62869	23283	1.74	NO_2	No	N	N 70m	5m from roundabout	n/a
FLX 34	Felixstowe 34	Industrial / Roadside	62791	23425	1.93	NO_2	No	N	N 50m	25m from roundabout	n/a
FLX 35	Felixstowe 35	Industrial / Roadside	62796	23425	1.82	NO_2	Yes	N	N 2m	77m from roundabout	No
FLX 36	Felixstowe 36	Industrial / Roadside	62798	23427	1.90	NO_2	No	N	N 28m	110m from roundabout	n/a

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
FLX 37	Felixstowe 37	Industrial / Roadside	62802	23427	1.66	NO_2	No	N	N 58m	133m from roundabout	n/a
FLX 38	Felixstowe 38	Industrial / Roadside	62815	23428	1.65	NO_2	No	N	N 145m	220m from roundabout	n/a
MEL 5	Melton 5	Roadside	628614	25041	1.90	NO_2	No	N	Y	3.6m	Yes
KSG 9	Kesgrave 9	Roadside	621680	24579	1.90	NO_2	No	N	N 0.1m	2.6m	Yes
WBG 1 a,b,c	Woodbridge 1	Kerbside	62759	24926	2.34	NO_2	Yes	Y	Y	1.26m	Yes
WBG 3	Woodbridge 3	Urban Background	62699	24848	1.90	NO_2	No	N	N 9m	1.5m	n/a
WBG 5	Woodbridge 5	Roadside	62760	24924	2.31	NO_2	No	N	Y	2.5m	Yes
WBG 6	Woodbridge 6	Roadside	62759	24925	2.21	NO_2	Yes	N	Y	2m	Yes
WBG 8	Woodbridge 8	Roadside	62759	24928	2.36	NO_2	Yes	N	Y	3m	Yes
WBG 10	Woodbridge 10	Roadside	62756	24924	2.12	NO_2	No	N	N 1m	2m	Yes
WBG 12	Woodbridge 12	Roadside	62766	24920	1.81	NO_2	No	N	Y	5m	Yes
WBG 13	Woodbridge 13	Roadside	62758	24924	1.88	NO_2	No	N	N 5m	2.5m	Yes
WBG 15	Woodbridge 15	Roadside	62758	24924	2.51	NO_2	Yes	N	Y	2m	Yes
WBG 17	Woodbridge 17	Roadside	62761	24926	1.85	NO_2	No	N	Y	7m	Yes
WBG 18	Woodbridge 18	Roadside	62762	24933	2.16	NO_2	Yes	N	Y	1.5m	Yes

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
WBG 22	Woodbridge 22	Roadside	62763	24923	2.16	NO_2	No	N	Y	8	Yes
WBG 23	Woodbridge 23	Kerbside	62755	24923	2.13	NO_2	No	N	N 1m	1	Yes
MRT 1 a,b,c	Martlesham 1	Roadside	62463	24544	1.65	NO_2	No	N	Y	21	Yes
LGM 1 a,b,c	Little Glemham 1	Roadside	63420	22588	1.45	NO_2	No	N	Y	19	Yes
FAR 1 a,b,c	Farnham 1	Roadside	63627	26013	1.76	NO_2	No	N	Y	3	Yes
FAR 2 a,b,c	Farnham 2	Roadside	63627	26011	1.92	NO_2	No	N	Y	2	Yes
STA 1 a,b,c	Stratford St. Andrew 1	Roadside	63574	25999	1.62	NO_2	No	N	Y	2	Yes
STA 2	Stratford St. Andrew 2	Roadside	63574	26001	1.78	NO_2	No	N	N 23m	1.72	Yes
STA 3	Stratford St. Andrew 3	Roadside	63581	26008	1.6	NO_2	No	N	N 18m	2.2	Yes
STA 4	Stratford St. Andrew 4	Roadside	63587	26011	1.78	NO_2	No	N	N 35m	3.8	Yes
STA 5	Stratford St. Andrew 5	Roadside	63572	25999	1.2	NO_2	No	N	N 38m	2.0	Yes

2.2 Comparison of Monitoring Results with Air Quality Objectives

Within the Suffolk Coastal district in 2012 monitoring was undertaken for nitrogen dioxide using both an automatic analyser and diffusion tubes. No other pollutants were monitored.

2.2.1 Nitrogen Dioxide (NO_2)

Automatic Monitoring Data

A summary of the results of automatic monitoring of NO_2 at the Woodbridge Junction can be seen in tables 2.3 and 2.4. Table 2.3 presents results comparable with the annual mean objective of 40µg/m^3, and Table 2.4 presents results comparable with the 1-hour mean objective of 200µg/m^3. In addition to the most recent monitoring, results for 2008, 2009, 2010 & 2011 have also been included in the tables for comparison purposes. Detailed summary tables and graphs of the 2012 monitoring results are presented in Appendix E.

The automatic analyser at Woodbridge is sited within a declared Air Quality Management Area (AQMA) and shows that the annual mean concentration, at 44µg/m^3, is still above the air quality objective (Table 2.3).

Table 2.3 shows that the annual mean concentration remained stable between 2008 and 2010 at 45µg/m^3, it then dropped in 2011 to 42µg/m^3 but has risen again in 2012 to 44µg/m^3. The Air Quality Action Plan has been formally in place since the start of 2011, and during the second half of 2011 one of the main measures (installation of a traffic queue detection system to the traffic lights at the junction) was implemented. It was hoped that this was the cause of the reduction in levels seen in 2011 and that this trend would continue in 2012 but this does not seem to be the case. More detailed discussion regarding the trends in NO_2 levels seen at the junction and the Action Plan implementation can be seen in Section 9 of this report.

The 1-hour mean objective is set at 200µg/m^3 not to be exceeded more than 18 times per year. The limit of 200µg/m^3 was exceeded only once in Woodbridge in 2012 (see Table 2.4), therefore the 1-hour mean objective was not exceeded. The maximum number of exceedances of the 1-hour mean objective was 2 in 2008, with other years either having only 1 or none.

Table 2.3 Results of Automatic Monitoring for NO_2: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % [a]	Valid Data Capture 2012 % [b]	Annual Mean Concentration (µg/m^3)				
					2008 [c]	2009 [c]	2010 [c]	2011 [c]	2012 [c]
Woodbridge	Kerbside	Yes	97.8%	97.8%	**45**	**45**	**45**	**42**	**44**

In bold, exceedence of the relevant NO_2 objective (annual mean AQS objective of 40 µg/m^3 and 1-hour mean AQS objective of 200 µg/m^3)

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" as in Box 3.2 of TG(09) (http://laqm.defra.gov.uk/technical-guidance/index.html?d=page=38), if valid data capture is less than 75%

[d] If the data capture for full calendar year is less than 90%, include the 99.8th percentile of hourly means in brackets

Table 2.4 Results of Automatic Monitoring for NO_2: Comparison with 1-hour Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % [a]	Valid Data Capture 2012 % [b]	Number of Hourly Means > 200µg/m^3				
					2008 [d]	2009 [d]	2010 [d]	2011 [d]	2012 [d]
Woodbridge	Kerbside	Yes	97.8%	97.8%	2	1	0	0	1

Diffusion Tube Monitoring Data

A summary of the results of diffusion tube monitoring for NO_2 at sites within the district can be seen in Table 2.5 overleaf. Detailed tables showing the monthly monitoring results for all sites in 2012 are presented in Appendix F.

The annual mean NO_2 concentrations shown in Table 2.5 have had a bias adjustment factor applied. The choice of bias adjustment factor is explained in Appendix C and the bias adjustment factor used at each site is presented in Appendix F.

Some diffusion tube sites failed to achieve full data capture, mainly due to stolen tubes. Where there was less than 90% data capture for the year (because two or more diffusion tube results were missing or invalid), the mean of the 2012 data has been "annualised" using the procedure set out in LAQM.TG(09) to produce the best estimate of the annual mean. The method is as follows:

- Identify 2-4 nearby, long term, continuous monitoring sites, ideally those forming part of the national network. These should be background sites to avoid any very local effects that may occur, and should wherever possible lie within a radius of about 50 miles. The two sites used here are St. Osyth (Rural) and Wicken Fen (Rural). Both sites are part of the UK Automatic Urban and Rural Network (AURN).
- Obtain the unadjusted (not corrected for bias) annual mean (Am) for the calendar year for these sites. As this calculation is to estimate the annual mean for a diffusion tube site, the diffusion tube calendar year for 2012 was based on the diffusion tube exposure periods rather than 1st Jan – 31st Dec 2012.
- Work out the period mean (Pm) for each period (month) with diffusion tube results at each of the comparison sites separately.
- All data is presented in Appendix C.
- Calculate the ratio of the annual mean to the period mean (Am:Pm) for each period at each location.
- Calculate the average of these ratios (R_a). This is the adjustment factor.
- Multiply the measured period mean (M) for the short term monitoring location by the adjustment factor (R_a) to give the estimate of the annual mean for 2012.

  WBG 6: the (unadjusted) measured period mean (M) was 44.9 µg/m^3: 44.9 µg/m^3 (M) x 1.02 (R_a) = **45.8 µg/m^3 (annualised mean)**

  WBG 8: the (unadjusted) measured period mean (M) was 47.0 µg/m^3: 47.0 µg/m^3 (M) x 1.03 (R_a) = **48.4 µg/m^3 (annualised mean)**

  WBG 10: the (unadjusted) measured period mean (M) was 37.6 µg/m^3: 37.6 µg/m^3 (M) x 0.93 (R_a) = **35.0 µg/m^3 (annualised mean)**

  STA 5: the (unadjusted) measured period mean (M) was 19.0 µg/m^3: 19.0 µg/m^3 (M) x 1.21 (R_a) = **23.0 µg/m^3 (annualised mean)**

- This annualised mean will then be bias adjusted as for all other sites.

Table 2.5 Results of NO_2 Diffusion Tubes 2012

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2012 (Number of Months or %) [a]	2012 Annual Mean Concentration (µg/m^3) Bias Adjustment factors: Woodbridge: 0.88 All other sites: 0.79 [b]
FLX 12 a,b,c	Hamilton Rd	Roadside	N	Triplicate	12	30
FLX 14	1 Adastral Close	Industrial	N	~	12	25
FLX 17	Spriteshall Lane	Roadside	N	~	12	24
FLX 20	Glemsford Close	Industrial / Roadside	N	~	12	23
FLX 21	Kingsfleet Road	Urban Background	N	~	12	22
FLX 22	Levington Road	Industrial	N	~	12	23
FLX 23	Heathgate Piece, Trimely	Roadside	N	~	12	26
FLX 24	Brandon Road	Roadside	N	~	12	28
FLX 26 a,b,c	The Dooley Inn (front), Ferry Road	Industrial / Roadside	Y	Triplicate	12	36
FLX 27 a,b,c	The Dooley Inn (side), Ferry Road	Industrial / Roadside	Y	Triplicate	12	33
FLX 29	18 Adastral Close	Industrial	N	~	11	23
FLX 31 a,b,c	44 Adastral Close	Industrial	N	Triplicate	12	26
FLX 32a,b,c	Dooley Inn (rear), Ferry Lane	Industrial	Y	Triplicate	12	34
FLX 33	Dock Gate 2 Roundabout	Roadside	N	~	11	**60**
FLX 34	Ferry Lane towards roundabout	Industrial / Roadside	Y	~	11	**46**
FLX 35	Dooley Inn (signpost) Ferry Lane.	Industrial / Roadside	N	~	12	**44**
FLX 36	Street Sign Hodgkinson Road.	Industrial / Roadside	N	~	12	37
FLX 37	Lampost, corner of Hodgkinson Rd.	Industrial / Roadside	N	~	12	**43**
FLX 38	Lampost on Ferry Lane, past PH	Industrial / Roadside	N	~	12	34
KSG 9	118 Main Road	Roadside	N		12	31
WBG 1 a,b,c	93 Thoroughfare	Kerbside	Y	Triplicate + Co-located	12	**44**
WBG 3	8 Kingston Farm Road	Urban Background	N	~	12	15
WBG 5	Suffolk Place, Lime Kiln Quay Rd	Roadside	N	~	12	26
WBG 6	87 Thoroughfare	Roadside	Y	~	**10**	**40**
WBG 8	95 Thoroughfare	Roadside	Y	~	**10**	**43**
WBG 10	St John's Street signpost	Roadside	N	~	**7**	31

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2012 (Number of Months or %) [a]	2012 Annual Mean Concentration (µg/m^3) Bias Adjustment factors: Woodbridge: 0.88 All other sites: 0.79 [b]
WBG 12	8 Lime Kiln Quay Road	Roadside	N	~	12	25
WBG 13	Traffic lights at 85 Thoroughfare	Roadside	N	~	12	36
WBG 15	87 Thoroughfare	Roadside	Y	~	12	**42**
WBG 17	Suffolk Place, Lime Kiln Quay Rd	Roadside	N	~	12	28
WBG 18	106/108 Thoroughfare	Roadside	Y	~	12	34
WBG 22	Suffolk Place, Lime Kiln Quay Rd	Roadside	N	~	12	22
WBG 23	Lamppost at 50 St. John's Street	Kerbside	N	~	12	26
MEL 5	6 The Street	Roadside	N	~	12	31
MRT 1 a,b,c	Horseman Court, Eagle Way	Roadside	N	Triplicate	12	21
LGM 1 a,b,c	Pear Tree House, Main Rd, Glemham	Roadside	N	Triplicate	12	14
FAR 1 a,b,c	Turret House, The Street, Farnham	Roadside	N	Triplicate	12	26
FAR 2 a,b,c	Post Office Stores, The Street, Farnham,	Roadside	N	Triplicate	12	31
STA 1 a,b,c	Long Row, Main Road, Stratford St Andrew	Roadside	N	Triplicate	12	**42**
STA 2	Road sign opposite Long Row, Main Road, Stratford St Andrew	Roadside	Y	~	12	26
STA 4	Lowestoft Street Sign bend, Main Road, Statford St Andrew	Roadside	N	~	12	24
STA 5	Great Glemham Sign, Opposite 1-5 Long Row, Stratford St Andrew	Roadside	N	~	**9**	18

In bold and shaded grey, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

Underlined, annual mean > 60µg/m^3, indicating a potential exceedence of the NO_2 hourly mean AQS objective

[a] Means should be "annualised" as in Box 3.2 of TG(09)(http://laqm.defra.gov.uk/technical-guidance/index.html?d=page=38), if full calendar year data capture is less than 75%

[b] If an exceedence is measured at a monitoring site not representative of public exposure, NO_2 concentration at the nearest relevant exposure should be estimated based on the "NO_2 fall-off with distance" calculator (http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html), and results should be discussed in a specific section. The procedure is also explained in Box 2.3 of Technical Guidance LAQM.TG(09) (http://laqm.defra.gov.uk/technical-guidance/index.html?d=page=30).

After annualisation (where applicable) and bias adjustment, nine sites had annual mean NO_2 concentrations above the Objective of 40µg/m^3 in 2012 and one site was borderline (with an annual mean NO_2 concentration of 37µg/m^3), these were:

- FLX 33 - lamppost at Dock Gate 2 Roundabout - not a relevant receptor.
- FLX 34 – lamppost in Ferry Lane, midway between roundabout and Dooley Inn PH - not a relevant receptor.
- FLX 35 - The Dooley Inn Signpost at front of building, Ferry Lane – not a relevant receptor.
- FLX 36 – Street sign in Hodgkinson Road – not a relevant receptor **(borderline result)**
- FLX 37 - lamppost in Ferry Lane on corner of Hodgkinson Road - not a relevant receptor.
- WBG 1 - 93 Thoroughfare, Woodbridge - co-located with the Woodbridge automatic monitoring site and within the declared AQMA.
- WBG 6 – 87 Thoroughfare, Woodbridge (end of house)
- WBG 8 – 95 Thoroughfare, Woodbridge
- WBG 15 – top guttering of 87 Thoroughfare, Woodbridge (middle of house)
- STA 1 - 1 Long Row, Main Road, Stratford St. Andrew.

Felixstowe

All sites within the AQMA declared at Felixstowe - Felixstowe 26, 27 and 32 are now within the air quality objective – at 36 µg/m^3, 33 µg/m^3 and 34 µg/m^3 respectively.

The four other sites at Felixstowe which are above the objective level and the one borderline site (Felixstowe 33, 34, 35, 36 and 37) are not situated at relevant receptors. These sites are located to help ascertain NO_2 levels around the declared AQMA at the Dooley Inn PH; whether the local road network (Ferry Lane and Hodgkinson Road) is producing more emissions than originally estimated, and whether there is a gradient from Dock Gate 2 roundabout up to The Dooley Inn. For this reason the NO_2 fall-off with distance calculator has not been used for these sites as they were not located to represent receptor locations.

Further discussions regarding the Felixstowe AQMA and the 2012 monitoring results can be seen in Section10 of this report.

Woodbridge

The Woodbridge sites (1, 6, 8 and 15) are all within the declared AQMA. The monitoring results for 2011 were lower at all of these sites with only Woodbridge 1 being above the objectives but these have increased again in 2012 to include exceedances at Woodbridge 6 and 8 as seen prior to 2011 but also now at Woodbridge 15. Further discussions regarding the Woodbridge AQMA and the 2012 monitoring results can be seen in Section 9 of this report.

Stratford St. Andrew

The site at Stratford St. Andrew (STA 1) is located on the drainpipe of a group of five houses which open directly onto the pavement of the A12. There is approximately 1 metre between the building façade and the kerb. Monitoring is being undertaken at

several sites along the A12 as part of the pre-planning application scoping exercise for Sizewell C. This location is the only site with NO_2 concentrations above the annual mean objective. During 2011 this site was monitored using a single diffusion tube, and so for increased accuracy in 2012 the site was triplicated. **This has confirmed that the annual mean NO_2 concentration is above the objective level and that we will need to proceed to a Detailed Assessment.** A number of additional sites (STA 2, 4 and 5) were put in place in the locality to provide additional spatial monitoring information, levels at these sites are all within the air quality objectives.

A Detailed Assessment has been undertaken on the Council's behalf by Transport Research Laboratory (TRL) for the A12 at Stratford in July 2013 and is attached here as Appendix G. The main conclusions in the Detailed Assessment report are as follows:

- The Detailed Assessment methodology takes into account the results from the NO_2 diffusion tube monitoring data collected by the local authority. In addition to this, a spatial analysis has been conducted to firstly determine the likely emissions profile owing to the traffic activity and secondly to understand the relationship between this profile and the monitoring data. A spatial buffer zone has been applied to confirm the extent of the exceedence of the annual mean objective with confidence.
- Based on the results of analysis and a precautionary approach, it is recommended that an Air Quality Management Area should be declared along the extent of the buffer zone. This would include the area of exceedence of the annual mean NO_2 objective and the zone in which any low emission or traffic management measures could apply.
- Alternatively, the local authority may choose to declare the Air Quality Management Area to include the area of exceedence only. In this case, the Air Quality Management Area boundary would encompass the four houses at 1-5 Long Row, Main Road, Stratford St Andrew

Having regard to the conclusions in the report, and the extent of the area where nitrogen dioxide levels exceed the Air Quality Objective, Suffolk Coastal District Council has chosen to limit the Area Quality Management Area to the boundary of the four houses at 1-5 Long Row, Main Road, Stratford St Andrew. The properties monitored at Farnham show nitrogen dioxide concentrations to be below the Air Quality Objectives at the same distance from the road as Long Row, Stratford St Andrew. Local knowledge suggests that the levels at Stratford St Andrew may be related to traffic movements associated with the petrol filling station and the change of speed limit close to Long Row.

The Detailed Assessment report and the recommendation to declare an Area Quality Management Area covering the boundary of the four houses at 1-5 Long Row was approved at the Council's Cabinet on 4th November 2013. The Detailed Assessment and the Cabinet decision regarding the AQMA boundary was sent to Defra in November 2013 and we are awaiting their response. Once approval has been received from Defra the AQMA Order will be made.

Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites

In addition to the most recent monitoring, historic diffusion tube results for 2008 to 2012 at all sites are presented in Table 2.6 overleaf for comparison purposes. For each of the 5 years presented the relevant different bias correction factors have been used and described.

Trend graphs have also been drawn, see Figures 2.3a -2.3c, showing annual mean NO_2 trends over time for diffusion tube sites with five or more years worth of data in the district. For more recent years, where local bias correction factors were available for Woodbridge or Felixstowe, these have been used for diffusion tubes in those particular areas. The national laboratory bias has been used for all other sites. For all other years the national laboratory bias has been used for all locations.

Each of the 4 areas monitored (Felixstowe, Kesgrave, Woodbridge and Melton) are very different, the majority of the Felixstowe sites are in place to measure concentrations around and associated with the Port of Felixstowe including both road traffic and other Port emissions. The remaining 3 sites are all at road junctions controlled by traffic lights, but again each is very different in terms of layout and the amount of congestion experienced. The sites at Kesgrave and Woodbridge are much more enclosed than that at Melton and the sites at Woodbridge and Felixstowe also have AQMAs and Action Plans in place which will be working towards trying to reduce concentrations in these areas.

Overall, the concentrations recorded in Felixstowe, Kesgrave and Woodbridge (sites outside the AQMA) have decreased over time, obviously with some fluctuations over the time period. Concentrations recorded in the Woodbridge AQMA and in Melton have however increased over the time period, but not considerably.

In **Felixstowe** (Figure 2.3a), the Urban Background site has fluctuated slightly between 2005 and 2012 with the overall trend being a reduction in levels. This trend is also seen in most of the other Felixstowe sites. All sites at Adastral Close, which is near to the Port boundary, have shown a steady reduction over time suggesting that emissions on and associated with the Port have also reduced. The only site with an unusual peak is that of Hamilton Road in 2009, the reason for this is thought to be roadworks that occurred throughout most of that year causing congestion at the monitoring site.

In **Woodbridge** (Figure 2.3b), the Urban Background site has fluctuated slightly but remained fairly steady between 2000-2012. The majority of sites outside of the AQMA have shown a reduction in levels over the monitoring period. Those within the AQMA (WBG 1, 8, 13, and 15) have all increased over the time period. Most of the Woodbridge sites showed a decrease in concentrations between 2010 and 2011 and then an increase again in 2012. This trend was not seen en masse across the rest of the district but there is no explanation that we have for this.

Trends over time for both **Melton** and **Kesgrave** (Figure 2.3c) are much more stable, Melton showing an overall slight increase over time and Kesgrave showing a decrease over time. Melton shows a steady increase in concentrations in recent years (2009-2012) but levels are still well within the Objectives. Monitoring is continuing at this location which will enable us to keep an eye on this.

Table 2.6 Results of NO_2 Diffusion Tubes (2008 to 2012)

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2008 Bias Adjustment Factors Woodbridge: 0.9 FLX 26 & 27: 0.77 All others: 0.8	2009 Bias Adjustment Factors Woodbridge: 0.82 All others: 0.9	2010 Bias Adjustment Factors Woodbridge: 0.89 All others: 0.85	2011 Bias Adjustment Factors Woodbridge: 0.84 All others: 0.84	2012 Bias Adjustment Factors Woodbridge: 0.88 All others: 0.79
FLX 12 a,b,c	Roadside	N	32	38	31	33	30
FLX 14	Industrial Site	N	29	28	27	25	25
FLX 17	Roadside	N	30	27	26	28	24
FLX 20	Idustrial / Roadside	N	31	29	24	26	23
FLX 21	Urban Background	N	28	24	24	25	22
FLX 22	Industrial	N	28	25	25	25	23
FLX 23	Roadside	N	32	29	31	29	26
FLX 24	Roadside	N	34	31	31	31	28
FLX 26 a,b,c	Idustrial / Roadside	Y	**42**	**45**	**43**	**40**	36
FLX 27 a,b,c	Idustrial / Roadside	Y	36	38	33	36	33
FLX 29	Industrial	N	30	27	27	25	23
FLX 31 a,b,c	Industrial	N	33	28	30	27	26
FLX 32a,b,c	Industrial	Y	27	25	~	37	34
FLX 33	Roadside	N	~	~	~	**66**	**60**
FLX 34	Industrial / Roadside	Y	~	~	~	**51**	**46**
FLX 35	Industrial / Roadside	N	~	~	~	**48**	**44**
FLX 36	Industrial / Roadside	N	~	~	~	**41**	37
FLX 37	Industrial / Roadside	N	~	~	~	**48**	**43**
FLX 38	Industrial / Roadside	N	~	~	~	39	34
KSG 9	Roadside	N	34	33	29	34	31
WBG 1 a,b,c	Roadside	Y	**46**	**45**	**42**	**42**	**44**
WBG 3	Kerbside	N	20	15	18	16	15
WBG 5	Roadside	N	30	28	29	25	26
WBG 6	Roadside	Y	**44**	**41**	**41**	37	**40**
WBG 8	Roadside	Y	**46**	**42**	**41**	38	**43**

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2008 Bias Adjustment Factors Woodbridge: 0.9 FLX 26 & 27: 0.77 All others: 0.8	**2009 Bias Adjustment Factors Woodbridge: 0.82 All others: 0.9**	**2010 Bias Adjustment Factors Woodbridge: 0.89 All others: 0.85**	**2011 Bias Adjustment Factors Woodbridge: 0.84 All others: 0.84**	**2012 Bias Adjustment Factors Woodbridge: 0.88 All others: 0.79**
WBG 10	Roadside	N	35	34	34	31	31
WBG 12	Roadside	N	30	26	26	24	25
WBG 13	Roadside	N	37	34	36	33	36
WBG 15	Roadside	Y	39	38	38	39	**42**
WBG 17	Roadside	N	33	31	30	28	28
WBG 18	Roadside	Y	39	38	38	32	34
WBG 22	Roadside	N	26	24	23	21	22
WBG 23	Kerbside	N	~	29	27	28	26
MEL 5	Roadside	N	28	24	28	31	31
MRT 1 a,b,c	Roadside	N	~	24	24	24	21
LGM 1 a,b,c	Roadside	N	~	~	~	17	14
FAR 1 a,b,c	Roadside	N	~	~	~	29	26
FAR 2 a,b,c	Roadside	N	~	~	~	33	31
STA 1 a,b,c	Roadside	N	~	~	~	**43**	**42**
STA 2	Roadside	Y	~	~	~	~	26
STA 4	Roadside	N	~	~	~	~	24
STA 5	Roadside	N	~	~	~	~	18

In bold and shaded grey, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

Underlined, annual mean > 60µg/m^3, indicating a potential exceedence of the NO_2 hourly mean AQS objective

[a] Means should be "annualised" as in Box 3.2 of TG(09) (http://laqm.defra.gov.uk/technical-guidance/index.html?d=page=38), if full calendar year data capture is less than 75%

Figure 2.3a - Felixstowe

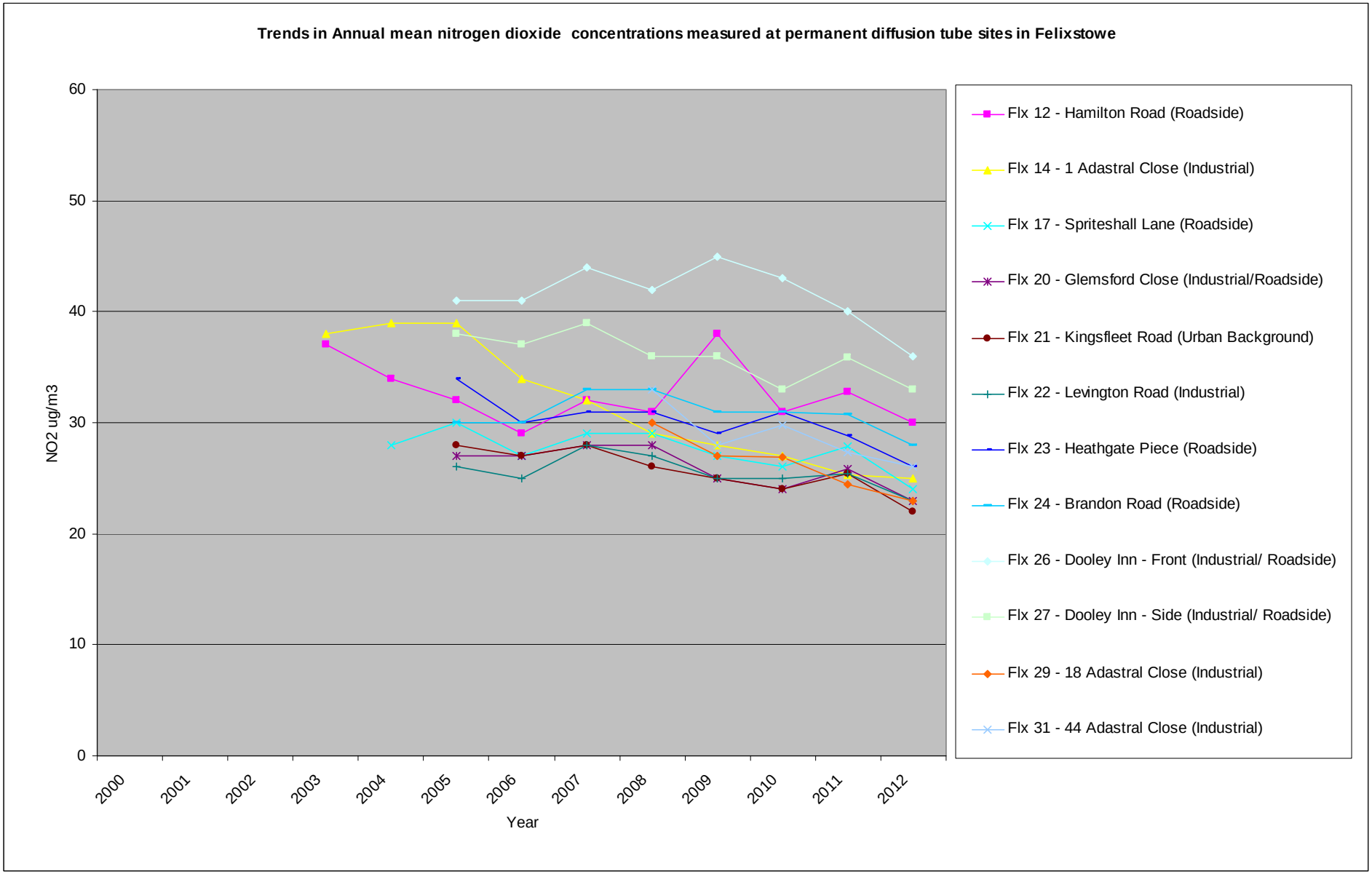


Figure 2.3b – Woodbridge

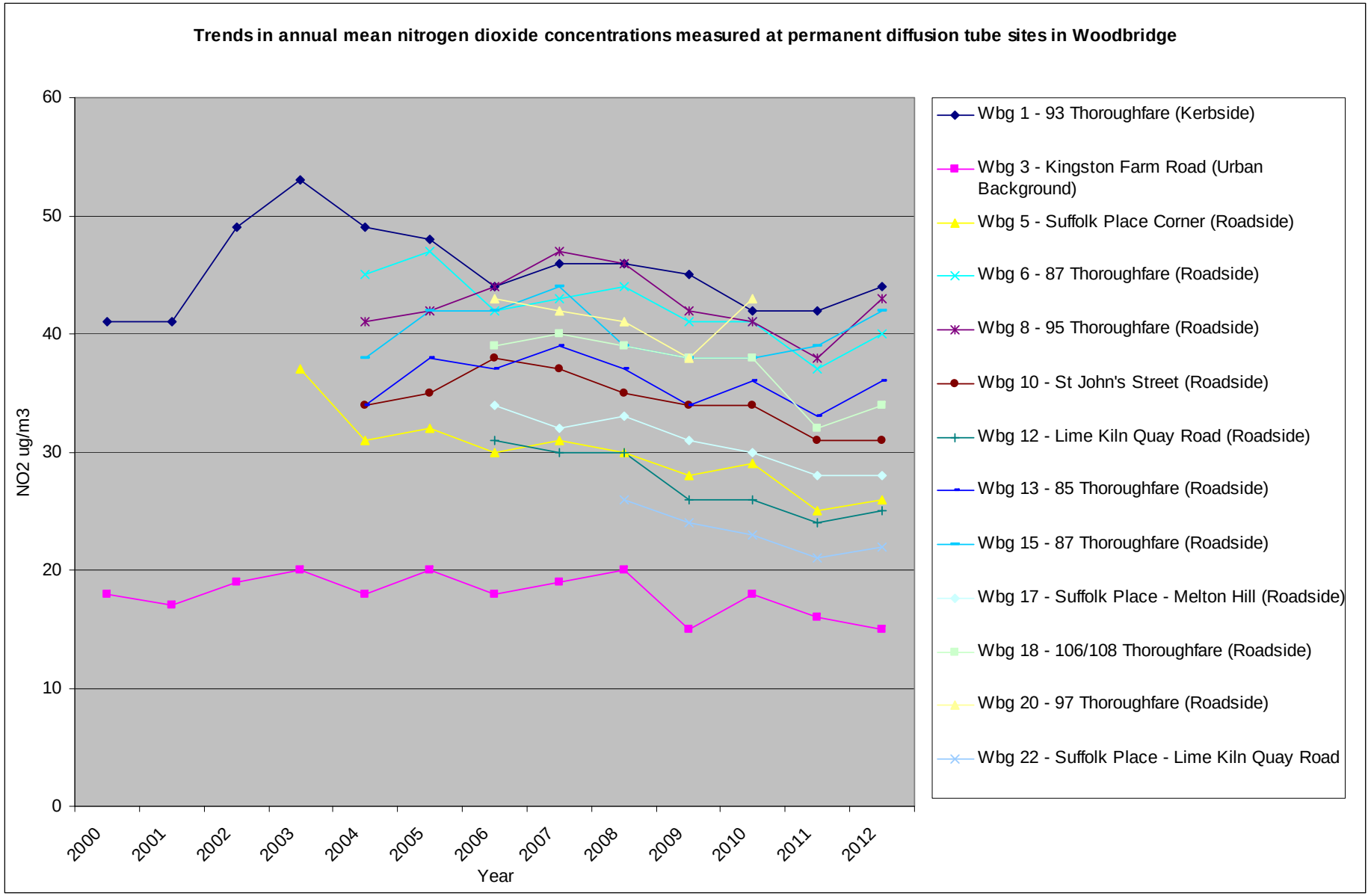
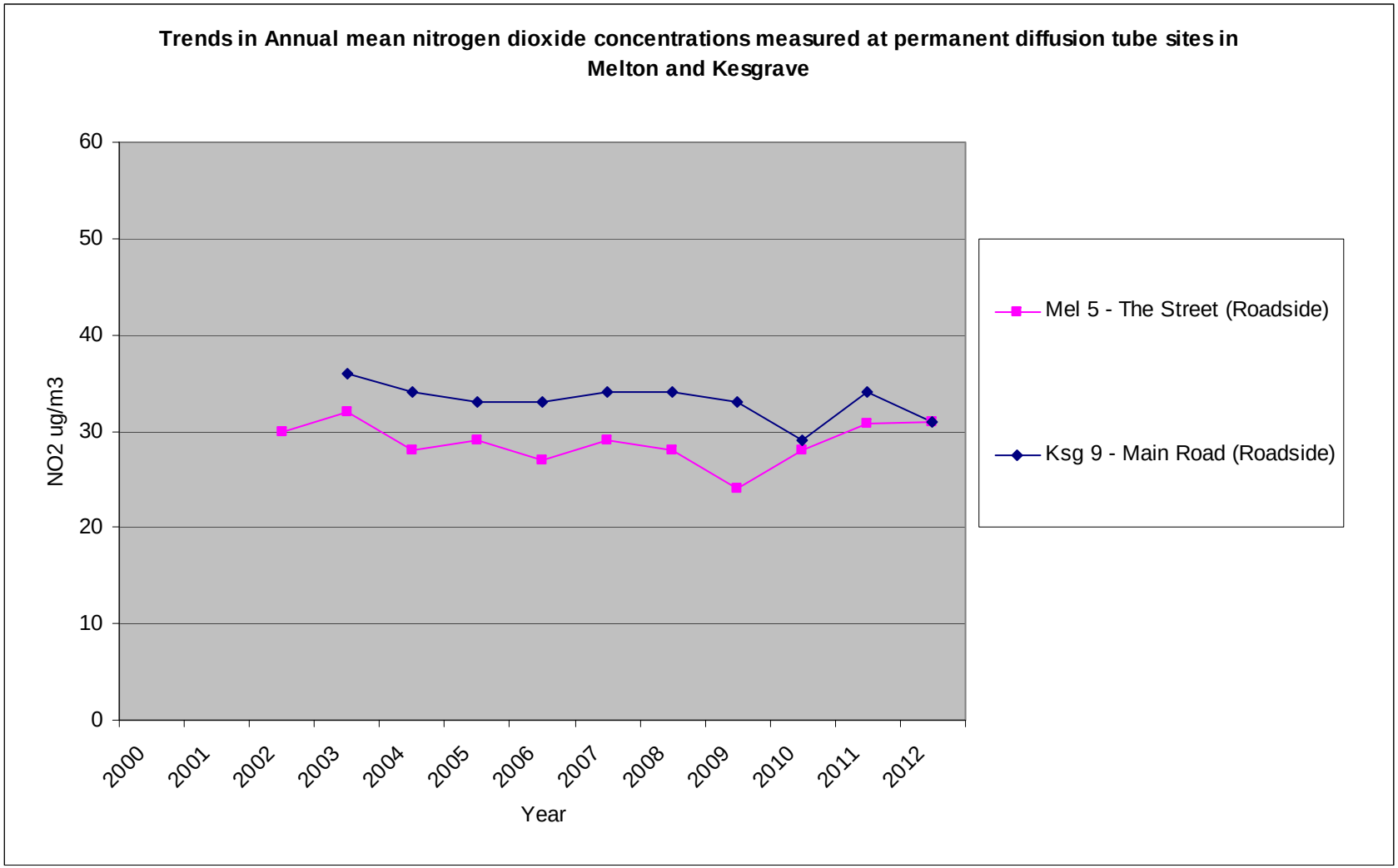


Figure 2.3c – Melton and Kesgrave



Summary of Compliance with AQS Objectives

Suffolk Coastal District Council has examined the results from monitoring in the district.

Concentrations within the AQMA in Woodbridge still exceed the annual mean objective for NO_2 and the AQMA should remain.

Concentrations within the AQMA in Felixstowe no longer exceed the annual mean objective for NO_2 in 2012. The AQMA is retained at present and monitoring will continue in order to allow us to confirm whether revocation is required in the future.

Suffolk Coastal District Council has measured concentrations of NO_2 above the annual mean objective at relevant locations within **Stratford St Andrew**, and has completed a Detailed Assessment. The findings of the Detailed Assessment confirm that **declaration of an Air Quality Management Area is required. The boundary will cover the four houses present at 1-5 Long Row, Main Road, Stratford St Andrew.** The findings have been sent to Defra, once approval is received the AQMA Order will be made.

3 New Local Developments

Any new local developments, since the 2012 Updating and Screening Assessment Report, that may affect air quality within the Suffolk Coastal district are listed in this Progress Report so that they can be considered in more detail during the next full round of review and assessment. This includes developments that are now in operation or have been granted planning permission to be brought into operation in the near future.

3.1 Road Traffic Sources

Any new / newly identified road traffic sources within the Suffolk Coastal district since the 2012 Updating and Screening Assessment must be identified, this includes;

- Narrow congested streets with residential properties close to the kerb.
- Busy streets where people may spend one hour or more close to traffic.
- Roads with a high flow of buses and/or HGVs.
- Junctions.
- New roads constructed or proposed since the last Updating and Screening Assessment.
- Roads with significantly changed traffic flows.
- Bus or coach stations.

There are no new / newly identified road traffic sources within the Suffolk Coastal district since the 2012 Updating and Screening Assessment.

3.2 Other Transport Sources

Any new / newly identified transport sources within the Suffolk Coastal district since the 2012 Updating and Screening Assessment must be identified, this includes;

- Airports.
- Locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.
- Locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.
- Ports for shipping.

There are no new / newly identified transport sources within the Suffolk Coastal district since the 2012 Updating and Screening Assessment.

3.3 Industrial Sources

Any new / newly identified industrial sources within the Suffolk Coastal district since the 2009 Updating and Screening Assessment must be identified, this includes;

- **Industrial installations:** new or proposed installations for which an air quality assessment has been carried out.
- **Industrial installations:** existing installations where emissions have increased substantially (greater than 30%) or new relevant exposure has been introduced.
- **Industrial installations:** new or significantly changed installations with no previous air quality assessment.
- Major fuel storage depots storing petrol.
- Petrol stations.
- Poultry farms.

3.3.1 New Installations

Since the 2012 Updating and Screening Assessment Report, there have been 2 new industrial installations within the district permitted under the Environmental Permitting Regulations 2010. Both are regulated by the Council and are listed below:

- Colin Carter Motor Engineer, Clarendon Works, Felixstowe
  Combustion Activity, Section 1.1

This installation is a Waste Oil Burner less than 0.4MW. This will not emit significant quantities of any of the pollutants of concern. **No further assessment is required.**

- Clarkes Demolition Limited, Chapel Works, Waldringfield
  Other Mineral Activities, Section 3.5

This installation is a mobile concrete crusher and is authorised for crushing, grinding or size reduction of bricks, tiles or concrete. The crusher is not based on site so **no further assessment is required**.

3.3.2 Industrial Installations with substantially increased emissions

Within the Suffolk Coastal district there are two existing industrial installations, permitted under the Environmental Permitting Regulations 2010, with the potential to emit significant quantities PM_{10} or NO_2, these are listed below.

- Eurovia Limited (previously Ringway Infrastructure Services), Foxhall Four Quarry, Foxhall Road, Brightwell (PM_{10})
- Novera Energy, Foxhall Generation Plant, Foxhall Landfill Site, Foxhall Road, Brightwell (NO_2)

LAQM.TG (09) advises that it should be determined whether any of the installations have either experienced substantially increased emissions (greater than 30%) or

have received new relevant exposure in their vicinity since the last review and assessment.

None of the installations have received any new relevant exposure. Recent emission testing reports (2012/13) for the installations have been obtained for comparison with emissions recorded in 2011/12.

Eurovia Limited sited at Foxhall Four Quarry, Brightwell

Annual emissions of Total Particulate Matter - TPM (assumed to all be PM_{10} for this assessment) recorded from the road stone coating plant at Eurovia Limited in the last 3 emission testing reports are detailed below:

March 2012	0.17 tonnes TPM per annum
October 2012	0.38 tonnes TPM per annum
May 2013	0.53 tonnes TPM per annum

The March 2012 figure was used in the 2012 Updating and Screening Assessment report to review the emissions from this site and emissions have therefore increased by 212% in May 2013. The reason for this rise is due to a productivity increase at the plant, because of increased demand which means the plant is operational for longer each day. Additionally, it was noticed that the internal diameter of the stack alters slightly in the different emission testing reports provided since 2007. Discussions with the plant revealed that the stack diameter alters along its length which would account for this. To run the assessment we require the internal diameter of the stack at its exit point. This has now been obtained from the process operator as 0.9m x 0.65m (it is a rectangular stack).

LAQM.TG(09) provides a calculation method for PM_{10} emissions, in the form of nomograms, to estimate the emission rate (in tonnes per annum) that would produce a 1 µg/m^3 contribution to the 90th percentile of 24-hour mean concentrations (for assessment against the 2004 objective). If the actual emission rate from the installation exceeds these thresholds then it will be necessary to proceed to a Detailed Assessment.

The following information was obtained for the chimney at Eurovia Limited:

- Actual stack height = 16.5m
- Effective stack height (as situated in a quarry) = 16.5m minus 7m (height of quarry face) x 1.66 = 15.77m
- Exit temperature = 59.2^{o}C
- Stack diameter = 0.9m x 0.65m (rectangular stack). Advice obtained from the Defra emissions helpdesk calculated the stack diameter as 0.86m.

As the exit temperature from the stack is less than 100^{o}C and the effective stack height is greater than 10m, LAQM.TG(09) advises to use the nomogram in Figure 5.5 for the assessment (pg 5-34). Using this nomogram, the emission rate that would produce a 1 µg/m^3 contribution to the 90th percentile of 24-hour mean concentrations would be 0.37 tonnes per annum.

LAQM.TG (09) advises that for PM_{10} emissions the impact will be largely dependant on the background concentrations in the locality. A precautionary method of taking the background concentration into account is to multiply the allowed emission by 32 minus the background. This will give a background-adjusted permitted emission for the installation.

- Grid reference for site – (6)24 (2)43
- The estimated annual mean background concentration for 2013 at this location is 17.15µg/m^3.

This calculation can be undertaken using a screening tool provided by Defra for low temperature stacks (<100^oC) with stack heights >10m. The calculator estimates that the background permitted emission for Eurovia Limited is 6.73 tonnes PM_{10} per annum. As the rate of emission in May 2013 for the installation was only 0.53 tonnes per annum a **Detailed Assessment is not required**.

Novera Energy is permitted by the Environment Agency under the Environmental Permitting Regulations 2007 as a Combustion Activity (under Section 1.1A (1) (b) (iii) of the Regulations). An Air Quality Assessment was undertaken for this process prior to its installation, which predicted no exceedences of the objectives at relevant receptor locations. Annual emissions testing of the Landfill Engine was undertaken in 2012 which showed the annual NO_2 emissions to be 17.3 Tonnes (compared with 11.7 Tonnes in 2011). This is an increase of approximately 48% which would usually prompt a reassessment of the site. However, the emissions predicted in the original Air Quality Assessment for Novera Energy were 29.2 Tonnes per annum at which there were no exceedances of the objectives predicted. The 2012 emissions are well within this figure and therefore **no further investigation is therefore necessary for this installation.**

3.4 Commercial and Domestic Sources

Consideration must be given to the use of biomass combustion in the commercial and domestic sectors, and to other solid-fuel combustion in domestic use. Biomass burning can lead to an increase in both PM_{10} and NOx emissions due to the process of combustion.

Any of the following, newly identified since the Updating and Screening Assessment 2012, must be listed in this report:

- Biomass combustion plant – individual installations.
- Areas where the combined impact of several biomass combustion sources may be relevant.
- Areas where domestic solid fuel burning may be relevant.

Individual installations

Table 3.2 at the end of this section shows a list of all biomass installations within the district that we are aware of, whether they have been assessed and the outcome of the assessment. There are no new biomass installations within the district that we are aware of since the 2012 Updating and Screening Assessment.

Heveningham Hall and estate buildings, Heveningham

This is a 900 kW thermal woodchip boiler sited at Home Farm in Heveningham, Suffolk which serves Heveningham Hall estate covering 26 commercial and residential properties via a district heating system. Expansion of the system could also occur in the future.

We have now been able to obtain all of the relevant details needed to run the screening assessment. The stack height of the boiler is 6.95m which is only 40 cm above the ridge height of the building it is situated within. Therefore the screening assessment provided within the Technical Guidance was unable to be used as the stack needs to be a minimum of 1m above the ridge height of any nearby building(s). The Defra Helpdesk was contacted and ran the dispersion model ADMS-Screen for the boiler. The Assumptions and model inputs, and the results are detailed below;

Assumptions and Model Inputs
Worst-case/closest sensitive receptor (assume residential) at 40m from stack
Maximum short-term emission rates for boiler: 0.026 g/s PM_{10} and 0.096 g/s NOx
Assume all NOx to be NO_2 at sensitive receptor
Exit velocity 4.11 m/s
Exit temperature 189^{o}C = 462K
Stack height 6.95m
Stack diameter 0.55m
Height of worst-case nearby building 6.55m
Background annual mean concentrations: 16.8 µg/m^3 PM_{10},
9.3 µg/m^3 NO_2
Generic meteorology for East Anglia

Results

Table 3.1 ADMS-Screen predictions at worst-case receptor 40 m from stack – stack contribution to ground level concentrations

(µg/m^3)	**NO_2**	**PM_{10}**
Annual mean	**6.8 µg/m^3** if continuous release, and all NOx as NO	**1.9 µg/m^3** if continuous release
Maximum 1-hour mean i.e. 100% percentile	**74.1 µg/m^3**	-
99.8th percentile of 1-hour means	**70.8 µg/m^3**	-
90th percentile of daily means	-	**4.92 µg/m^3**

Comments

ADMS-Screen has limitations which are important for this investigation:

- Can only model a single release point
- Can only include a single stylised building
- Cannot account for terrain features

Conclusions

In order to ascertain whether there may be any possible exceedances of the objectives, the stack contributions from table 3.1 need to be added to the background concentrations of the pollutants in this area.

For annual mean emissions the stack contribution is simply added to the estimated background concentration. For **NO_2** this totals **16.1µg/m^3** and for **PM_{10}** this totals **18.7µg/m^3**. Both concentrations are well within the limits set by the objectives (both set at 40µg/m^3) and no further assessment will be necessary.

For the **NO_2 1-hour objective** (set at 200µg/m^3 not to be exceeded more than 18 times a year – the 99.8th percentile) the stack contribution is added to twice the estimated annual mean background concentration. This totals **89.4 µg/m^3** which is well within the objective limit and no further assessment will be necessary.

For the **PM_{10} 24-hour mean objective** (set at 50 µg/m^3 not to be exceeded more than 35 times a year – the 90th percentile) the stack contribution is just added to the estimated annual mean background concentration. This totals **21.72 µg/m^3** which is less than half of the objective limit and no further assessment will be necessary.

The impacts of the biomass boiler stack and the possibility of exceeding the air quality objectives have therefore been screened out using ADMS-Screen. **There is no need to proceed to a Detailed Assessment for this biomass boiler.**

L F Geater & Sons Limited, West End Nurseries, Westward Ho, Leiston

This is a market gardening business which uses a 1.5 MW thermal straw burner to provide supplementary heating (the main heating is supplied by an oil fired boiler) to the glass houses during the colder months of the year. It is a Part B process permitted under the Environmental Permitting Regulations 2010 but also requires assessment here.

We have now been able to obtain all of the relevant details needed to undertake a screening assessment of the straw burner. This confirmed that the boiler would require a Detailed Assessment for the 1-hour NO_2 and 24-hour PM_{10} objectives.

A Detailed Air Quality Assessment was commissioned from Air Quality Consultants in order to assess the impact of emissions. The assessment used the detailed computer dispersion model ADMS-5 to predict the contribution of NOx and PM_{10} from the straw burner at relevant nearby receptor locations in the surrounding area. The assessment looked at both the short term (1-hour NO_2 and 24-hour PM_{10}) objectives and also the annual means for both pollutants.

The Detailed Assessment concluded that both the NO_2 and PM_{10} objectives are not exceeded at any receptor locations in the vicinity of the Straw Burner, with concentrations of both being well below the relevant objectives. **No further investigation is required**. The Air Quality Assessment is attached as Appendix H

Combined impacts of biomass combustion sources

There is no new information since the 2012 Updating and Screening Assessment which would require us to be concerned regarding any areas within the district. It is concluded that there are no areas within the district that would trigger a Detailed Assessment for combined impacts of biomass use.

Domestic solid fuel burning

There are no new areas within the district, identified since the 2012 Updating and Screening Assessment, which would trigger a Detailed Assessment for domestic solid-fuel burning.

Table 3.2 Biomass boilers within the Suffolk Coastal district and stage of assessment

Address of biomass boiler	Size of boiler (kW thermal)	Screening Assessment undertaken ?	Further action required?	Detailed Assessment undertaken?	Further action required?
Private residence, Sibton	60 kW	Yes	**No**		
Private Farm, Alderton Road, Hollesley	60 kW	Yes	**No**		
Private Farm, Theberton	70 kW	Yes	**No**		
Control tower, Bentwaters Airfield, Rendlesham	60 kW	Yes	**No**		
Private residence, Orford	60 kW	Yes	**No**		
Suffolk Punch Trust, Hollesley	75 kW	Yes	**No**		
Private residence, Wenhaston	120 kW	Yes	**No**		
Private residence, Playford Road, Little Bealings	Unknown but small	Yes	**No**		
Private residence, Aldeburgh	75 kW	Yes	**No**		
Felixstowe Road, Purdis Farm – wood burning stove	Unknown	Yes	**No**		
Rendlesham County Primary School	115 kW	Yes	**No**		
Eyke County Primary School	120 kW	Yes	**No**		
Cookley & Walpole County Primary School	80 kW	Yes	**No**		
Knodishall Coldfair Green County Primary School	80 kW	Yes	**No**		
Hollesley County Primary School	95 kW	Yes	**No**		
GR Green Cricket Bats, Bromeswell	154 kW	Yes	**No**		
Snape Maltings, Tunstall	550 kW	Yes	Yes	Yes	**No**
Aldeburgh Productions music offices, Snape Maltings, Tunstall	60 kW	Yes	Yes	Yes	**No**
Heveningham Hall and estate buildings, Heveningham	900 kW	Yes	**No**		
L F Geater & Sons Limited, West End Nurseries, Westward Ho, Leiston	1.5 MW	Yes	Yes	Yes	**No**
SuperSIPS, Newbourne Business Park, Newbourne	150kW	Yes	**No**		

3.5 New Developments with Fugitive or Uncontrolled Sources

Dust emissions from a number of fugitive and uncontrolled sources can give rise to elevated PM_{10} concentrations. These sources include, but are not limited to:

- Landfill sites
- Quarries
- Unmade haulage roads on industrial sites
- Waste transfer station etc
- Other potential sources of fugitive particulate emissions

There are no new locations with significant emissions and no areas where there is any new relevant exposure that we are aware of within the district.

Suffolk Coastal District Council confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

Suffolk Coastal District Council confirms that all the following have been considered:

- **Road traffic sources**
- **Other transport sources**
- **Industrial sources**
- **Commercial and domestic sources**
- **New developments with fugitive or uncontrolled sources.**

4 Local / Regional Air Quality Strategy

Suffolk Coastal District Council has not drawn up a local Air Quality Strategy at the present time. We have two AQMAs declared in the district for annual mean nitrogen dioxide and a further area of concern, each due to very localised and different sources. Air quality in these three areas will be dealt with most effectively by the individual Action Plans prepared. The need for a strategy will be considered as part of our ongoing review of air quality.

5 Planning Applications

It is important that any new developments are logged in the Air Quality Progress Reports so that their progress through the planning system can be monitored and any potential impacts on air quality assessed.

There are **4 developments** which have been detailed within previous Progress Reports for which either the Planning Application has still yet to be determined or Planning Permissions has been granted but works on site have not yet been completed, and **3 recent planning applications** which have not as yet been detailed in our air quality reports.

The **four developments previously detailed** are outlined briefly below, for additional information see the 2011 Progress Report:

Land at junction of Station Road and Wilford Bridge Road and Girdlestone Pumps, Station Road, Melton – Planning Application (C09/0584)

Demolition of the Girdlestones building to be replaced by the erection of 10,735m^2 of light and general industrial use. This will consist of two and three storey business units to include offices, workshops, coffee shop/café. There will also be associated external works, off site highway works and formation of new access to Station Road. The application obtained Planning consent but works have not yet been completed.

The application provided an Air Quality Assessment which determined that the impact of the proposed development on the ambient air quality near the development site, at the junction of Wilford Bridge Road and Melton Road, and at the Woodbridge Junction (location of our AQMA) will be very small and will not cause a breach of the limits set out in the Air Quality Limit Value Regulations of 2000. It was concluded that air quality does not constitute a material consideration in the assessment of the planning application. The Air Quality Assessment was reviewed by this Department and the findings accepted.

Outline Planning Application for Orwell High School and land to the North West and High Street, Maidstone Road, Felixstowe (Planning Reference C10/0161) Detailed Planning Application for Felixstowe Academy, Maidstone Road, Felixstowe (C11/2590)

These Planning Applications have been determined by Suffolk County Council for a new High School located on a site currently occupied by Orwell High School which will have capacity to accommodate pupils from both Orwell and Deben Schools. Main vehicular, pedestrian and cycle access proposed from The High Road.

Outline Planning Permission was granted by Suffolk County Council in 2010 with 43 conditions attached. Two were relevant to air quality and requested a screening air quality assessment of road traffic impacts on properties in close proximity to the new access on High Street, Walton and an air quality assessment of emissions from any Biomass Boilers and/or Combined Heat and Power installations to be used on the site.

The above reports were submitted to the County Council in October/November 2011 and the findings concluded:

- Road traffic emissions – an assessment was made using the Design Manual for Roads and Bridges for the nearest dwellings adjacent to high street, Walton for 2013 both with and without the development in place. The results for nitrogen dioxide and particulate matter showed predicted increases of 1.1% and 0.6% respectively with the development in place giving annual mean concentrations of 18.91µg/m^3 and 17.02µg/m^3. These levels are both well within the Air Quality Objectives which are set at 40µg/m^3 for both pollutants and therefore are not a cause for concern.
- Biomass Boiler emissions – the air quality assessment concluded that a stack height of 15m would be sufficient to ensure that there would not be any significant contribution of emissions to the local area form the boiler.
- Construction Dust – there is the potential for dust from the works but this can be adequately controlled using best practise.

Planning Consent was granted in March 2012 with a Condition regarding Construction. The site is now almost completed and is due to be open Spring 2014.

Land between Rendham Road and A12, Rendham Road, Saxmundham (Planning Application C10/0294, C12/1123, C12/2289). Outline Planning Permission.

The site encompasses an area of 5.2 hectares of former agricultural land on the western edge of Saxmundham, broadly between Rendham Road (to the north) and the A12 (to the west). This application is now for entirely residential use, it has obtained outline planning permission for the original 90 residential units (this will be Phase 1 – C10/0294) , a further 20 dwellings on another parcel of land to the south next to it (Phase 2 – C12/1123) and another 57 dwellings (Phase 3 – C12/2289).

Originally this department was consulted as part of the Planning process and recommended, with regard to air quality, that insufficient information was provided and that an air quality assessment should be made to determine the effect of traffic generated by the proposed development on the Air Quality Objectives. The application went to Development Control Sub Committee in May 2010 who approved the scheme subject to controlling conditions. The controlling conditions have now been finalised and the air quality recommendations of this department were not included. There was therefore no obligation for the applicant to provide any information regarding air quality.

As part of the most recent planning application for the additional 57 dwellings (C12/2289) an air quality assessment was requested and provided which looked at the cumulative impacts of all 3 phases (167 houses) of the development. It concluded that traffic associated with all of the proposed dwellings will not significantly contribute to the local air quality and the Air Quality Objectives are unlikely to be exceeded. The occupiers of the new dwellings are also unlikely to be adversely affected by air quality. Air pollution from Construction activities was also considered and good practise for mitigating dust and general pollution is appropriate.

The Air Quality Assessment was reviewed by this Department and the findings accepted. Work has now started on the site to build the show homes.

Redevelopment of Adastral Park, Martlesham Heath (Planning Application C09/0555)

British Telecommunications plc (BT) submitted a revised outline planning application for the regeneration of Adastral Park and land to the east and south in April 2009. This includes refurbishment of Adastral Park and development of adjoining land for the creation of a new residential community with its own infrastructure, services and facilities to include:

- Up to 60,000m^2 net additional employment floor space, related car parking spaces and landscaping
- Up to 2,000 homes, related car parking spaces and landscaping
- Mixed use local centre (comprising health care provision, community centre, retail, Cafe, Public House, takeaway, related car parking spaces and landscaping.
- Education provision
- Hotel, related car parking spaces and landscaping
- Energy centre and other utility infrastructure
- Public car park and other areas of public open space, including formal open space provision for recreation and play
- Supporting services and facilities
- New road connections to C356 (Newbourne Road/Heath Road/ Waldringfield Road) and related road improvements
- Changes to junctions on the A12

In 2010 the applicants submitted an Environmental Impact Assessment Statement, which included an air quality assessment for the application, together with a Transport Assessment to predict the likely impact of the development on existing transport patterns. The air quality assessment identifies 5 sources of emissions that have the potential to influence air quality:

- Dust emissions during the construction period
- Emissions from construction traffic and plant during the construction period
- Traffic emissions from vehicles accessing the application area once the development is complete
- Emissions from the energy centre proposed for the development
- Potential emissions from quarrying activities within the application site

The conclusions of the Environmental Impact Assessment Statement with regard to air quality are summarised as follows:

- Construction activities at the development site have the potential to cause dust emissions at nearby sensitive receptors. Dust emissions from construction sites can be controlled effectively by the employment of management practices, for example wheel washers, use of screens etc. Measures for control of dust will be included within a Construction Environmental Management Plan which will be submitted and agreed with SCDC prior to construction commencing.

- Prediction of pollution concentrations arising from traffic flows arising with the proposed development once operational have shown that the development will have a negligible impact on ambient air quality

- Pollution concentrations within the vicinity of the development site are predicted to remain well below the UK air quality objectives at all locations with the completed development in place. Therefore there will be negligible impacts from the introduction of new residential occupants in terms of exposure to poor air quality.

- As part of the development proposals there will be a number of junction improvements along the A12, three junctions of concern which are to be signalised are as follows:

    - A12/Newbourne Road/Foxhall Road roundabout
    - A12/Eagle Way/Barrack Square roundabout
    - A12/Eagle Way/Anson Road roundabout

  There are no sensitive receptors located adjacent to the A12/Newbourne Road/Foxhall Road and so no assessment was made for this junction. Prediction of pollutant concentrations arising as a result of the other two junction changes have shown that at the majority of locations these changes will have a negligible impact on air quality, and in fact the increase in distance from the junction at some receptors on the A12/Eagle Way/Anson Road junction is predicted to have a slightly beneficial impact on air quality.

- Combined Heat and Power and biomass boilers are proposed for the site but adequate information is not yet available to complete a Detailed Assessment of the impact on air quality from the proposed plant. The impact will be assessed in detail at the detailed planning application stage to ensure that stacks are sized appropriately for adequate dispersal of pollutants, and that emissions do not have an adverse impact on air quality.

- There is potential that some areas of the site will be utilised for sand and gravel extraction at the same time as the remainder of the site is developed which would have the potential for high emissions of dust. The phased approach to the mineral extraction works and the proposed development, along with attention to site management and the appropriate use of mitigation techniques will significantly reduce any impacts and the potential for nuisance impacts will be low.

The air quality assessment was appraised by external consultants AEA Technology plc, on behalf of the Environmental Protection team at SCDC who concluded that the approach taken to the potential impacts of construction of the development on air quality should ensure that the potential negative impacts are minimised. The road traffic modelling assessment predicts that at all sensitive receptors concentrations will be well below the annual mean objectives for NO_2 and PM_{10} in 2011 or 2018 both with and without the development and the impact of the development itself is negligible. **In light of this it is recommended that the application is <u>not</u> refused on the grounds of air quality.**

The applicants submitted further information and revised documentation which included altered traffic predictions. An addendum to the Environmental Impact

Assessment Statement was provided which concluded that the daily traffic flows used in the April 2009 Environmental Impact Assessment Statement to assess air quality are not affected. The air quality results therefore remain valid.

Details of the application and associated documents can be viewed on the Council's website at www.suffolkcoastal.gov.uk/yourdistrict/planning/devcontrol/adastralpark/default.htm.

The **3 recent planning applications** relevant to air quality which have not been detailed in any quality reports previously, are as follows:

Proposed food store, land between Garrison Lane and North and West of Felixstowe Town Station Railway Approach, Felixstowe (C12/2395)

This application is a proposed redevelopment of the former railway sidings and nursery land off Railway Approach and High Road West, Felixstowe. The proposed development is for a 2-level convenience goods foodstore with 300 parking spaces, associated landscaping, service, access and parking arrangements. Customer vehicular access will be from Railway Approach off High Road West with a second access point for servicing only from the Garrison Lane/High Road West/ junction at the north west corner of the site.

An Air Quality Assessment was requested by this department and provided for this application in March 2013. The relevant conclusions of which are as follows:

- Due to residential properties being within 50m of the site boundary it is anticipated that dust from construction activities could be of a 'large' significance. However, by employing a number of proposed mitigation measures these impacts can be managed and minimised.
- The operational impact of the development on the air quality in the area with respect to nitrogen dioxide from the increase in road transport has been shown to range from a 'small' to 'medium/slightly adverse'. The 'meduim' impact is for receptors at points close to the site and the 'small' to 'negligible' impact for receptors further from the site.

The predicted annual mean concentrations of nitrogen dioxide at the receptor locations modelled with the development in place are in the range 25–31µg/m^3 which is well within the Air Quality Objective set (40µg/m^3).

The Air Quality Assessment has been reviewed by this department and the findings accepted – there is no predicted exceedance of the Air Quality Objectives with the foodstore in place.

This application recently received Planning Consent but work has not yet begun on the site.

Outline Planning Application for residential development, public open space and associated infrastructure on 8.9ha, Trinity Park, Felixstowe Road, Ipswich (C12/1930)

This outline planning application comprises of a 300 dwellings residential development with public open space and associated infrastructure, together with 2 roundabouts to serve Trinity Park on the A1156 Felixstowe Road.

An Air Quality assessment was requested by this department and provided by the applicants in September 2013. the relevant conclusions of which are as follows:

- Assessment of the impacts of construction activities from the proposed development shows that it is considered as a 'Low to High Risk' site. Mitigation measures have been detailed in the report which if implemented will alter the risk to 'slightly adverse to negligible'. This department agrees with the findings and has requested that implementation of these measures is required as a Condition of the planning consent.
- Assessment of the potential impacts of emissions from vehicles associated with the construction phase has been undertaken and shows the impacts to be 'negligible' and temporary in nature.
- Assessment of the effect of the proposed development on local air quality and the potential exposure of future occupants of the site to air pollution was undertaken using a screening model. The predictions for both nitrogen dioxide and particulate matter were all well below the Air Quality Objectives and the effect of the development is therefore classed as 'negligible'.

The Air Quality Assessment has been reviewed by this department and the findings accepted – there is no predicted exceedance of the Air Quality Objectives with the development in place.

This application was approved at Planning Committee in Decemnber 2013 but consent details are not yet available.

Outline Planning permission for up to 200 dwellings on lane West of Ferry Road Residential Centre Ferry Road Felixstowe Suffolk (C13/3069)

This application is for outline planning permission for the creation of up to 200 dwellings, two vehicle access points on Ferry Road and associated landscaping buffers and public open space.

This application has only recently been received and is currently being reviewed by this department. Further information will be provided in the 2014 Progress report.

6 Air Quality Planning Policies

With the introduction of the Localism Act 2011, the previous Local Development Framework (LDF) phraseology has been altered to "The Suffolk Coastal District Local Plan". This will consist of a suite of future planning documents for the district.

The Council's new Local Plan will set out the spatial policies, guidance, land use designations and site allocations against which all planning applications and other development proposals will be assessed, and will be made up of the following documents:

- **Core Strategy & Development Management Policies** - sets out strategic vision for the district also includes the Development Management Policies which will be used in the determination of planning applications.
- **Site Specific Allocations & Area Specific Policies** - policies applying to specific sites, locations and areas within the district. These will also allocate land for development, covering a variety of uses from housing, to new sites for employment and retail uses.
- **Area Action Plans** - documents focusing on the future development of specific towns or areas, with a specific focus on regeneration.
- **Gypsies, Travellers & Travelling Showpeople -** will allocate land to accommodate the identified housing needs of the Gypsy, Traveller and Travelling Showpeople communities.
- **Neighbourhood Plans** - documents prepared by Town and Parish Councils containing specific policies for an individual parish, or group of parishes.
- **Proposals Map** will show the adopted policies in geographical format and be updated as each document is adopted. The Proposals Map will initially be derived from the Suffolk Coastal Local Plan.

The Suffolk Coastal Core Strategy and Development Management Policies document was adopted on 5 July 2013. The Core Strategy is the first of the development plan documents to be produced, setting the principles and providing the context for those more detailed documents which will follow. As such, it should be possible using the information and policies contained in the Core Strategy to tell, at least in principle, if a development proposal whatever its size, type or location is acceptable or not. It will, nonetheless, still be necessary to look at more detailed individual circumstances each time.

The Core Strategy sets out the vision for Suffolk Coastal to 2027. It sets out principles for providing new homes and extra jobs in the District, together with the necessary associated social, community and physical infrastructure improvements. It also ensures there are strong policies in place to protect the unique and treasured environmental and historic quality of the area. This will not only provide the district with a long term up to date and robust set of key planning policies, but will also provide a sound basis on which to continue production of a number of other important policy documents. It includes policies for:

- The provision of 7,900 new homes across the District during the next 15 years, including 2,000 new homes south and east of Adastral Park, Martlesham Heath.
- Extra employment land, to allow for industrial/commercial development and the creation of new jobs.
- Protection of the District's high quality environment.

The following documents have also been prepared to support the Local Plan and will be updated over time:

- **Statement of Community Involvement** sets out how and when you can influence new planning documents and the ways in which you can comment on planning applications and other forms of consent.
- **Local Development Scheme** sets out the range of planning documents that will be produced and the timetable for their preparation.
- **Monitoring Report** outlines the progress made in the production of planning documents, the performance in implementing development plan policies and other important indicators and statistics for the district.
- **Supplementary Planning Documents** will be prepared or updated to provide further detailed guidance to support the development plan documents.

In addition to the Core Strategy the Council will continue to have regard to the remaining 'saved policies' from the Suffolk Coastal Local Plan (incorporating the 1st & 2nd Alterations) (2006) until replaced by policies in other development plan documents. Those remaining 'saved polices' from the 2006 Local Plan are listed in Appendix C of the Core Strategy.

Specifics included within the Core Strategy for our declared AQMAs and LAQM in general are found under 'Other Sources of Pollution' – section 3.139:

"In respect of air pollution, the Council has declared two Air Quality Management Areas (AQMAs). These are located at specific areas in Felixstowe and Woodbridge. The Council is working on Action Plans to hopefully secure improvements. Whilst there are no other AQMA identified, there is a potential conflict in siting new development close to the main road networks. Care will need to be taken to ensure that the scale and location of new development does not create new problems that could result in additional AQMAs having to be declared. This may influence the location and mix of uses on potential development sites."

7 Local Transport Plans and Strategies

The third Suffolk Local Transport Plan (LTP3) is now in place and runs from 2011 to 2031. The Plan sets out Suffolk County Council's long-term transport strategy for the next 20 years. The key focus of the plan is to support Suffolk's economy as it recovers from the recession and future sustainable economic growth.

The LTP3 is in two parts. The first sets out the county council's long-term transport strategy up to 2031 and highlights ambitions for the transport network. The second part is an implementation plan, setting out how the strategy could be delivered over the short, medium and long term, using a variety of funding and delivery mechanisms. This includes a short-term programme of county council investment to 2015. The implementation plan will be reviewed over time to take account of any changes in priorities and funding levels.

The first part of the Plan (long-term transport strategy) identifies a number of specific areas and schemes in Suffolk which are priorities. There are no areas on the road network within Suffolk Coastal included in the lists. Regarding the rail network, the completion of the Felixstowe to Nuneaton route, particularly for freight, is highlighted along with improvements to the East Suffolk railway line which runs through the district.

There are 4 priorities listed in the Plan:

- A prosperous and vibrant economy
- Creating the greenest county
- Safe, healthy and inclusive communities (Protect vulnerable people and reduce inequalities)
- Learning and skills for the future (Transform learning and skills)

The second and third priorities have 'improving air quality' as one of their challenge's with the 'transport aims' being to reduce air pollutant emissions and reduce the impact of poor air quality on local communities. The Plan lists the current Air Quality Management Areas (AQMAs) within Suffolk and states that the county council will work with district and borough councils to develop action plans targeted at air quality improvement in each AQMA.

There is a section in the report dedicated to each local authority in Suffolk. For Suffolk Coastal it states that along with housing growth a need for a greater level of employment has also been forecast. Three strategic employment sites have been identified: the Port of Felixstowe with associated port related and logistics uses; Martlesham Heath business campus, with the development of high-tech industries linked to Adastral Park; and an extension to Ransomes Europark. Tourism effects are also discussed. Congestion and the AQMA in Woodbridge are specifically mentioned together with the long standing issues of traffic volume through the villages of Marlesford, Little Glemham, Stratford St Andrew, and Farnham on the A12. The Plan states that Suffolk County Council strongly supports the provision of proper relief for these communities by the provision of a relief road and will work with the nuclear industry to secure its provision alongside any new power station at Sizewell.

Part 2 – The Implementation Plan lists a number of proposed schemes within Suffolk, some of which are within the Suffolk Coastal district and are listed below. With the exception of the operation stack facility all schemes below are to be undertaken by developers as part of the planning process.

- Felixstowe Dock Spur roundabout improvement
- Felixstowe branch line Trimley to Levington double tracking
- A12 Four Villages improvement
- Operation stack facility
- Felixstowe to Nuneaton rail improvements
- Leiston passenger rail reinstatement

There are plans for the urban areas within Suffolk, including Felixstowe but there is no mention of the AQMA or air quality within this part of the report.

Woodbridge and the AQMA declared here does not feature in this report.

The County Councils investment programme to 2015 is provided in the Implementation Plan which allows £450,000 for Felixstowe for traffic management and cycle route improvements. There is no reference to any funding for air quality issues anywhere in the district.

8 Climate Change Strategies

On 26 October 2006 The Council signed the Nottingham Declaration, an acknowledgement that Climate Change is a key issue for the Council. Since then further work has been done to ensure that this area of activity is given a high priority within the Council and the Local Strategic Partnership.

In 2009 Suffolk Coastal District Council produced a Climate Change Strategy and Action Plan - these have now been replaced by the Joint Environmental Policy, which was adopted by Suffolk Coastal and Waveney District Councils in January 2013. The Policy replaces and joins up not only the Climate Change Strategy but also the Suffolk Coastal Local Agenda 21 Charter and Waveney District Council's Sustainability Plan and the Green Travel Plan. It summarises key environmental challenges facing the district, some significant action to date, and sets out how the Councils will themselves and with others deliver a co-ordinated forward looking approach across the whole of East Suffolk.

In relation to Climate Change and LAQM, the Plan states that the Council will carry out the following:

- Work in partnership with others to create Districts that are reducing greenhouse gas emissions and equipped to rapidly respond to changing situations through understanding of and good management of its ecological, historic, built and natural environment and social networks.

- Fulfil its duties under the Environment Act 1995 to produce and implement Action Plans for any declared Air Quality Management Areas within the districts, currently situated in Woodbridge and Felixstowe.

Relevant work to date shows that;

The Councils have reduced their overall greenhouse gas emissions through a combination of: increased insulation, improved heating controls, improvements to fleet vehicles, changes to operating hours in one of our buildings, staff engagement and provision of video conferencing facilities between sites. There has also been investment in low carbon and renewable technology.

In support of the Suffolk Climate Change Partnership Business Advice Service the Suffolk Coastal Business Advice Service with funds from the Local Authority Business Growth Incentive Scheme, Groundwork East of England, Suffolk Coastal LSP and Areas of Outstanding Natural Beauty Sustainable Development Fund has identified cumulative potential annual cost savings of £698,822 and cumulative potential annual carbon savings of 3,711 tonnes of CO2(e) from a total of 146 energy audits carried out in small and medium sized enterprises.

Following Public Consultation on the Joint Environmental Policy, 26 of the 43 actions proposed received sufficient public support to become the focus of the Policy. They are listed below - the Annual Environmental Report will focus on these with other actions being monitored and managed by the relevant lead service area. Many of the actions have links to LAQM, for example reducing car usage by Council employees through teleconferencing, home working etc, Sustainable travel

promotion, and sustainable transport initiatives. However there are none specific to the Air Quality Management Areas declared in Woodbridge and Felixstowe or any other specific LAQM pollutants.

- To identify funding options for developing projects which bring empty houses back into use so that they include more energy and water efficiency measures and a behavioural change element.
- Continue to assess and improve the energy efficiency of Waveney District Council's Housing Stock and provide efficient, low carbon or renewable generation solutions where feasible.
- Support and facilitate the Councils' Officer Greenest County Steering Group and Green Team action to engage staff and encourage a shift towards reducing energy and water use, homeworking, teleconferencing, videoconferencing, online training, car sharing, and use of trains and cycles and more fuel efficient driving.
- Extend the Waveney Cycle to Work scheme to cover Suffolk Coastal. To increase the numbers of staff cycling to and from work – evidenced in the annual survey.
- Encourage a shift to more sustainable travel patterns.
- With the Suffolk Sustainable Travel Forum endeavour to facilitate major investment in public transport to improve existing services and develop new ones.
- Support Sustrans and Cycle Suffolk efforts to promote cycling through Lowestoft Local Links and investigate any potential opportunities that arise for extending this to promote national routes and potential of combining train and cycle rides.
- Continue to advise on and support community litter picks.
- Progress towards a low paper use office Council.
- Amend the Suffolk Coastal Lift Home Scheme as appropriate and to include cyclists and adopt across the two councils.
- Promote the reuse of consumables across the councils, prompt reduce and reuse when asked to procure consumables and implement new ways of working which reduce need for procuring consumables.
- Explore feasibility of kerbside glass collection.
- Produce and maintain up to date management plans for all designated sites & biodiversity priority habitats. Develop effective management arrangements, involving voluntary and community sectors to ensure the most cost-effective delivery mechanisms are in place.
- Ensure focus of AONB Management Plan 2013-18 further promotes and delivers landscape scale initiatives throughout the AONB.
- Ensure delivery of the sustainable transport initiatives as set out in Suffolk's Local Transport Plan 2011-2031.
- Promote and support community local food initiatives through the Greenprint Forum.
- Develop and deliver evidenced, costed corporate building management and improvement strategies for both authorities prioritising actions based on the future of the buildings, current efficiency and cost and potential to further improve efficiency in relation to energy and water.
- Efforts to reduce emissions reported through the annual greenhouse gas report.
- Investigate the potential for bringing Suffolk Coastal up to Fairtrade Status to match Waveney.

- Support the Suffolk Coast Forum in bringing together partners and local communities to address some of the challenges faced.
- Investigate the potential offered by the new BREEAM Domestic Refurbishment programme as a means of assessing progress on reducing energy, water and waste, being adaptable to climate change and providing a healthy indoor environment for occupants.
- In Partnership with Suffolk County Council introduce smart metering in all Council properties deemed to be significant users of energy and water.
- Further investigate feasibility of renewable energy on building stock whilst considering the outcome from office accommodation review and options appraisal on leisure centres. Commission projects where viable and publicly supported, and communicate this initiative within local communities.
- Through community communications, the two councils, the East Suffolk Partnership and the Greenprint Forum, promote the Suffolk Green Building network to enable a share of experiences and understanding on resource efficiency and renewable technologies.
- As part of the Suffolk Climate Change Partnership maximise use of existing (e.g. grants, Community Energy Saving Program) and future frameworks (Green Deal, Energy Company Obligation) to drive householder take-up of retrofitting opportunities, with 28,000 properties taking up the Green Deal / Energy Company Obligation.
- In partnership with the Environment Agency work with communities (Town and Parish Councils, and other groups) to assess risks and encourage the development of appropriate emergency plans (which include extreme weather events) to promote community resilience (utilising experience from emergencies, incidents and events).

9 Action Plan Progress Report for Woodbridge AQMA

Junction of Lime Kiln Quay Road, Thoroughfare, Melton Hill and St. John's Street in Woodbridge, Suffolk (Woodbridge Junction)

9.1 Introduction

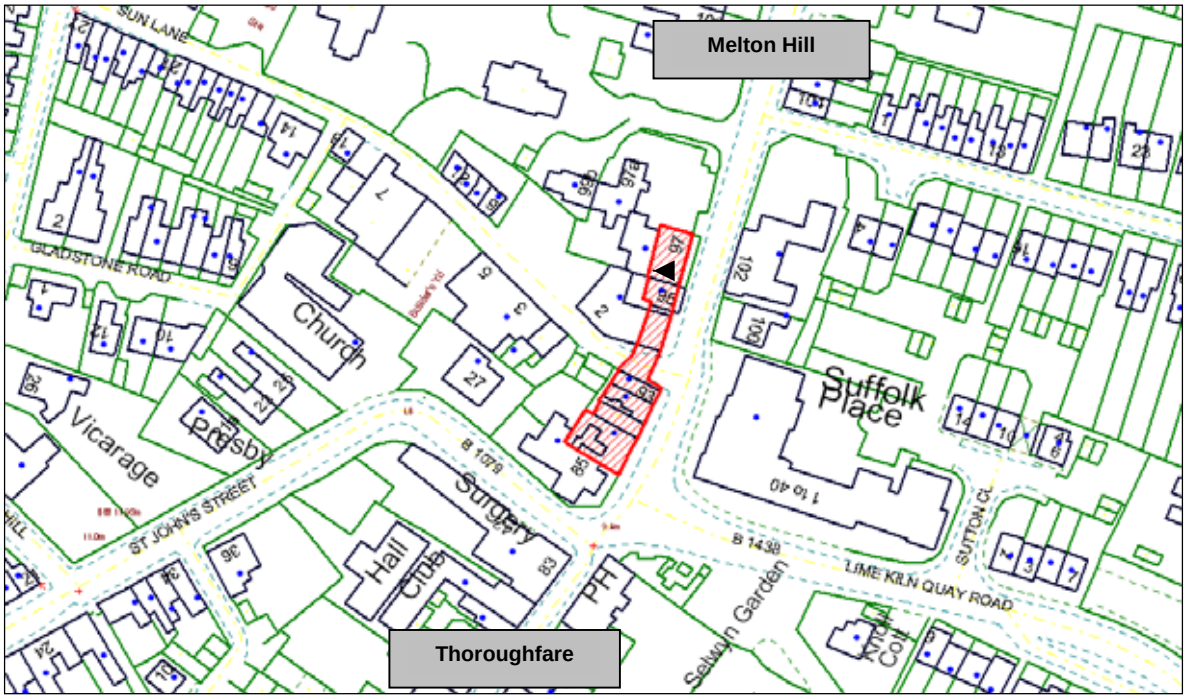
On 3 April 2006 an Air Quality Management Area (AQMA) Order made for an area of the Woodbridge Junction with regard to the annual mean NO_2 concentration came into effect. The designated area incorporates properties on the Western side of the Melton Hill arm of the junction. A copy of the AQMA Order is included as Appendix A and a location map is provided in Figure 9.1 below.

A Further Assessment was produced for the Woodbridge Junction AQMA in 2007 and the draft Action Plan underwent Public Consultation in 2010. Responses received were presented in the final Action Plan, accepted by Defra in 2011.

The Action Plan confirms the likely source of NO_2 is from transport, in particular heavy goods vehicles. Evidence suggests that a 16% reduction in traffic emissions of oxides of nitrogen (NOx), a precursor to NO_2, is necessary (based on 2006 figures) to achieve the air quality standard. The Action Plan considers 79 options to improve air quality and recommends 20 of these for implementation.

Table 9.3 contains an updated summary of progress made on each of the measures within the Action Plan. Additional details regarding each measure are provided in the main text.

Figure 9.1 Location of AQMA declared at the Woodbridge Junction (hatched in red)



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Not to scale

N

9.2 Monitoring Data

A summary of the monitoring data from the continuous analyser and diffusion tubes at the junction for 2012 is presented below in Table 9.1 and 9.2. In addition to the most recent monitoring, results for 2008, 2009, 2010 and 2011 have also been included in the tables for comparison purposes. More detailed results are presented in Section 2 of this report and also Appendix E and F.

Table 9.1 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean and 1-hour mean Objectives

Year	2008	2009	2010	2011	2012
Annual Mean Concentration (μg/m^3)	**45**	**45**	**45**	**42**	**44**
Number of exceedences of hourly mean (200 μg/m^3)	2	1	0	0	1

Table 9.2 Results of Nitrogen dioxide diffusion tube monitoring

Site ID	Location	Within AQMA	Annual mean concentration (μg/m^3)				
		Yes / No	2008	2009	2010	2011	2012
WBG 1	93 Thoroughfare	Yes	**46**	**45**	**42**	**42**	**44**
WBG 3	8 Kingston Farm Road	No	20	15	18	16	15
WBG 5	Suffolk Place, Lime Kiln Quay Rd	No	30	28	29	25	26
WBG 6	87 Thoroughfare	Yes	**44**	**41**	**41**	37	**40**
WBG 8	95 Thoroughfare	Yes	**46**	**42**	**41**	38	**43**
WBG 10	St John's Street signpost	No	35	34	34	31	31
WBG 12	8 Lime Kiln Quay Road	No	30	26	26	24	25
WBG 13	85 Thoroughfare	No	37	34	36	33	36
WBG 15	87 Thoroughfare	Yes	39	38	38	39	**42**
WBG 17	Suffolk Place, Lime Kiln Quay Rd	No	33	31	30	28	28
WBG 18	106/108 Thoroughfare	Yes	39	38	38	32	34
WBG 22	Suffolk Place, Lime Kiln Quay Rd	No	26	24	23	21	22
WBG 23	50 St. John's Street	No	~	29	27	28	26

The automatic analyser is sited within the declared AQMA and shows the 2012 annual mean concentration to be above the air quality objective (Table 9.1). Trends over time show that the annual mean concentration remained stable between 2008 and 2010 at 45μg/m^3 but dropped in 2011 to 42μg/m^3. We had hoped this may be due to the installation during the second half of 2011 of the traffic queue detection system (MOVA) at the junction. The concentrations in 2012 however have increased again to 44μg/m^3 suggesting that MOVA was not the cause of the 2011 reductions. It may have, therefore, been due to Meteorological conditions that year.

The 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times per year) was exceeded once in Woodbridge in 2012 (see Table 9.1) which is comparable with the trends seen since 2008.

Table 9.2 shows the diffusion tube results for 2008 – 2012 in Woodbridge. With the exception of the diffusion tube monitoring sites at WBG 3 (Background site), 10 and 23 (both situated in St. John's Street), NO_2 concentrations at all sites in Woodbridge have increased between 2011 and 2012. Concentrations at Woodbridge 15 (sited at 87 Thoroughfare) have now increased to also be above the Objectives. This property is within the declared AQMA.

Investigation of traffic flows at the junction show that they were fairly stable between 2010 and 2012 so the fluctuations in NO_2 concentrations at the junction cannot be attributed to changes in traffic volumes. Heavy Duty Vehicle percentages have also not altered significantly between 2010 and 2012 so the fluctuations cannot be attributed in any part to this either. There is no obvious reason therefore as to why the concentrations decreased in 2011 and have risen again in 2012. As explained above, this could be due to different Meteorological conditions in 2011.

All monitoring locations have been kept in place for 2013. The results for 2013 will be reported in the AQMA Progress Report due in 2014.

9.3 Action Plan Measures update

As detailed above, following the reduction in NO_2 concentrations seen at the junction in 2011 we were hopeful that the MOVA system installed at the traffic lights to reduce congestion was the cause. The monitoring results for 2012 have unfortunately showed that the concentrations have increased again, thereby discounting the MOVA system as the source. Traffic flows and Heavy Duty Vehicle (HDV) percentages using the junction have remained fairly stable between 2010 and 2012 also discounting this as a factor. Further information regarding the MOVA system is detailed below under the Measure 1 update.

Since the last Action Plan Progress Report at the end of 2012, a number of different traffic surveys have been undertaken at the junction. This includes a video cordon survey to investigate the percentage of through traffic using the main route through Woodbridge and also using the Thoroughfare. Transport Research Laboratory (TRL) have been commissioned to undertake a Drive Cycle analysis of the junction and to then use the data from this to undertake Detailed modelling of a number of scenarios to ascertain whether they would reduce NO_2 concentrations within the AQMA.

The Drive Cycle analysis was undertaken by TRL in May 2013. It consists of a specialised vehicle which travels through the junction from all directions at different speeds and in different scenarios (for example stopping at the lights versus going straight through without being stopped at the junction). It has an on-board emission recording device to record each emission profile associated with each different scenario/manoeuvre undertaken at the junction.

The results from the Drive Cycle will be input into computer modelling to investigate whether different proposals for traffic alterations at the junction would have any impact on NO_2 concentrations within the AQMA. We are currently awaiting the

results of the Drive Cycle and computer modelling of a number of scenarios for the junction, these will be published in the 2014 AQMA Progress Report.

SCC measures

We have been in discussions with Suffolk County Council Highways Team to assess our working relationship and find a way forward with regard to implementation of specific traffic related measures, particularly with regard to funding. Following receipt of our computer modelling results for the junction, we will re-submit our Action Plan to the Policy Team within the County Council. They will look at the measures included in the Action Plan to determine whether funding is available to undertake them. If it is not then these measures will have to be removed from the Action Plan. Results of this process will be published in the 2014 AQMA Progress Report.

The bid to Defra for grant funding to carry out feasibility study work associated with any junction alterations was successful. The money has been spent on the feasibility studies for Measures 3, 4, 5, 6 and 21.

Table 9.3 Woodbridge Junction Action Plan Progress Summary Table 2012

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
1	Install queue detectors (MOVA) on traffic signals to reduce queuing at the junction	Reduce queuing traffic at the lights	Suffolk County Council	2009	2011	Reduction in peak queue lengths	10%	Queue length survey undertaken 2009. MOVA not functional until June 2011. Post MOVA queue length survey undertaken 2013. See main text for results and discussion.	Post MOVA queue length survey undertaken	2013. **Completed**	Monitoring results for 2012 show NO_2 concentrations have risen again following decreases seen in 2011. No significant changes in traffic flow and % HDV between 2009 and 2012 so not to do with that. Possibly Meteorological conditions in 2011 causing lower readings? Post MOVA queue survey shows average queue lengths have increased on all arms of the junction but that the extremes of queues have been reduced.
2	Install right hand turning lane at lights on Melton Hill arm of junction – **THIS MEASURE WAS REMOVED FROM THE ACTION PLAN IN 2012**										
3	Extension of restrictions to Thoroughfare (8am-6pm)	Reduce queuing traffic at the lights	Suffolk County Council	2013-2014	2014-2015 Now to be considered as measure 1 has not been successful on its own	Reduction in peak queue lengths on Melton Hill	Not known Air quality modelling will enable us to put a figure to this	Preliminary discussions with new team at SCC show this option to be supported. See also comments under new Measure 21.	Traffic counts and Drive Cycle undertaken. Awaiting results of Detailed modelling looking at removing ability to go straight over from Melton Hill.	2014-2015	This could be one way of partly implementing the new Measure 21 (remove ability of traffic to go straight over from Melton Hill to Thoroughfare). Computer Modelling currently underway. This will be looked at when the modelling results are received.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
4	Remove ability to turn right from direction of Melton Hill	Reduce queuing traffic at the lights	Suffolk County Council	2013 – 2014	2014-2015 Now to be considered as measure 1 has not been successful on its own	Reduction in peak queue lengths on Melton Hill	Not known Air quality modelling will enable us to put a figure to this	Defra agreed to use of their funding for computer modelling feasibility study. Traffic data collected, Drive Cycle undertaken and now awaiting computer modelling results.	Traffic data collected, Drive Cycle undertaken. Awaiting computer modelling results.	2014-2015	We are not sure whether this scenario, either alone or in conjunction with option 21, would cause a reduction in emissions within the AQMA, although it would seem likely. If the modelling shows a reduction in emissions we can look at the options available to enable this to happen. Links with option 3 above.
5	Relocate the on street parking currently in Melton Hill to the opposite side of carriageway.	Reduce queuing traffic in AQMA	Suffolk County Council	2012-2013	Originally 2013 now 2014/15 If study and consultation shows this is feasible.	Reduction in peak queue lengths. Only traffic heading away from junction along Melton Hill	5%	Preliminary design prepared. Defra grant funding obtained. Traffic data collection and Drive Cycle undertaken and now awaiting computer modelling results.	Preliminary design prepared. Traffic data collection and Drive Cycle undertaken and now awaiting computer modelling results	Originally 2013 now 2014/15	Air quality modelling will give us idea of potential emission reductions. SCC has advised that we could trial this temporarily if residents are concerned.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
6	Remove the on street parking currently in Melton Hill.	Reduce queuing traffic in AQMA	Suffolk County Council	2012-2013	2014 Only for consideration if measure 5 is not successful.	Reduction in peak queue lengths Would only be traffic heading away from junction along Melton Hill	5%	Preliminary design prepared. Defra grant funding obtained. Traffic data collected, Drive Cycle undertaken Awaiting computer modelling.	Preliminary design prepared. Traffic data collection and Drive Cycle undertaken and now awaiting computer modelling results.	2014/15	Air quality modelling will give us idea of potential emission reductions.
7	Investigate Satellite Navigation (SatNav) system routes around town and lorry/HGV delivery routes	Reduce traffic flows through AQMA	SCDC	N/A	2013 for SatNav 2014 for lorry/HGV routes		1%	Most popular SatNav systems tested, some routes are via the junction but majority sent via the bypass. **Completed 2010.** Video cordon survey undertaken	Discussed with SCC, number of new options. See notes in main text. Video cordon survey undertaken and shows HGV/lorry through traffic to be significant. See main text.	2013 for SatNav 2014 for lorry/HGV routes	Video cordon survey to investigate amount of HGV through traffic. Shows HGV/lorry through traffic to be significant - will look at lorry ban with SCC. Unsure whether anything can be gained from the new delivery investigations listed. Once we know will try to apply an emission reduction target if possible.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
8	Bus operators to use cleanest fleet in Woodbridge – contact them to request.	Reduce emissions from HDVs through the AQMA junction	SCDC	2010	Originally 2013 Now 2014	Number of Euro IV buses operating in Wood-bridge.	2%	List of 8 bus operators compiled. 3 bus operators contacted.	Nothing further undertaken.	Originally 2013 now 2014	Of operators contacted none willing so far to alter fleet as only very small service operates in Woodbridge. All buses maintained regularly so no emission reductions to be gained as yet. All First buses operating out of Ipswich now low floor, but Euro standard information not available.
9	Demand Responsive Transport	Reduce traffic flows through AQMA junction	Suffolk County Council	N/A	2009	None	2%	Scheme in place as of 2009	Scheme is doing really well and will be retained for next 4 years in Wilford and Alde areas.	2009 **Completed**	SCC has been able to provide patronage info for 2012/13 which shows that there were 8,425 individual passenger journeys using Demand Responsive Transport for the Wilford Area and 4,435 for the Alde Area. This will have a positive effect to reduce car usage in the area and hopefully at the junction.
10	Simplified Ticket Scheme	Reduce traffic flows through AQMA junction	Suffolk County Council	2013	2014	Increased ticket sales	1%	Working group set up 2009 to investigate option. The Endeavour Card went live in October 2013 for 16-19 year olds. Details in main text below.	The Endeavour Card went live in October 2013 for 16-19 year olds.	2014	Original bus patronage indicator removed, as above. Unsure about ticket sales indicator. Will have a positive effect to reduce cars using junction, but no real way to measure whether emission reduction target will be reached.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
11	Improve accessibility to bus timetable	Reduce traffic flows through AQMA junction	Suffolk County Council	2009	2009	Website launch. Leaflets delivered.	1%	Website launched. New leaflets delivered. New style of timetable developed – more accessible and easy to read.	New computer system in place replacing old timetables with new 'stick' style ones – see main text for details	2009 **Completed**	Bus patronage indicator removed, as above. No other relevant indicator. Will have had a positive effect to reduce cars using junction, but no real way to measure whether emission reduction target has been reached.
12	Turban Centre new bus station/ interchange Now withdrawn as no funding.	Reduce traffic flows through AQMA junction	Suffolk County Council	2010 /2011	2012	Opening of new bus shelter.	2%	Design not agreed in time for budget cuts. Funding withdrawn. Bus shelters only to be upgraded.	Bus shelters upgraded December 2012.	2012 **Completed**	May be some positive influence on bus patronage due to new bus shelters. Not possible to predict what reduction in emissions this may give.
13	Procurement of bus contracts to include fleet upgrade	Reduce emission from HDVs through AQMA junction	Suffolk County Council	2009	2009 2015	Quality assess-ment process in place. Buses to be Euro III standard	2%	Quality assessment process in place as of 2009. New Quality Scoring System due Jan 2013.	New Quality Scoring system to come in Jan 2013. First Buses introduced newer buses to meet 2015 accessibility Regulations, mainly EURO III standard.	2015	New low emission vehicles added to SCC's fleet are compliant for the London Low Emission Zone and the London 2012 Olympics. However, impacts on AQMA likely to be very small. Newer vehicles used by First Buses will have reduced emissions.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
14	Car sharing scheme	Reduce car trips	SCDC	N/A	2010 and on-going	Increase in registered users of scheme	2%	Baseline no. of scheme users 2010 = 1,599. 2011 = 1,831. 2012 = 2,334 2013 = 2,338 SCDC website updated. Articles published. See main text for details.	Updated number of users of site. Nothing further undertaken during 2013.	On-going 2014	Increased number of users can only have a positive effect. Scheme Suffolk wide but information may be available on a postcode basis to determine journeys saved through our AQMA junction by members since they started the scheme. See main text for discussion.
15 a	Business Travel Plans	Reduce reliance on car and queuing time in AQMA	Suffolk County Council / SCDC	N/A	2010 - 2011	Businesses contacted. Number of Travel Plans adopted by businesses	2% for 15a,b and c combined	List of businesses in Woodbridge with > 20 employees sent to SCC to contact.	No progress made.	Originally 2012. Measure to be reviewed 2014	Investigations show there are not really any large businesses within Woodbridge. Potential to adopt Travel Plans much smaller and any impact from them also minimal.
15 b	School Travel Plans	Reduce reliance on car and reduce queuing time in AQMA	Suffolk County Council / SCDC	N/A	2010	Contact schools to remind them about Travel Plan. Contact Wood-bridge School re adopting a Travel Plan.	2% for 15a,b and c combined	All schools in Woodbridge have a Travel Plan in place. Exception is Woodbridge School who are interested in producing one in the future. New footpath on Pytches Road and 30mph 'reduce your speed sign' for	SCDC and SCC met with Woodbridge School. Are interested in investigating possibility of a Travel Plan in the future. Have provided info on bus services they already run and pupils who may use	Originally 2013 for contacting schools. Now 2014.	All schools currently have a Travel Plan so most associated emission reductions will have already been made. Will have a positive effect to reduce cars using junction, but no real way to measure whether emission reduction target will be reached. Woodbridge School has identified families who could use the AQMA junction to travel to school. Do not think the majority would due to locations.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
								Woodbridge CPS users.	the junction. See main text below.		Difficult to predict impact of any Travel Plan on AQMA. See main text below.
15 c	Travel Plan for the District Council offices	Reduce reliance on car and reduce queuing time in AQMA	SCDC	N/A	2009	Travel Plan adopted Key actions completed Reduction in staff work mileage	2% for 15a,b and c combined	Travel Plan adopted 2009 Key actions complete 2010. Travel Plan now in Joint Environmental Sustainability and Action Plan (JESPAP).	Nothing further undertaken	2014 obtain data to assess any emission reductions due to Travel Plan.	Is difficult to ascertain overall emissions reduction from the original Travel Plan, although it can only have a positive effect on emissions in the AQMA. Are some potential indicators - see main text for details.
16	Promotion of cycling and walking in Woodbridge	Reduce traffic flows through AQMA	Suffolk County Council	2010	2011/2012	None currently.	1%	Cycling and walking in Woodbridge reviewed. Wish list drawn up by SCC, see main text below. New footpath on Pytches Road and 30mph lit sign to calm traffic and aid walking to school. 5 cycle racks now behind Café Nero and 3 on Market Hill. Sandy Lane cycle scheme implemented.	Number of cycle racks behind Café Nero increased from 3 to 5 and 3 new ones installed on Market Hill. Cycle scheme on Sandy Lane competed, see main text. No further action on wish list.	2013 - cycle rack installation. 2013 -cycle scheme on Sandy Lane complete. Originally 2013 - investigate wish list.	Previous indicator has been removed (Build base network of current situation Investigate any ideas from the above process). Base network of current situation has not been built and is not now planned. Cycle rack increases and Sandy Lane cycle scheme can only have a positive impact to increase the number of people cycling and reduce the number of vehicles on the road.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
17	Integration with Planning System	Avoid worse-ning air quality and open S106 funding stream	SCDC	2010/ 2011	2011	Produce Supple-mentary Planning Document for Suffolk and consult	1%	Draft Document produced and consultation undertaken. Document finalised. Not adopted by this authority formally but being used as guidance for planning applications.	As per previous column No planning applications received related to this AQMA where S106 funding would be appropriate.	2012 / 2013 produced 2013 used as guidance document. S106 funding On-going	Document will ensure air quality reports are produced for planning applications when they require one. Unsure how we can measure emission reductions due to this unless application is closely associated with AQMA. Assess as and when relevant application(s) received.
18	Raise air quality awareness	Reduce traffic flows in AQMA	SCDC	N/A	On-going	Promotion of air quality and reports on website	N/A	Articles published in local magazines and papers. Air quality reports on the SCDC website.	As for previous column	On-going	No emission reduction targets possible for this measure although it can only have a positive effect To try and reduce car usage and emissions in the AQMA.
19	Monitor air quality	To report progress	SCDC	N/A	On-going	Continue monitoring	N/A	Monitoring on-going	As previous column	On-going	Monitoring is main way to inform us whether Measures are being successful. Emissions in 2011 showed a reduction but have risen again in 2012.

No.	Measure description	Focus	Lead authority	Plan-ning phase	Impleme-ntation date	Indicator	Target annual emission reduction in the AQMA	Progress to date	Progress in last 12 months	Estimated comple-tion date	Comments relating to emission reductions
20	Undertake identified feasibility studies	To fully understa nd impact of identified measure	SCDC / Suffolk County Council	N/A	2013	Feasibility studies for measures 3, 4, 5, 6 and 21 undertaken	N/A	Measure 2 no longer feasible. Feasibility studies for measures 3, 4, 5, 6 and 21 are progressing. Traffic data collected, Drive Cycle undertaken. Awaiting results of computer modelling.	Traffic data collected, Drive Cycle undertaken. Awaiting results of computer modelling	2013/2014	Feasibility studies will inform us what emission reductions we are likely to see as a result of implementing the different measures investigated. Should the studies show a reduction in NO_2 emissions within the AQMA (and no knock effects anywhere else on the junction) discussions will begin with SCC.
21	Remove the ability of traffic to go straight on from Melton Hill to Thoroughfare	Reduce queuing traffic at the lights	Suffolk County Council	2013-2014	2014-2015 Now to be considered as measure 1 has not been successful on its own	Reduction in peak queue lengths on Melton Hill.	Not known Air quality modelling will enable us to put a figure to this.	Defra approved request to use grant funding for this project. Traffic data collected, Drive Cycle undertaken. Awaiting results of computer modelling.	Traffic data collected, Drive Cycle undertaken. Awaiting results of computer modelling.	2014-15	We are not sure whether this scenario either alone or in conjunction with option 4 would cause a reduction in emissions within the AQMA, although it would seem likely. If the modelling shows a reduction in emissions we can then look at the options available to enable this to happen. Links with option 3 and option 20 above.

Measure 1 - MOVA installation (SCC)

MOVA has been fully functional since 26 June 2011. The pre-MOVA queue length surveys were undertaken in November 2009 (as the MOVA system was supposed to originally be on-line in 2010 but was delayed), and the post-MOVA queue length surveys have now been undertaken in April 2013. The surveys recorded the length in metres of the queues at each arm of the junction. The original survey was undertaken by Suffolk County Council (SCC) and the latter commissioned by Suffolk Coastal District Council using a traffic survey company. When studying the pre and post MOVA queue length surveys in detail it has been found that the timings of the data recorded are different, SCC recorded queues at arbitrary time intervals and the survey company recorded every 5 minutes. It has been possible to extract the data recorded every 5 minutes from the first survey using the timings of the latter one so we can compare this information, this data is presented in Appendix I.

Using the 5-minute comparison data we have been able to calculate an hourly average queue length for each arm of the junction, an average for the period of the traffic count (08:00-18:00 hours), and also find the number of times the queue length was 100m or more and 70m or more. The results are shown in Tables 9.4 to 9.7 overleaf.

We have also looked at all of the raw data available from both surveys to record the maximum queue lengths seen as this would not have been dependant on timings. The results are presented in table 9.8 overleaf.

The data shows varying results following the installation of the MOVA system to the junction. These are summarised below:

- Average hourly queue lengths on Melton Hill have either increased or stayed the same for all hours included in the survey.
- Average hourly queue lengths on Lime Kiln Quay Road have increased for all hours (with the exception of 13:00-16:00 hours where they have decreased).
- Average hourly queue lengths on St John's Street have both increased and decreased at different hours of the day.
- Average total queue length at the junction has increased on all arms.
- Number of times in a day that the queue length exceeds 100m+ has decreased on all arms of the junction.
- Number of times in a day that the queue length exceeds 70m+ has decreased on all arms of the junction.
- Maximum queue lengths seen on all arms of the junction during the surveys have decreased, more significantly on Melton Hill and St. John's Street than Lime Kiln Quay Road.

The results indicate that the MOVA system has been successful at reducing the extremes of queuing on all arms of the junction, but that the total average queue lengths have generally increased on all arms of the junction. Average hourly queue lengths have increased throughout the entire day on Melton Hill where the AQMA is located. Permanent traffic counters located on Melton Hill since 2009 show that there has been no significant change in traffic volumes over this period. This would indicate that the MOVA system will have potentially had no effect to reduce emissions from queuing traffic on Melton Hill affecting the AQMA.

This is borne out by the monitoring results for the junction, discussed earlier in this section - NO_2 concentrations recorded by the automatic analyser (see Table 2.6) decreased from 45µg/m^3 (seen in 2008, 2009 and 2010) to 42µg/m^3 in 2011 and it was hoped that this may have been due to the MOVA system being in place. Concentrations recorded in 2012 however rose again to 44µg/m^3. Traffic flows at the junction were fairly stable between 2010 and 2012 and Heavy Duty Vehicle percentages have also not altered significantly during this period. This suggests that the reduction in NO_2 concentrations seen in 2011 was unfortunately not associated with the MOVA system as was hoped. We are unsure why the concentrations reduced in 2011 but one suggestion could be Meteorological conditions that year.

Table 9.4 Average queue lengths recorded on each arm of the Woodbridge Junction from 08:00 to 18:00 hours

	Time	Average queue length Pre – MOVA (m) 26.11.2009	Average queue length Post – MOVA (m) 25.04.2013
Melton Hill	08:00-09:00	43	**52**
	09:00-10:00	78	78
	10:00-11:00	35	**46**
	11:00-12:00	41	**53**
	12:00-13:00	33	**49**
	13:00-14:00	31	**43**
	14:00-15:00	32	**43**
	15:00-16:00	38	**46**
	16:00-17:00	45	**48**
	17:00-18:00	25	**41**
Lime Kiln Quay	08:00-09:00	24	**43**
	09:00-10:00	35	**39**
	10:00-11:00	28	**40**
	11:00-12:00	43	**54**
	12:00-13:00	44	**52**
	13:00-14:00	**50**	43
	14:00-15:00	**48**	46
	15:00-16:00	**72**	55
	16:00-17:00	50	**58**
	17:00-18:00	49	**75**
St John's	08:00-09:00	28	**36**
	09:00-10:00	**38**	35
	10:00-11:00	22	**33**
	11:00-12:00	**41**	33
	12:00-13:00	25	**43**
	13:00-14:00	**38**	31
	14:00-15:00	**35**	30
	15:00-16:00	59	**43**
	16:00-17:00	**49**	41
	17:00-18:00	18	**36**

Table 9.5 Average queue length on each arm of the junction over the traffic count period (08:00-18:00 hours)

Location	Average queue length (m) Pre- MOVA	Average queue length (m) Post- MOVA
Melton Hill	40	**50**
Lime Kiln Quay Road	44	**51**
St. John's Street	35	**36**

Table 9.6 Number of times the queue length was 100m or above over the traffic count period (08:00-18:00 hours) on each arm of the junction

Location	Number of times queue length 100m + Pre- MOVA	Number of times queue length 100m + Post- MOVA
Melton Hill	**7**	4
Lime Kiln Quay Road	**8**	5
St. John's Street	**4**	0

Table 9.7 Number of times the queue length was 70m or above over the traffic count period (08:00-18:00 hours) on each arm of the junction

Location	Number of times queue length 70m + Pre- MOVA	Number of times queue length 70m + Post- MOVA
Melton Hill	**17**	14
Lime Kiln Quay Road	**21**	18
St. John's Street	**11**	1

Table 9.8 Maximum queue lengths seen at each arm of the junction pre and post MOVA installation

Location	Queue length (m) Pre- MOVA	Queue length (m) Post- MOVA
Melton Hill	**240**	120
Lime Kiln Quay Road	**150**	120
St. John's Street	**150**	75

Measure 3 - Extension of the Thoroughfare restrictions (SCC) – This measure will now be considered as Measure 1 (MOVA) has not been successful on its own. Air quality modelling has been commissioned, using grant funding obtained from Defra, to investigate the effect on air quality at the AQMA that removing the ability to go straight over into the Thoroughfare from Melton Hill would have. Should this scenario prove to have a positive impact to reduce NO_2 emissions and concentrations within the AQMA, without causing a negative affect elsewhere, we will investigate extension of the Thoroughfare restrictions. Effective policing of these restrictions would be required to make them of any use and this too will be investigated. Extension of the restrictions to include the busy rush hour times at the junction should have a similar affect to removing the ability to go straight over from Melton Hill in that it would reduce the number of vehicles that block the left hand filter lane traffic from flowing.

Additional traffic data required in order to undertake the computer modelling has been collected and a 'Drive Cycle' undertaken at the junction. The 'Drive Cycle' is able to be constructed using emissions data collected from an instrumented vehicle fitted with a system to record speed, acceleration, gear selection and position. This vehicle spent a whole day driving through the junction from all directions and covering all different scenarios which can occur (for example travelling straight through the lights without stopping, stopping for one light cycle, 2 light cycles, travelling at different speeds etc). The data collected was used to generate second by second emissions to map the current scenario at the junction. When looking at different options for the junction the emissions data gathered can be used to predict what changes will occur to emissions. This information is then put into a computer model to predict what changes would occur to NO_2 concentrations in the AQMA and around the junction. When the results from the computer modelling are received this Measure will be investigated further with SCC if relevant.

Measure 4 - Remove the ability to turn right from the direction of Melton Hill (SCC) – This measure will now be considered as Measure 1 (MOVA) has not been successful on its own. Air quality modelling has been commissioned, using grant funding obtained from Defra, to investigate the effect on air quality at the AQMA that removing the ability to turn right into St John's Street from Melton Hill would have. The additional traffic data required has been collected and a Drive Cycle undertaken, see Measure 3 above. When the results from the computer modelling are received this will be investigated further with SCC if relevant.

Measure 5 - Relocate Parking (SCC) – Modelling of the impacts of this proposal are being carried out as an additional part of the feasibility study work for Measure 3. It is important to ensure that moving parking from one side of the road to the other would result in an improvement in air quality as many local residents do not support this measure. Residents and Councillors are more likely to support this change than Measure 6 below, which would result in all parking being removed. SCC has advised that this Measure could be trialled at first if residents are concerned. Once the results from the computer modelling are received this will be investigated further with SCC if relevant.

Measure 6 - Remove parking - to be considered if Measure 5 is not successful (SCC) – Modelling of this Option is also being included in the feasibility study work so that a full appreciation of the impact of the Options can be obtained before

consulting residents if this is needed. Consultation responses to the Action Plan suggest that this Option would not be supported.

Measure 7 - Investigate Satellite Navigation (SatNav) system routes around town (SCDC) – SCC has suggested looking at Heavy Goods Vehicles (HGV) /lorry SatNavs, Tesco delivery routes and contacting the Chamber of Commerce to see if they know anything about business delivery routes. SCDC will investigate this but nothing further has been done to date.

SCC advised that if we can determine there is a significant amount of HGV/lorry through traffic using the junction they would support investigating the option of a lorry ban for Woodbridge. This would allow 'access only' for HGVs/lorries.

SCDC funded a further origin and destination video camera survey to include detail on HGVs. This survey looks at vehicles entering and exiting Woodbridge at Ipswich Road and Melton crossroads and travelling via the Woodbridge junction and through the AQMA. It records the time it takes the vehicles to make their journey between the two points and we can then determine whether they drove straight through or stopped on route. From this we can determine the percentage of HGVs/lorries which are classed as 'through traffic' using the route via the AQMA.

The results of the survey show that on the route travelling from Melton crossroads to Ipswich Road 27% of the HGVs/lorries were classed as 'through traffic'. On the route travelling from Ipswich Road to Melton crossroads 58% of the HGVs/lorries were classed as 'through traffic'. This equated to approximately 25 journeys (out of a total of 57) on the day of the survey. When you take into consideration that our studies have estimated that 50% of the emissions at the AQMA will be coming from HGVs/lorries but that they only make up <5% of the total traffic flow it shows that **these figures are significant**.

We will discuss with SCC the options available to try and reduce HGV/lorry 'through traffic' from Woodbridge which may be via the suggested lorry ban. We will report on our progress in the next report due for the AQMA in 2014.

Measure 8 - Bus operators to use cleanest fleet in Woodbridge (SCDC) –No further work has been undertaken on this Measure to date.

Measures 9 to 13 - Bus measures (SCC) - Suffolk County Council have set up a dedicated web-site called "Get on board" which can be found at: http://www.suffolkonboard.com/ A more general web-page is available at http://www.suffolk.gov.uk/environment-and-transport/public-transport/ Both sites deliver information on Passenger Transport, Demand Responsive Transport Services, Community Transport, Education Transport and Tendering and Contract procedures.

A new bus service came on line in December 2012 running from Leiston to Ipswich through Woodbridge (the 164 service operated by Anglian) which may take more cars off the roads and can only be positive for our AQMA.

The 165 service which ran through Woodbridge has been removed which will take some buses off the road and reduce emissions. Capacity has generally been maintained from realigning other services so no additional cars should be added.

The age profile in the bus fleet used by First Buses has improved slightly with the introduction of newer buses to meet the 2015 accessibility Regulations. Generally these are Euro III standard. First Buses also now employ on-bus monitoring equipment to ensure fuel efficient driving. This is monitored centrally and drivers who accelerate or brake sharply are advised of this.

SCC are rolling out Real Time Passenger Information for use on buses but unfortunately First Buses have some hardware issues so will not be participating.

SCC routinely monitors planning applications and where appropriate seeks contributions from developers to improve or introduce sustainable transport mitigation measures.

Measure 9 - Demand Responsive Transport (SCC) – This is a demand responsive service that provides links to bus and train services in more remote areas by phoning and making a booking. It has been put in place of bus services in remote areas where the buses were not being regularly used. See weblink for further information http://www.suffolkonboard.com/ which identifies the Areas where the service is currently set up. This includes the Alde Area, to the north of Woodbridge, which may have some influence on Woodbridge traffic and also the Wilford Area which includes Woodbridge and villages to the east. The scheme is doing really well for the Alde and Wilford areas and data has been gathered for 2012/13 which shows that there were 8,425 individual passenger journeys using Demand Responsive Transport for the Wilford Area and 4,435 for the Alde Area. The contract has been retendered for the Wilford Area for the next 4 years and was also undertaken for the Alde Area early in 2013 running until 2016.

Measure 10 – Simplified Ticket Scheme (SCC) – The Endeavour card went live at the beginning of October 2013 for 16-19 year olds with a 25% discount off single and return fares on participating public services. The card is designed to enable cashless payment in the near future on public transport services where the bus company agrees to accept it. A major operator in the Ipswich area, First Buses is participating in the scheme on a trial basis but without the ability to use it as a smart card. With other participating operators the card will have a stored value and an on-line top up ability when fully functional. Long term plans are that the card may be rolled out to all bus users (without the discount element) to allow cashless payment on buses. In the wider Suffolk Coastal area, Anglian Buses are participating fully in the Endeavour card scheme. It is hoped that this may get more people out of their cars and on to buses.

Measure 11 – Improve accessibility to bus timetable (SCC) – SCC uses a computer system with a ‘stick’ style timetable - the bus route is laid out as a straight line with each stop marked on with a dot, the arrival times for each stop are then printed in a list downwards below the dot. This makes timetables easier to read quickly and more accessible. Bus and rail timetables and additional leaflets are available on http://www.suffolkonboard.com/timetables_leaflet

Measure 12 - Turban Centre new bus station/interchange (SCC) – Design could not be agreed before budget cuts so option removed. New bus shelters installed December 2012 instead. This measure now **Completed.**

Measure 13 – Procurement of bus contracts to include fleet upgrade (SCC) – A Quality Assessment Procedure is in place and all operators seeking to be included on the list of suppliers are required to provide details of their fleet proposals as included on the Suffolk County Council web page;
http://www.suffolkonboard.com/tendering_contracts/list_of_approved_transport_suppliers

SCC has also now introduced quality scoring to their procurement process with a slant on environmentally friendly and accessible vehicles. From January 2013 new European Union Regulations will also come in which mean that there is also a score for 'socially responsible public procurement' – for example companies who employ local people, practise ethical trading etc.

Measure 14 - Car sharing scheme (SCDC) – Promotion of the website www.SuffolkCarShare.com has been historically undertaken in local magazines and papers and on the Council's website. We have not, however, undertaken any promotion since the last air quality report in 2012. The number of registered users of the scheme has increased as below, with very little increase during the past 12 months:

- October 2010 1,599 members
- July 2011 1,831 members
- November 2012 2,334 members
- October 2013 2,338 members

Current projections provided by the scheme state that for the number of current members (2,338) there will be a saving of £762.44 on average per person per year. This scheme however is county wide, so members could be located anywhere in Suffolk. Investigations into the scheme have resulted in information on the total CO_2 and number of miles saved by members living at a certain postcode. IP12 1AU (Council Offices) has been looked at and this provided a saving of 3.22g CO_2 or 8,475 miles by members of the scheme whose journeys started or ended at this postcode. This information could be obtained for other postcodes near to the junction. The only problem is that the savings are for the whole journey undertaken by the member and not just for travelling via the junction. Further work still needs to be undertaken into statistics available to see if we can obtain information that could help us estimate NOx savings within the junction. For example, the total number of saved journeys by member journeys starting or ending at postcodes close to the junction would tell us how many vehicle trips have been saved. It may then be possible to calculate emission savings from this.

Measure 15a - Business Travel Plans (SCDC and SCC) – A listing of local businesses with >20 employees has been prepared by SCDC. There are no larger businesses (+60 employees) in Woodbridge (with the exception of SCDC who already have a Travel Plan) which could make a significant difference should a Travel Plan be adopted, and so it may be difficult to provide the estimated emissions reductions suggested for this measure. Any Travel Plans adopted by local businesses will however have a positive effect in reducing emissions at the junction.

SCC has not progressed this measure during 2012 and 2013. We will liaise with them during 2014 to either move this forward or remove it from the Action Plan as a measure.

Measure 15b - School Travel Plans (SCDC and SCC) – All schools within Woodbridge and the surrounding area, with the exception of Woodbridge School (a private school), have Travel Plans in place. We will be writing to each of the schools to ask them to promote their Travel Plan where possible in relation to our local air quality problem being experienced at the Woodbridge junction.

A new piece of footpath was installed along Pytches Road, together with a 30mph speed sign which flashes on if vehicles are travelling faster than 30mph. These two things will increase pedestrian safety along Pytches Road which should encourage more families to walk to Woodbridge CPS. This is the closest school to the AQMA so it could help reduce vehicles using the junction and therefore emissions.

SCDC and SCC have now met with Woodbridge School who are interested in investigating putting together a Travel Plan. They already run school buses on 8 routes (none of which travel through our AQMA junction); Ipswich, Lowestoft, Thwaite (on A140), Bungay, Hadleigh, Stowmarket, Fressingfield, Leiston and Aldeburgh. They also share another bus service with Farlingaye High School which runs to Felixstowe, again not travelling through the AQMA junction. This will reduce the number of vehicles visiting the school. There are approximately 20 children who cycle to school but due to the number of after school sports and music lessons, which require additional equipment to be brought in, they do not expect to increase this number.

One of the areas where they have identified a potential reduction of vehicle trips to and from the school is via their catering suppliers and they are investigating this.

The school has provided information regarding the number of pupils who attend from the IP12 and IP15 area and may therefore use the AQMA junction – this is 173 families. The school believe however, due to the exact locations, that a large proportion of those families would not travel via the AQMA junction. It would therefore be very difficult to estimate what potential trip reductions could be gained at our junction by any Travel Plan adopted by the school.

Measure 15c - Travel Plan for the District Council offices (SCDC) – SCDC adopted a Travel Plan late 2009 which had nine key objectives. These were all completed in 2010. Unfortunately there are no indicators associated with the plan which could provide information regarding reduced car usage following the Travel Plan introduction. Staff mileage figures are being looked at to obtain information regarding work mileage, but this does not provide information about use of vehicles by staff in general to and from work. Further investigations are being carried out to determine whether this information can be obtained. Each year SCC undertakes a one-day staff travel survey for all local authorities. We will look at the information provided in here to see if anything can be deduced before and after the Travel Plan was put in place. Potential problem is that it is not compulsory and therefore only undertaken by a small percentage of the workforce.

The Travel Plan has now been amalgamated with a number of other policies and strategies in the Council's Joint Environmental Sustainability Policy and Action Plan (JESPAP). There are a number of actions in the JESPAP which relate to the Travel Plan and are still to be undertaken. Further detail is provided in section 9.4.

Measure 16 - cycling and walking (SCC) – SCC were not able to provide a formal report regarding the review of previous walking and cycling studies carried out, but have provided a wish list of different schemes. These schemes have not yet been analysed for feasibility or funding potential. SCC has not progressed this during 2013. We will liaise with them during 2014 to either move this forward or remove it from the Action Plan as a measure.

As discussed previously, a new piece of footpath was installed along Pytches Road, together with a flashing 30mph speed sign. These two things will increase pedestrian safety along Pytches Road which should encourage more families to walk to the school situated here – Woodbridge CPS.

The County Councillor for the Woodbridge area (Councillor Caroline Page) provided the funding to increase the number of cycle racks behind Café Nero from 3 to 5 and to install 3 cycle racks on Market Hill (where there was previously no provision). In addition, Councillor Paige funded a scheme for Sandy Lane to encourage cycling and walking and improve the links between Martlesham and Woodbridge. Sets of signs warning drivers of the presence of walkers and cyclists have bee installed and the edges of Sandy Lane have been white lined so that users can better see the edges at night.

Measure 17 - Integration with Planning System (SCDC) – An Air Quality Supplementary Planning Document for Suffolk has been prepared but not as yet formally adopted by this Authority. It is however being used as guidance for planning applications that are submitted. This document will aid in the planning process to ensure that air quality assessments are undertaken by applicants where required.

Section 106 agreements will be made as and when a planning application requires them and will not necessarily relate to the AQMA at Woodbridge as they will depend upon where the application site is situated. We have not had any applications where it has been relevant to seek S106 funding relating to our AQMA to date.

Measure 18 - Raise air quality awareness (SCDC) – This is on-going with articles published in local magazines and newspapers, Consultation undertaken on air quality in the district, and information updated on the Council's website as required.

Measure 19 - Monitor air quality (SCDC) – This is on-going at the junction using both a continuous NOx analyser and 12 diffusion tube sites in various locations, see section 2 of this report for detail. This is our main indicator to determine whether NO_2 reductions are being achieved. Monitoring results for 2011 showed a reduction in levels at most sites, but these have increased again in 2012 as discussed earlier.

Measure 20 - Undertake identified feasibility studies (SCDC) – The feasibility studies identified in the Action Plan are associated with Measures 3, 4, 5, 6 and 21. Updates are provided on each of these in the text above which advise that the traffic data has been collected for the junction and Drive Cycle analysis undertaken. The results from the Drive Cycle will be input into a computer model to investigate whether different proposals for traffic alterations at the junction would have any impact on NO_2 concentrations within the AQMA. We are currently awaiting the results of the Drive Cycle and computer modelling of a number of scenarios for the junction, these will be published in the 2014 AQMA Progress Report.

Measure 21 – Remove ability of traffic to go straight on from Melton Hill (SCC) – This measure is a fairly recent suggestion from SCC which could reduce queuing on the Melton Hill arm of the junction directly opposite the AQMA. Currently, if a vehicle wishes to travel straight over from Melton Hill into the Thoroughfare it has to wait at the lights whilst the green left hand filter is on, thus stopping any other vehicles from filtering left due to lack of room. Measure 2 was originally investigated as an answer to this problem (install a right hand queuing lane) but this has now been removed from the Action Plan as plans drawn up showed that it would bring the carriageway too close to Suffolk Place Residential Home. A request was made of Defra to use the grant money obtained to run the scenario of removing the ability of traffic to go straight over which would allow us to see if any air quality benefit would be obtained. Should the feasibility study show that an air quality benefit would be obtained options will be assessed. This measure also links in with Measure 3 (extension of the Thoroughfare restrictions) as this may be one way to reduce the number of vehicles undertaking this manoeuvre during peak hours.

Traffic data has been collected and a Drive Cycle undertaken (see Measure 3 for more details). We are awaiting results of the computer modelling.

Additional Action Plan Measures

a) Through traffic reduction

A video cordon survey was undertaken on behalf of SCDC on 25 April 2013 to look at the number of vehicles which are travelling along the B1438 between Ipswich Road and Melton crossroads via the Woodbridge junction and AQMA without stopping – and would therefore be classed as 'through traffic'.

The survey revealed that 13% of all journeys undertaken South to North (Ipswich Road towards Melton crossroads) and 10% of all journeys undertaken North to South (Melton crossroads towards Ipswich Road) can be classed as 'through traffic'. This equated to approximately 1,007 journeys (out of a total of 8,351) on the day of the survey. If a percentage of these vehicles could be re-routed along the bypass it may have an impact on traffic flows, and therefore emissions, within the AQMA.

As discussed earlier, the survey also recorded the number of Heavy Goods Vehicles (HGVs) / lorries which would be classed as through traffic. The results showed a very high percentage with 58% of all journeys undertaken South to North (Ipswich Road towards Melton crossroads) and 27% of all journeys undertaken North to South (Melton crossroads towards Ipswich Road) classed as 'through traffic'. This equated to approximately 25 journeys (out of a total of 57) on the day of the survey. This number of journeys may seem small but when you take into consideration that our studies have estimated that 50% of the emissions at the AQMA will be coming from HGVs/lorries but that they only make up <5% of the total traffic flow it shows how significant these figures are.
This is discussed in more detail under Measure 7 previously.

Previously SCC was asked to look at options for reduction of through traffic along this route. They advised that a formal report on the feasibility of options for re-routing of traffic, traffic calming and 20mph speed limits would be prepared but this has not been received. Preliminary considerations suggest that traffic calming is

unlikely to be feasible, since it would encourage rat-running and increase the likelihood of generating air quality problems elsewhere. Emergency vehicles would also still need to use this route. We will approach the new contacts at SCC to discuss the results of the survey (particularly with respect to the HGVs) and provide an update in our next report for 2014.

b) Traffic Signing

A number of Consultation responses requested a review of traffic signing on the main routes into Woodbridge with a view to trying to reduce vehicles being directed through the town unnecessarily. The new sign for the approach to the Melton Cross Roads from Wilford Bridge has been installed by SCC. This should ensure that traffic gets into the correct lane to minimise unnecessary trips into Woodbridge.

In addition, SCC replaced some signs on Quayside opposite the Hamblin Road exit from the car parking areas. These signs originally sent A12 traffic to the east, along Lime Kiln Quay Road and through the junction to Melton crossroads. The team has taken on board the need to reduce unnecessary trips through the junction and the signs now direct A12 traffic to the west along Ipswich Road and out. This minor alteration will hopefully decrease some of the traffic passing through the junction.

9.4 Joint Environmental Sustainability Policy and Action Plan 2012–2022 (JESPAP)

The Council's JESPAP combines and replaces a number of Policies and Documents including the Council's Climate Change Strategy and the Green Travel Plan. It sets out a number of priorities where the Council will focus its efforts and those relevant to our AQMA are:

5.1.1 Continue in our efforts to reduce the Councils' use of energy, fuel and water and amount of waste going to landfill through building and fleet management, improving information and communication technology and staff engagement.

5.4.6 The Council will through meeting its strategic objectives: Fulfil its duties under the Environment Act 1995 to produce and implement Action Plans for any declared Air Quality Management Areas within the districts.

The Council has already undertaken measures under the original Climate Change Strategy and Green Travel Plan which would have a positive impact on emissions within our AQMA as it is located very close to the Council Offices at Melton Hill;

- Improvements to the Council's fleet vehicles
- Video conferencing facilities installed at the Council Offices to reduce need to travel.
- The Suffolk Coastal Business Advice Service has undertaken 146 energy audits of local small and medium sized enterprises offering suggestions to reduce energy use. Travel is one of the criteria looked at for some businesses.

The JESPAP Action Plan includes a number of measures which will assist with emission reduction within the district and therefore aid with work within our AQMA;

- Action 10 – Efforts to reduce emissions reported through the annual greenhouse gas report. To demonstrate commitment to reducing greenhouse gas emissions and highlight reasons for any significant shifts in direction of travel.
- Action 12 - Support and facilitate the Councils' Officer Greenest County Steering Group and Green Team action to engage staff and encourage a shift towards reducing energy and water use, homeworking, teleconferencing, videoconferencing, online training, car sharing, and use of trains and cycles and more fuel efficient driving.
- Action 13 - Amend the Suffolk Coastal Lift Home Scheme as appropriate and to include cyclists and adopt across the two Councils. To increase the numbers of staff cycling or car sharing to and from work.
- Action 14 - Extend the Waveney Cycle to Work scheme to cover Suffolk Coastal. To increase the numbers of staff cycling to and from work.
- Action 27 - With the Suffolk Sustainable Travel Forum endeavour to facilitate major investment in public transport to improve existing services and develop new ones.
- Action 33 - Ensure delivery of the sustainable transport initiatives as set out in Suffolk's Local Transport Plan 2011-2031. Encourage a shift to more sustainable travel patterns

As the Woodbridge AQMA is located close to the Council Offices any actions which will reduce vehicle emissions from the Council itself will aid in emission reduction within the AQMA as many Council journeys will travel through the junction.

9.5 Planning Applications

There are 7 planning applications mentioned in the Progress Report, see Section 5. Two of these applications could impact on the AQMA due to their location, but only minimally. The others are located too far away to have an impact.

Land at junction of Station Road and Wilford Bridge and Girdlestone Pumps, Station Road, Melton (C09/0584)

This application was for the demolition of the Girdlestones building to be replaced by the erection of 10,735m^2 of light and general industrial use. This will consist of two and three storey business units to include offices, workshops, coffee shop/café. There will also be associated external works, off site highway works and formation of new access to Station Road.

The application provided an Air Quality Assessment which determined that overall it is considered that the impact of the proposed development on the ambient air quality near the development site and at the junction of Wilford Bridge Road and Melton Road will be very small and will not cause a breach of the limits set out in the Air Quality Limit Value Regulations of 2000.

At the Woodbridge Junction, where our AQMA is located, the increase in traffic from this development was predicted to be 3 light duty vehicles during the peak hour flow which was not considered significant and does not constitute a material consideration in the assessment of the planning application.

The Air Quality Assessment was reviewed by this Department and the findings accepted. The application was determined on 4 March 2010 and approval was given. Work has not yet begun on the site.

Redevelopment of Adastral Park, Martlesham Heath (C09/0555)

This is a revised outline planning application submitted for the regeneration of Adastral Park and land to the east and south. Adastral Park itself covers nearly 40 hectares (100 acres), and British Telecommunications plc (BT) own a further 100 hectares (250 acres) of land surrounding the site, much of which has been or will be quarried to extract sand and gravel. BT's revised outline planning application includes refurbishment of Adastral Park and development of the adjoining land for the creation of a new residential community with its own infrastructure, services and facilities.

The site is approximately 7 km fro the AQMA in Woodbridge and it will therefore have little impact on the AQMA. Possibly some residential traffic may visit Woodbridge occasionally but as they would enter Woodbridge to the west of the AQMA they would be likely to park before they encounter the AQMA junction. Any impacts will therefore be negligible.

10 AQMA Action Plan Progress Report for The Dooley Inn, Ferry Lane, Felixstowe

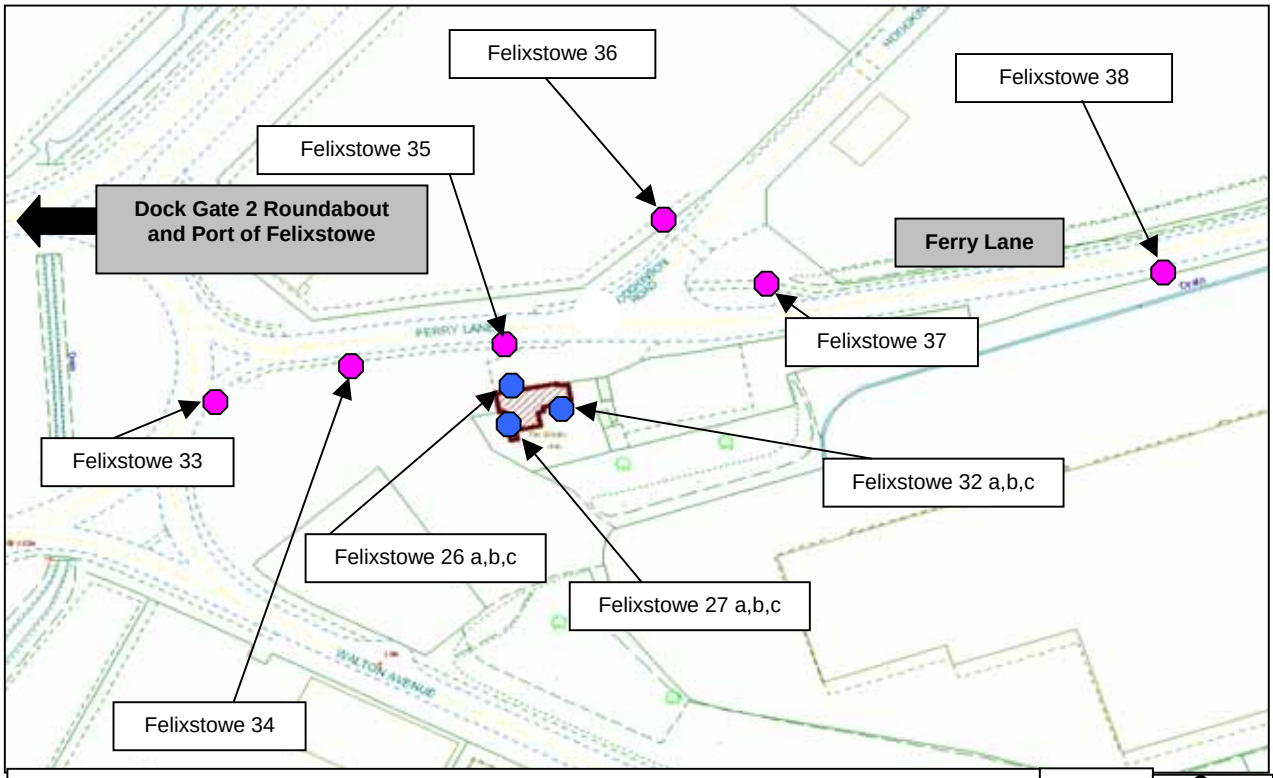
10.1 Introduction

On 1 May 2009 an Air Quality Management Area Order was made by Suffolk Coastal District Council for the Dooley Inn, Ferry Lane, Felixstowe with regard to the annual mean NO_2 concentration. A copy of the AQMA Order is included as Appendix B and a location map is provided below as Figure 9.1.

External consultants Transport Research Laboratories (TRL) were commissioned to complete the Further Assessment and Action Plan required for the AQMA.

The Further Assessment was produced in April 2010 and received Defra approval. As part of the Further Assessment, a source apportionment exercise was conducted to calculate the proportion of oxides of nitrogen (NOx) that are emitted from different sources and their impact on the AQMA. The results showed that there are two main contributors to the NOx concentrations at the AQMA; container handling operations (including vehicles on roads within the Port boundary) (36.9%), and emissions from heavy duty vehicles (HDVs) on roads outside the Port boundary (28.5%).

Figure 10.1 AQMA declared at The Dooley Inn, Ferry Lane, Felixstowe (hatched in dark red) and locations of diffusion tube monitoring



The Final Action Plan was completed in September 2012 and approved by Defa, this can be viewed at: http://www.suffolkcoastal.gov.uk/assets/Documents/District/Air-quality/FelixstoweFerryLaneAQAPSeptember2012.pdf The Action Plan takes into account comments received from Defra and from the wider consultation exercise. These have not led to any alteration in the final list of options. The report identifies measures to be adopted as part of the formal Action Plan and sets out how these measures will be implemented and monitored.

Table 10.2 contains an updated summary of progress made on each of the measures within the Action Plan. Additional details regarding the measures are also provided in the main text following the table.

10.2 Monitoring Data

A summary of monitoring data from the diffusion tubes in the vicinity of the AQMA, together with the Urban Background site for this area (FLX 21), for 2012 is presented overleaf in Table 10.1. In addition, results for 2008, 2009, 2010 and 2011 have also been included in the table for comparison purposes. Concentrations above the objective at sites which are relevant (residential dwellings) are highlighted in bold. Further details are presented in section 2 of this report, with detailed results presented in Appendix F.

There are 9 monitoring locations in the vicinity of the AQMA, 3 of which (FLX 26, 27 and 32) are within the AQMA itself. The additional sites (FLX 33, 34, 35, 36, 37 and 38) are not situated at relevant receptors (residential dwellings). These sites were put in place to help ascertain NO_2 levels in the locality of the declared AQMA in order to provide additional information on sources of NOx more local to the Dooley Inn.

In 2012, annual mean NO_2 concentrations at all of the 3 monitoring locations within the AQMA fell below the air quality objective level of 40µg/m^3. Historically FLX 26, situated on the front façade of the Dooley Inn facing Ferry Lane, is the only site where the annual mean NO_2 objective level of 40µg/m^3 was exceeded and this continues to be the site with the highest concentrations in 2012 at 36µg/m^3.

Included in Table 10.1 are records for FLX 21 which is an Urban Background site for the Felixstowe and Trimley area, this site provides data for a nearby area not affected by emissions related to the Port of Felixstowe or any other significant nearby source. This site shows fairly stable levels between 2009 and 2011 with a reduction seen in 2012. This trend is also seen at all of the sites presented In Table 10.1. It is therefore important that we continue to monitor concentrations in these areas in order to determine whether the reduction is related to the locality of The Dooley Inn and not Meteorological conditions or general monitoring issues in 2012.

The additional monitoring sites FLX 32-38 show the highest concentration of NO_2 to be at Dock Gate 2 roundabout (FLX 33). The concentrations then reduce as you travel away from Dock Gate 2 roundabout towards The Dooley Inn (FLX 34 and 35) and then past it, with FLX 38 being the furthest site from Dock Gate 2 roundabout and below the objectives at 34µg/m^3. Monitoring at the entrance to Hodgkinson Road (FLX 36 and 37) shows higher concentrations on the side where vehicles exit the junction (43µg/m^3 at FLX 37), similar concentrations are also seen on the signpost at the front of The Dooley Inn (FLX 35). This indicates that local Heavy

Goods Vehicles associated with the depots in Hodgkinson Road are an emission source more relevant to our AQMA than previously thought.

All monitoring locations have been kept in place for 2013 and will also be retained in 2014. The results for 2013 will be reported in the 2014 AQMA Progress Report.

Table 10.1 Results of Nitrogen dioxide diffusion tube monitoring at sites near to the Dooley Inn, Ferry Lane, Felixstowe AQMA (2008-2012)

Site ID	Location	Within AQMA?	Annual mean concentration bias adjusted ($\mu g/m^3$) *(Adjustment factor used for 2012 = 0.88)*				
			2008	2009	2010	2011	2012
FLX 21	4 Kingsfleet Road, Trimley St. Mary (Urban Background)	No	27	25	24	25	22
FLX 26a,b,c	Front of The Dooley Inn at first floor window height	**Yes**	**42**	**45**	**43**	**40**	36
FLX 27a,b,c	Side of The Dooley Inn facing the Port of Felixstowe	**Yes**	36	38	33	36	33
FLX 32a,b,c	Guttering at rear of Dooley Inn facing the rear garden	**Yes**	~	~	~	37	34
FLX 33	Dock Gate 2 Roundabout. Not relevant receptor	No	~	~	~	**66**	**60**
FLX 34	Ferry Lane, Midway between roundabout and Dooley Inn. Not relevant receptor	No	**~**	**~**	**~**	**51**	**46**
FLX 35	Dooley Inn signpost at front. Not relavant receptor	No	**~**	**~**	**~**	**48**	**44**
FLX 36	Street Sign in Hodgkinson Road. Not relevant receptor	No	**~**	**~**	**~**	**41**	37
FLX 37	Lampost at Ferry Lane on corner of Hodgkinson Rd. Not a relevant receptor	No	**~**	**~**	**~**	**48**	**43**
FLX 38	Lampost on Ferry Lane, past Hodgkinson Rd. Not a relevant receptor	No	**~**	**~**	**~**	39	34

10.3 Action Plan Measures update

Since the Action Plan was finalised in 2012/13 we have obtained results of diffusion tube monitoring for 2012. These show that annual mean NO_2 concentrations within the AQMA have fallen below the air quality Objective. Several more years of monitoring data will be needed to confirm whether this is a true trend and not related to Meteorological Conditions or any general monitoring issues. However, with the reduced concentrations in mind, it is our intention to move some of the Planning and Implementation dates for our measures further into the future. This will be reviewed each year in light of monitoring results obtained.

Table 10.2 Action Plan Progress Summary Table 2012

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
1a	Air Quality awareness campaign	Target local businesses using major roads in the area e.g A14. Reduce unnecessary traffic and emissions in the AQMA and local area.	Suffolk Coastal District Council	2014-15 Only if the NO_2 conc. rises back above objectives	2015-16	Measured concentrations at the Dooley Inn public house	N/A	Draft action plan consultation has increased awareness of air quality issues in the area amongst businesses and members of the public.	Concentrations at the Dooley Inn public House were below the objective in 2012.	2016-17	This measure will only be undertaken if concentration of NO_2 in the AQMA increases above objectives.
1b	Implement an Environmental Management System at the Port	Reduction of emissions from port activities. Includes employee and tenant education in best practice which will encompass emission reduction.	Port of Felixstowe	2005	2007-2011	No direct indicator Continued certification to ISO 14001	N/A	First implemented and certified to Port Environmental Review System (PERS) in 2006. Developed through the stages of BS8555 from 2007 to full ISO14001 certification from 2011.	Continued certification to ISO14001 Delivered training on EMS and individual responsibilities to approx 200 employees in 2011/12	**Completed** and now on-going	

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
2a	Engage National / EU / international governments to develop policies which influence port activities to improve air quality.	Reduction in NOx emissions from Port activities countrywide	Suffolk Coastal District Council	2014-15	2014-15	No direct indicator	N/A	None	This measure will be considered further if the objective is exceeded in the future	2014-15	Port of Felixstowe agreed; acknowledged that all ports should consider adopting a strategy to overcome competition issues.
2b	Develop Port action plan re emissions from processes over a longer term (5 years)	Reduction in NOx emissions from Port processes	Port of Felixstowe		2011 and on-going	Emissions monitoring of NO_2 and SO_2 at the Port (including CO2 emissions)	N/A	Estimates from the Port's five year carbon reduction plan is an annual reduction of approximately 4000 tonnes CO_2. Plan reviewed annually and now part of energy management system, (EnMS).	NO_2 concentrations monitored since 2007 in a number of locations. Have seen significant and sustained improvements since 2007. SO_2 monitored since 2009, annual mean concentrations fallen by over 80%.	**Completed** and on-going	Table showing NO_2 and SO_2 monitoring results included in text below.

No.	Measure	Focus	Lead Authority	Planning Phase	Implemen-tation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
2c	Identify Section 106 planning gain opportunities to balance any future air quality impact caused by local development	Mitigate any increases in emissions from future development	Suffolk Coastal District Council	On-going	On-going	Uptake/ implementation of Section 106 agreements.	N/A	There have been no Planning applications in the area where S106 agreement could be implemented	There have been no Planning applications in the area where S106 agreement could be implemented	On-going	Potential to mitigate increase in emissions. Measures. might involve providing sustainable transport options and could include installing long term air quality monitoring.
3a	Evaluate and implement efficient power technologies (e.g. hybrid-electric) for cargo handling equipment (rubber tyre gantry (RTG) cranes) and internal movement vehicles (IMVs) in the Port	Reduction of NOx emissions from Port equipment	Port of Felixstowe	On-going	On-going	Power use at the Port	N/A	The Port has purchased 22 eco-RTGs – these run at maximum efficiency, leading to reductions in emissions – 40% reduction in fuel use.	The port is planning to convert two sections of the Trinity Terminal to accommodate four fully electric RTGs. This trial project should be implemented early 2014.	On-going 2014 for fully electric RTGs trial	Information on power use at the Port is included in the main text below and shows that use has decreased since 2008. This will have led to reduced emissions.

No.	Measure	Focus	Lead Authority	Planning Phase	Implemen-tation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
3b	Retro-fitting fuel saving controls to existing Rubber Tyred Gantry (RTG) cranes in the Port.	Reduction of NOx emissions from Port equipment	Port of Felixstowe	2011	2011	Power use at the Port	N/A	The Port has carried out retro-fit of 22 RTGs - greater than 25% of the fleet	n/a	**Completed**	Reduction in fuel use of approximately 25% compared to original RTGs.
3c	Investigate feasibility to convert IMVs in the Port from diesel fuel to liquefied natural gas (LNG).	Reduction of NOx emissions from Port equipment	Port of Felixstowe	On-going	On-going	No direct indicator	N/A	Port is investigating this – issues with net emission savings owing to the practicalities of storing LNG - to be considered further.	Investigations continuing	On-going	Possible reductions in NO_X, PM_{10} and CO_2. Difficult to quantity.

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
3d	Adopt NO_X abatement technologies on Internal Movement Vehicles (IMVs) in the Port.	Reduction of NOx emissions from Port equipment	Port of Felixstowe	2010	2011 (ongoing replacement plan)	Emissions monitoring of NO_2 and SO_2 at the Port (including CO2 emissions)	N/A	The Port were to start fitting Adblue (selective catalytic reduction) to IMVs. This has not been undertaken but instead 34 IMVs were replaced in 2011/ 2012 and a further 22 are due in 2014. Effectiveness of technologies such as SCR investigated in literature review.	Port have reviewed report and provided comments – see main text after table Further 22 IMVs to be replaced in 2014. Will have reduced emissions	On-going	Table showing NO_2 and SO_2 monitoring results included in main text below Replacement IMVs comply with Euro IIIa Emission standards instead of Euro I standards which means they have reduced emissions.

No.	Measure	Focus	Lead Authority	Planning Phase	Implemen-tation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
4	Use of a vehicle booking system (VBS) to manage access to the Port.	Spread HGV flows more evenly throughout 24 hour period to reduce congestion.	Port of Felixstowe	~		Traffic flows (HGVs).	N/A	System implemented, all vehicles now book a time slot to arrive. If arrive out of time slot, it is not allowed on to the Port and required to re-book. Strictly enforced.	n/a	**Completed**	If book at night (between midnight and 7am) can arrive anytime - encourages more deliveries during this time period. Has changed traffic flows in and around the Port, significantly reducing peak HGV flows. See main text below.

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
5a	Review of air pollution mitigation options being considered in UK, European and non-European ports	Investigate other potential measures for reduction of emissions from Port activities.	Suffolk Coastal District Council	2012	2013	No direct indicator Report completed	N/A	TRL commissioned to produce report	Report produced, sent to the port of Felixstowe and their comments received and detailed in this section of the report.	**Completed**	Comments from the Port of Felixstowe regarding each option confirmed that some are being undertaken and researched already and others are not currently viable. Noted for the future if needed.
5b	Vehicle number plate surveys	Gain clear understanding of vehicle fleet - age and type of HGVs at specific locations.	Suffolk Coastal District Council	2011	2011/12	No direct indicator. Can assist in quantifying the impact from articulated HGVs over time if repeated	N/A	Report commissioned and produced 2011/12.	Results analysed and show activity from the goods yard does not appear to be affecting air quality concentrations at the Dooley Inn to any greater extent than previously thought. Confirms findings of our earlier reports.	**Completed**	Allows tailored options to target more polluting vehicle types in vicinity of the Dooley Inn AQMA

No.	Measure	Focus	Lead Authority	Planning Phase	Implemen-tation Phase	Indicator	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months	Estimated Completion Date	Comments Relating to Emission Reductions
5c	Develop a Supplementary Planning Document (SPD) – Air Quality.	Ensure that emissions impacts from proposed developments are fully assessed.	Suffolk Coastal District Council	2010/11	2012	No direct indicator	N/A	Report completed in 2012, not formally adopted by SCDC but being used as guidance	This guidance has been used for all relevant planning applications on the district.	**Completed and in use**	Establishes planning control mechanism to appraise potential air quality impacts of proposed development, especially within or near to existing AQMAs.

Of the 13 measures set out In the Action Plan, 7 have already been completed - 3 by Suffolk Coastal District Council and 4 by the Port of Felixstowe. All other measures which are the responsibility of the port of Felixstowe have been started and are on-going.

Measure 1a – Awareness Campaign (SCDC)
We have moved the Planning and Implementation dates for this measure further into the future and these dates will be reassessed year on year in light of monitoring results. Consultations undertaken on the draft Action Plan and our annual air quality reports will themselves increase awareness for the public and within the business sector. Consultations are usually published within the local press, on the Hauliers Association website and with any other publications that are due at the time. An air quality article is also usually placed within the Suffolk Coastal magazine (Coastline) which goes out to all residences within the district.

Measure 1b – Port of Felixstowe Environmental Management System (EMS) (PoF) - Completed
In 2011 the Port obtained full ISO14001 certification for their Environmental Management System which continues to be in place. They delivered training on the EMS and individual responsibilities to about 200 employees in 2011/12. With the EMS in place best practice should be followed when carrying out business so that, for example, employees follow eco-driving practises, efficient handling and best practise in construction. This should in turn reduce emissions from a number of activities undertaken at the Port.

Measure 2a – Engage Governments to develop policies to improve air quality from Port activities (SCDC)
We have moved the Planning and Implementation dates for this measure further into the future and these dates will be reassessed year on year in light of monitoring results.

Measure 2b – Develop Port Action Plan (PoF)
This measure is to develop a Port Action Plan which considers the net effect of emissions from processes over a longer term (five years). The Port currently has a 5 year carbon reduction plan which is reviewed annually. Estimates are that outputs of the plan are responsible for an annual reduction of approximately 4000 tonnes CO_2 at the Port. This Plan is now part of the EMS at the Port.

Both nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) concentrations are measured at the Port, NO_2 has been since 2007 and SO_2 since 2009 which gives an indication of trends over time. The locations of monitoring points are shown on the map in Figure 10.1 overleaf. All SO_2 locations are on the rear legs of the quay cranes, NO_2 monitoring points are in two main areas; near to the Dooley Inn AQMA and near to the Adastral Close residential area.

The results of monitoring are detailed in Tables 10.3 and 10.4. The results of NO_2 monitoring show a reduction in levels from 2007, there was a spike in 2010 at all locations but NO_2 concentrations have all decreased again since this time. The results of SO_2 monitoring show a reduction at all locations year on year since monitoring began in 2009.

These results indicate that emissions of NO_2 and SO_2 from the Port of Felixstowe site are reducing over time. Results from NO_2 monitoring locations run by Suffolk Coastal close to the Port boundary (Ferry Lane, Adastral Close and Levington Road) can be seen in Section 2 of this report (Table 2.6) and also show reductions in levels since 2008, but do not mirror the 2010 spike shown in the Port's results.

Table 10.3 Port of Felixstowe NO_2 Monitoring Results 2007-2012

Site ID	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]					
	2007	2008	2009	2010	2011	2012
Mallard House (Site 2)	**50.1**	**49.4**	**47.4**	**49.8**	**45.7**	**45.5**
Central Eng. / Stores Car Park (Site 3)	**49.3**	**49.3**	**46.6**	**48.6**	**44.0**	**42.5**
Pier House LT7113 (Site 4)	~	34.8	32.4	35.1	33.0	32.9
Pier House LT7120 (Site 5)	~	33.7	31.3	33.6	31.3	31.7
Landguard Eng LT7404 (Site 6)	~	36.4	32.4	33.4	30.8	29.5
90 Park LT7403 (Site 7)	~	31.9	30.7	32.4	30.2	30.0
90 Park LT7410 (Site 8)	~	30.2	28.4	29.7	27.9	27.1
75 Park LT7402 (Site 9)	~	37.1	35.4	38.2	35.4	34.8
75 Park LT7507 (Site 10)	34.7	33.1	31.6	32.0	29.5	29.1

Table 10.4 Port of Felixstowe SO_2 Monitoring Results 2007-2012

Site ID	Annual Mean Concentration (µg/m^3)					
	2007	2008	2009	2010	2011	2012
QC5 - Berth 1 & 2	~	~	13.0	7.4	5.9	2.4
QC10 - Berth 3 & 4	~	~	14.3	8.8	7.2	2.9
QC15 - Berth 5	~	~	15.6	6.9	5.2	2.3
QC20 - Berth 6	~	~	16.8	7.3	5.9	2.6
QC25 - Berth 6 & 7	~	~	14.7	5.1	4.4	2.9
QC29 - Berth 7	~	~	12.6	6.0	5.2	2.1
QC1 - Berth 8	~	~	~	~	6.7	2.9
QC 4 - Berth 9	~	~	~	~	3.6	2.9

Measure 2c – Identify Section 106 Planning gain opportunities (SCDC)

All relevant planning applications for the district are assessed for their impacts on air quality, particularly with respect to declared AQMAs. There were no planning applications received for this area which would require Section 106 agreements to be made in 2012/13.

Measure 3a – Evaluate and implement efficient power technologies (PoF)
The Port has invested in a number of environmental projects recently and will continue to do so, where practicable. They have purchased 22 eco-Rubber Tyred Gantry Cranes (RTGs), these have smaller engines which allow them to run at maximum efficiency - leading to reductions in emission. They are also planning to convert two sections of the Trinity Terminal to accommodate four fully electric RTGs. This trial project should be implemented early 2014.

The Port of Felixstowe has advised that their energy use increased slightly in 2011 and 2012, but is still down by about 13% on 2008 figures. During this same period the port has expanded significantly with Berths 8 and 9 now fully operational and a new rail terminal. The increase in rail traffic, whilst reducing heavy goods vehicle traffic, does increase their internal energy use, but the net benefit in terms of emissions is about 200%. There are also a lot of projects under way at the port at present (approximately 30) to reduce energy consumption and the first all-electric RTGs will be operational next year, further reducing emissions.

These figures indicate that overall energy use at the Port has reduced (when offset by the expansion) even in recent years.

Measure 3b – Retro-fit fuel saving controls to existing RTGs (PoF)
The Port has already carried out retro-fitting of 22 RTGs covering more than 25% of their fleet. These have a reduction in fuel use of approximately 25% compared to the original RTGs. The indicator for this measure is again power use at the Port, as detailed in 3a above, which has decreased overall at the Port since 2008.

Measure 3c – Investigate converting IMVs from diesel fuel to liquefied natural gas (LNG) (PoF)

These investigations are on-going.

Measure 3d – Adopt NOx abatement technologies on Internal Movement Vehicles (IMVs) (PoF)
The Port planned to purchase 35 new IMVs during 2011 as part of an on-going replacement plan. 17 new IMVs were purchased in 2011 and 17 purchased in 2012 which were delivered early in 2013. 22 additional units have been ordered in 2013 to be delivered early in 2014.

The original intention was to fit these new IMVs with selective catalytic reduction using Adblue which could have possible reductions in NOx emissions. Adblue has not been fitted, however these are replacement machines and the emissions standards they comply with are Euro IIIa which is a significant improvement over the ones replaced which had Euro I emission requirements. Emissions from IMVs will therefore have reduced since 2011 and will continue to do so with the additional replacement ones due in 2014.

The Port monitor how effective the replacement vehicles are through their NO_2 and SO_2 monitoring undertaken on the Port site which has shown reductions in recent years – see measure 2b for data and more detail.

Measure 4 – Vehicle Booking System (PoF) - completed

A Vehicle Booking System was implemented at the Port of Felixstowe which became mandatory in 2008. All vehicles have to book a time slot in which they can arrive. If a vehicle arrives out of its allotted time slot, it is not allowed on to the Port and is required to re-book. This is strictly enforced. At night time, if booked, vehicles can arrive any time between midnight and 7am – to try and encourage more deliveries during this quieter time period. This and other traffic management systems have changed traffic flows in and around the Port, significantly reducing peak Heavy Goods Vehicle (HGV) flows. This has enabled increased efficiency of container handling.

Queues previously seen on Dock Gate 2 Roundabout appear to be reduced. The Port of Felixstowe has advised that peak HGV flows are tending to reduce slightly and instead shifting to less busy periods. In addition, since the VBS was introduced in 2008 the number of containers exchanged (job ratio) per HGV has improved from 1.53 in 2008 to 1.71 in 2012. This means that more work is being undertaken by each HGV entering the Port which equates to emission reductions per 'job' undertaken.

Measure 5a – Literature review of air pollution mitigation options (SCDC) – completed

A literature review has been undertaken and the report was produced in March 2013. It provides a review of air pollution mitigation options for ports in the UK, Europe and worldwide. The review identifies 27 different measures relating to ocean going vessels and harbour craft, cargo handling, lorries, trains and construction equipment, management measures, and more broader measures. Some measures are already implemented by the Port of Felixstowe (Vehicle Booking System) and some are not viable here as yet (cold-ironing – shore based power for ships – not enough grid power available in the area for this). The literature review is attached as Appendix J.

The literature review has been sent to the Port of Felixstowe who has commented on each measure outlined, their comments are attached as Appendix K.

Details from the Port's covering letter are included below:

"Regarding air quality in general, the trends we are seeing are significant and sustained improvement primarily through action implemented by the Port of Felixstowe.

We are planning to continue to implement measures which will continue to reduce the port's emissions. The attached summary of the literature review of mitigation options includes a weighting factor derived from the source apportionment contribution to oxides of nitrogen (NOX) concentration at the Dooley Inn from the Local Air Quality Management Action Plan report by TRL for SCDC. This should help to focus resource towards areas most likely to have an impact on air quality at the monitoring site.

From this weighting factor it can been seen that container handling is the largest contributing factor, however this still only represents around 1/3 of the total contributing sources. This area has seen the greatest investment and subsequent improvement in NO_2 emissions. Going forward the continued

planned investments will see further improvements, but it should be noted that these will likely have a diminishing impact in terms of improvements at the AQMA site.

This source apportionment suggests that shipping contributes less than 10% to the NO_2 concentrations at the Dooley Inn. Again this is likely to have reduced with improvements in engine technologies and efficiencies. The opportunities for the port to influence this area are limited, and with such a low contributing factor any investment is likely to give a low return, e.g. the cost to supply vessels with shore power would be disproportionate to the environmental benefit.

The next largest contributor is external road (HDV) at 28.5%. Besides the contributions made to date by the port (i.e. modal shift to rail), and the management of traffic implemented through the ports Vehicle Booking System and subsequent traffic flow improvements, it is unclear what other measures are being made to tackle this area via the contribution of other actors.

In summary, the Port of Felixstowe's environmental management is significantly improving air quality in an area where there is low risk to public health from air quality and "*The Dooley Inn public house was the only relevant receptor where an exceedence of the annual mea n NO_2 objective was predicted or measured*" (Transport Research Laboratory 2012). Many of the measures in the literature review are very high cost and are in the early stages of use, or proposed for ports within major urban conurbations with significant air quality issues, unlike Felixstowe. Any proposals should be proportionate to the environmental and/or public health risk and possible benefit here at Felixstowe."

We agree with the above comments made by the Port of Felixstowe, especially in light of reduced NO_2 concentrations within the AQMA which bring the levels in 2012 to within the air quality objectives. We would not look for any further unplanned investment at this time. The literature review does, however, provide us with options to reconsider in the future should the NO_2 concentrations rise above the objectives again.

Measure 5b – Vehicle number plate surveys (SCDC) – completed

This is detailed in section 7.2 and Appendix E of the AQMA Action Plan. Suffolk Coastal District Council commissioned TRL to undertake an automatic number plate recognition (ANPR) camera survey to investigate vehicle movements together with age and type of vehicle in close proximity to the Dooley Inn. This was in order to see whether there may be a more local source of emissions affecting concentrations in the AQMA. The main results are summarised as follows:

- Identified disproportionate emissions from articulated heavy goods vehicles (HGVs), adding further evidence to support the findings of the source apportionment exercise (completed as part of the 2010 further assessment): approximately 86% of road NO_X emissions were found to be generated by articulated HGVs, whereas this vehicle type constitutes approximately 25% of local traffic.

- Overall, the activity from the goods yards in Hodgkinson Road does not appear to be affecting air quality concentrations at the Dooley Inn to any greater extent than previously thought.

- The survey does not take into account cold-starting or emissions from idling vehicles. These activities may have an impact on the annual mean NO_2 concentration at the Dooley Inn. Further work may therefore focus on

understanding cold-starting and idling emissions within local haulage depots if deemed necessary.

Measure 5c – Develop Supplementary Planning Document (SCDC)
The Supplementary Planning Document for Suffolk Local Authorities was completed in 2012. It has not been formally adopted by SCDC but is being used by the Environmental Health Department for all planning applications as guidance for air quality matters.

10.4 Joint Environmental Sustainability Policy and Action Plan 2012–2022 (JESPAP)

The Council's JESPAP combines and replaces a number of Policies and Documents including the Council's Climate Change Strategy and the Green Travel Plan. It sets out a number of priorities where the Council will focus its efforts and those relevant to our Felixstowe AQMA are:

5.1.1 Continue in our efforts to reduce the Councils' use of energy, fuel and water and amount of waste going to landfill through building and fleet management, improving information and communication technology and staff engagement.

This measure is of relevance as the Council's Port Health Department is located within the Port of Felixstowe and employees will use Dock Gate 2 roundabout for access.

5.4.7 The Council will through meeting its strategic objectives: Fulfil its duties under the Environment Act 1995 to produce and implement Action Plans for any declared Air Quality Management Areas within the districts.

The Council has already undertaken measures under the original Climate Change Strategy and Green Travel Plan which would have a positive impact on emissions;

- Improvements to the Council's fleet vehicles
- Video conferencing facilities installed to reduce need to travel.
- The Suffolk Coastal Business Advice Service has undertaken 146 energy audits of local small and medium sized enterprises offering suggestions to reduce energy use. Travel is one of the criteria looked at for some businesses.

The JESPAP Action Plan includes a number of measures which will assist with emission reduction within the district and therefore aid with work within our AQMA;

- Action 10 – Efforts to reduce emissions reported through the annual greenhouse gas report. To demonstrate commitment to reducing greenhouse gas emissions and highlight reasons for any significant shifts in direction of travel.

- Action 12 - Support and facilitate the Councils' Officer Greenest County Steering Group and Green Team action to engage staff and encourage a shift towards reducing energy and water use, homeworking, teleconferencing, videoconferencing, online training, car sharing, and use of trains and cycles and more fuel efficient driving.
- Action 13 - Amend the Suffolk Coastal Lift Home Scheme as appropriate and to include cyclists and adopt across the two Councils. To increase the numbers of staff cycling or car sharing to and from work.
- Action 14 - Extend the Waveney Cycle to Work scheme to cover Suffolk Coastal. To increase the numbers of staff cycling to and from work.
- Action 33 - Ensure delivery of the sustainable transport initiatives as set out in Suffolk's Local Transport Plan 2011-2031. Encourage a shift to more sustainable travel patterns

As the AQMA is located close to Dock Gate roundabout any actions which will reduce vehicle emissions from the Council itself will aid in emission reduction in the locality of the AQMA.

10.5 Planning Applications

There are 7 planning applications mentioned in the Progress Report, see Section 5. Only 3 of these applications are within Felixstowe but, due to their location and the type of proposal, will not really have any impact on the AQMA declared at Ferry Lane.

11 Conclusions and Proposed Actions

11.1 Conclusions from New Monitoring Data

Monitoring undertaken in 2012 by the automatic NO_X analyser and diffusion tubes situated within the AQMA at Woodbridge confirm that the annual mean NO_2 objective continues to be exceeded but that the 1–hour objective is not exceeded. Concentrations recorded by diffusion tubes within the AQMA at Felixstowe have shown a further reduction in 2012, the highest recorded concentration now being 36µg/m^3 - below the Air Quality Objective.

The results of NO_2 monitoring undertaken across the district in 2012 using diffusion tubes show a number of sites within the district where the annual mean NO_2 objective is exceeded. With the exception of 1 location, at Stratford St. Andrew, all sites at relevant receptor locations are within the declared AQMA at Woodbridge.

The site at Stratford St. Andrew is located on a group of five houses which open directly onto the pavement of the A12. Monitoring is being undertaken at several sites along the A12 as part of the pre-planning application scoping exercise for Sizewell C. This location is the only site with NO_2 concentrations above the annual mean objective. During 2012 this site was triplicated for increased accuracy confirming that the concentration at this location (42µg/m^3) is above the annual mean NO_2 Objective. A Detailed Assessment was undertaken which confirmed the requirement for declaration of an AQMA at this location. The Detailed Assessment report has been taken to Suffolk Coastal's Cabinet who have recommended declaration of an AQMA to cover the 4 houses situated at Long Row, Main Road, Stratford St Andrew.

11.2 Conclusions relating to New Local Developments

There are no new / newly identified road traffic sources or other transport sources within the Suffolk Coastal district since the 2012 Updating and Screening Assessment Report.

Since the 2012 Updating and Screening Assessment Report, there have been 2 new industrial installations within the district permitted under the Environmental Permitting Regulations 2010. There are no significant emissions predicted from either of these installations and Detailed Assessment is not required. There are two existing industrial installations within the district, permitted under the Environmental Permitting Regulations 2010, with the potential to emit significant quantities PM_{10} or NO_2. Emissions from both have been assessed and there are no predicted exceedances of the Objectives. No further assessment is therefore required.

Assessment of commercial and domestic sources of pollutants has investigated 21 biomass combustion installations within the district. Results of screening assessment undertaken at Heveningham Hall in Heveningham, and Detailed Assessment

undertaken for West End Nurseries in Leiston is presented in this report. The findings of both are that the Objectives are not likely to be exceeded at relevant receptor locations and no further action is required.

11.3 Other Conclusions

There are **4 developments** within the Suffolk Coastal district which have been detailed within previous Progress Reports for which either the Planning Application has still yet to be determined or Planning Permissions has been granted but works on site have not yet been completed. Each has been assessed for air quality impacts by this department.

There are an additional **3 planning applications** which have been recently approved or are currently waiting to be determined, and which may impact on air quality. Each has been assessed or is in the process of being assessed for air quality impacts by this department.

The **Local Transport Plan** states that Suffolk County Council strongly supports the provision of proper relief for the **villages of Marlesford, Little Glemham, Stratford St Andrew, and Farnham on the A12** by the provision of a relief road and will work with the nuclear industry to secure its provision alongside any new power station at Sizewell. At Farnham, Suffolk County Council has now implemented a warning sign system so that should HGVs be approaching from both directions at the same time a warning sign is activated to inform the vehicles of the approaching situation. Bypass options are currently being investigated by Suffolk County Council.

The Action Plan for the **Woodbridge junction AQMA** consists of 20 measures, one has now been removed from the plan as studies have shown it to not be viable, four have now been completed, and one new measure has been added.

The new computerised system for the traffic lights (MOVA) has been in place and working since July 2011, this has reduced queue lengths at each arm of the junction but has not reduced the average number of vehicles queuing at the junction. Monitoring results for 2012 show an increase in NO_2 levels over those witnessed in 2011 at most of the sites on the junction. The highest concentration in 2012 was 44µg/m^3. The MOVA system would therefore appear not to have been successful in reducing NO_2 concentrations at the junction.

A number of traffic surveys have been undertaken at the junction during 2013; to investigate the percentage of through traffic, undertake a Drive Cycle analysis of the junction and collect data to undertake Detailed computer modelling of a number of scenarios. The results are allowing us to investigate whether different proposals for traffic alterations at the junction would have any impact on NO_2 concentrations within the AQMA. We are currently awaiting the results of the Drive Cycle and computer modelling which will help us to then move forward.

The Action Plan for the **Felixstowe AQMA** consists of 13 measures, 6 of which are the responsibility of Suffolk Coastal District Council and 7 the responsibility of the Port of Felixstowe. Of the 13 measures 7 have already been completed - 3 by Suffolk

Coastal District Council and 4 by the Port of Felixstowe. All other measures which are the responsibility of the port of Felixstowe have been started and are on-going.

The results of diffusion tube monitoring for 2012 show that annual mean NO_2 concentrations within the AQMA have fallen below the air quality Objective. Several more years of monitoring data will be needed to confirm whether this is a true trend. With the reduced concentrations in mind, we have moved a number of the Planning and Implementation dates for our measures further into the future and this will be reviewed each year in light of monitoring results obtained.

11.4 Proposed Actions

- The Detailed Assessment report looking at annual mean NO_2 concentrations at Long Row, Stratford St Andrew and recommending declaration of an AQMA has been sent to Defra for their approval. Once this is received we will make the AQMA Order and work will begin to produce a Further Assessment and Action Plan for the AQMA.

- Following receipt of the Drive Cycle analysis and air quality modelling at the Woodbridge junction AQMA, we will reassess the Action Plan measures. These will then be sent to Suffolk County Council to comment on whether they will continue to support each one.

- The diffusion tube results for locations within the AQMA at Ferry Lane, Felixstowe in 2013 will be assessed as soon as they are available to confirm whether they continue to be below the Objectives.

- Findings of the above actions will be presented in the next annual air quality report – the Progress Report 2014.

12 References

1. *Environment Act 1995*, Chapter 25. HMSO, 1997.

2. *Air Quality (England) Regulations 2000* – S.I 2000, No 928. HMSO, 2000.

3. *Air Quality (England) Amendment Regulations 2002* – S.I 2002, No. 3043. HMSO, 2002.

4. *The Environmental Permitting (England and Wales) Regulations 2010* – S.I 2010, No. 675. HMSO, 2010.

5. *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1 and 2)*. Report by the Department of Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh assembly Government and Department of the Environment Northern Ireland. DEFRA Publications, July 2007.

6. *Part IV of the Environment Act 1995, Local Air Quality Management, Technical Guidance*. *LAQM.TG(09).* Report by the Department of Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh assembly Government and Department of the Environment Northern Ireland. DEFRA Publications, February 2009.

7. *Part IV of the Environment Act 1995, Local Air Quality Management, Policy Guidance PG(09).* Report by the Department of Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh assembly Government and Department of the Environment Northern Ireland. DEFRA Publications, February 2009.

8. *Technical Guidance: Screening Assessment for biomass boilers.* AEA Energy & Environment, July 2008.

9. *2011 Air Quality Progress Report for Suffolk Coastal District Council.* Produced by Suffolk Coastal District Council, August 2011.

10. *2012 Air Quality Updating and Screening Assessment for Suffolk Coastal District Council.* Produced by Suffolk Coastal district Council, December 2012.

11. *Suffolk Coastal District Council Air Quality Action Plan for Woodbridge.* Prepared by AEA Technology plc under contract to Suffolk Coastal District Council, August 2009.

12. *Further Assessment for the Air Quality Management Areas at Ferry Lane, Felixstowe.* Prepared by Transport Research Laboratories under contract to Suffolk Coastal District Council, April 2010

13. *Local Air Quality Management Action Plan for the Air Quality Management Area at Ferry Lane Felixstowe.* Prepared by Transport Research Laboratory under contract to Suffolk Coastal District Council, September 2012.

14. *National Air Quality Information Archive – National Background Maps*. Information from which can be viewed at www.airquality.co.uk/archive/laqm/tools/php. Defra.

15. *Supplementary Guidance – Air Quality Management and New Development 2011 – Suffolk Local Authorities.* Suffolk Air Quality Management Group, 2011.

Appendices

Appendix A	**AQMA Order - Woodbridge Junction**
Appendix B	**AQMA Order – Ferry Lane, Felixstowe**
Appendix C	**QA:QC Data**
Appendix D	**Maps showing NO_2 diffusion tube locations**
Appendix E	**NOx analyser results summary**
Appendix F	**Diffusion tube results for 2012**
Appendix G	**Air Quality Detailed Assessment for Stratford St Andrew**
Appendix H	**Detailed Assessment of a Straw Burning Biomass Boiler for Suffolk Coastal – Geaters, West End Nurseries, Leiston**
Appendix I	**Results of Queue length surveys undertaken at the Woodbridge Junction**
Appendix J	**Air Pollution Mitigation Options for Ports – State of the Art Review of options being considered in Ports worldwide**
Appendix K	**Port of Felixstowe response to the 'Air Pollution Mitigation Options for Ports' literature review.**

Appendix A:
AQMA Order - Woodbridge Junction

Environment Protection Act 1995, Part IV section 83(1)

Suffolk Coastal District Council

Air Quality Management Area Order

THE SUFFOLK COASTAL DISTRICT COUNCIL AIR QUALITY MANAGEMENT AREA ORDER NO 1, 2006

Suffolk Coastal District Council, in exercise of the powers conferred upon it by Section 83(1) of the Environment Act 1995, hereby makes the following Order

This Order may be referred to as '**The Suffolk Coastal District Council Air Quality Management Area Order No 1, 2006',** and shall come into effect on the **3rd April 2006**

The area shown on the attached map hatched in red is to be designated as an air quality management area (the designated area). **The designated area incorporates properties on the Western side of the Thoroughfare and Melton Hill arm of the junction with Lime Kiln Quay Road, in Woodbridge, Suffolk.**

The map may be viewed at the Council Offices, at Melton Hill, Woodbridge, between the hours of 08.45am to 5.15pm Mondays to Thursdays, and 08.45am to 4.45pm on Fridays.

This Area is designated in relation to a likely breach of the nitrogen dioxide (annual mean) objective as specified in the Air Quality Regulations (England) (Wales) 2000.

This order shall remain in force until it is varied or revoked by a subsequent order.
Dated; this Third day of March 2006

The Common Seal of Suffolk Coastal District Council was affixed in the presence of;

Ian S de Prez

……..
Authorised Officer

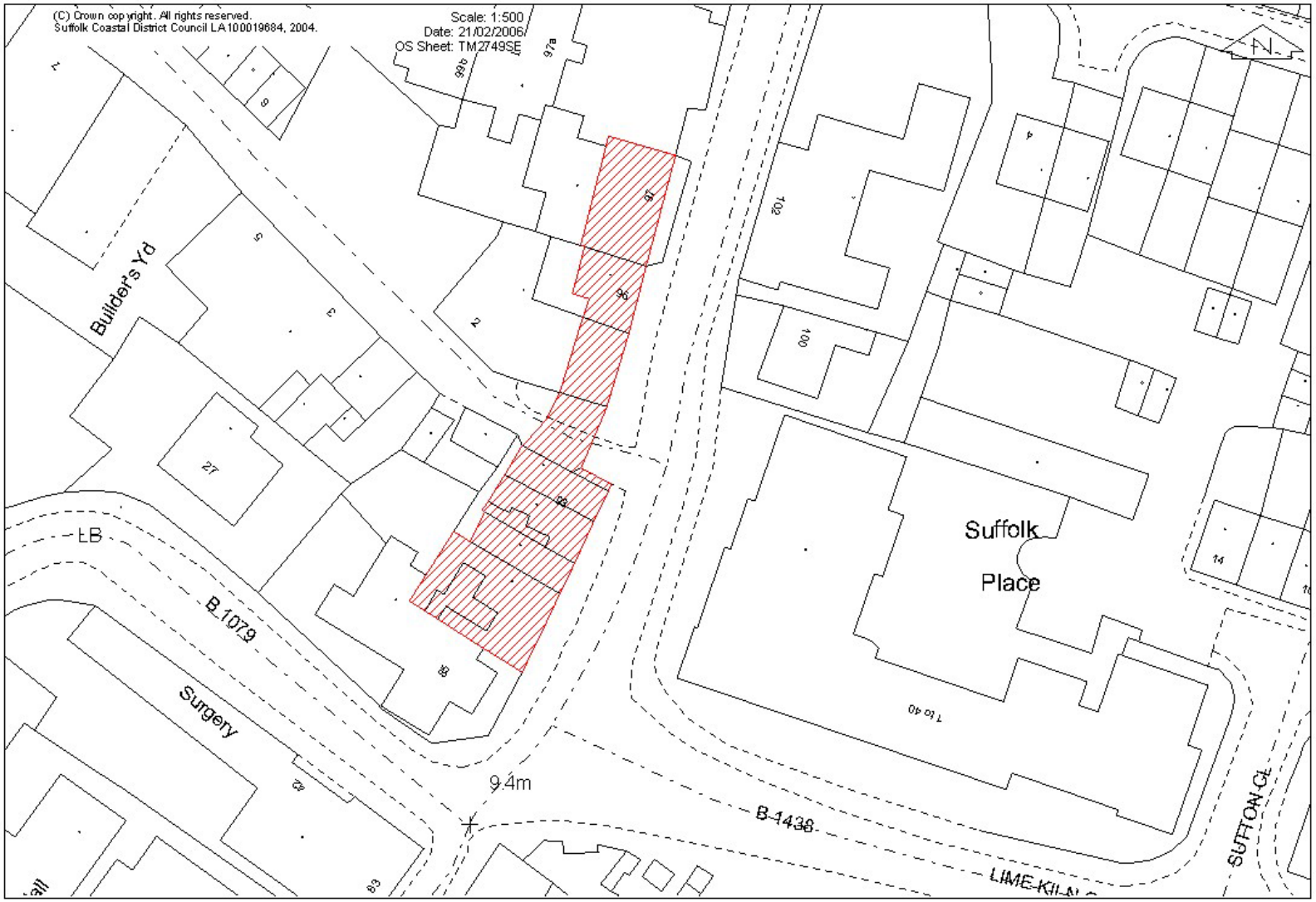
And

Simon Burridge

…… **CS** 9281
Authorised Officer

Dated: 3rd March 2006

THE SUFFOLK COASTAL DISTRICT COUNCIL AIR QUALITY MANAGEMENT AREA ORDER NO 1, 2006



Appendix B:
AQMA Order – Ferry Lane, Felixstowe

Environment Protection Act 1995, Part IV section 83(1)
Suffolk Coastal District Council

Air Quality Management Area Order

THE SUFFOLK COASTAL DISTRICT COUNCIL AIR QUALITY MANAGEMENT AREA ORDER NO 2, 2009

Suffolk Coastal District Council, in exercise of the powers conferred upon it by Section 83(1) of the
Environment Act 1995, hereby makes the following Order

This Order may be referred to as
'**The Suffolk Coastal District Council Air Quality Management Area Order No 2, 2009',**

and shall come into effect on the **1st May 2009**
The area shown on the attached map hatched in red is to be designated as an air quality management area (the designated area).

The designated area contains the property known as The Dooley Inn, situated at Ferry Lane, Felixstowe, Suffolk.

The map may be viewed at the Council Offices, at Melton Hill, Woodbridge, between the hours of
08.45am to 5.15pm Mondays to Thursdays and 08.45am to 4.45pm on Fridays.

This Area is designated in relation to a likely breach of the nitrogen dioxide (annual mean) objective as specified in the Air Quality Regulations (England) (Wales) 2000.

This order shall remain in force until it is varied or revoked by a subsequent order.
Dated; this Twenty-third day of April 2009

The Common Seal of Suffolk Coastal District Council was affixed in the presence of;

Ian S de Prez
……..
Authorised Officer

And

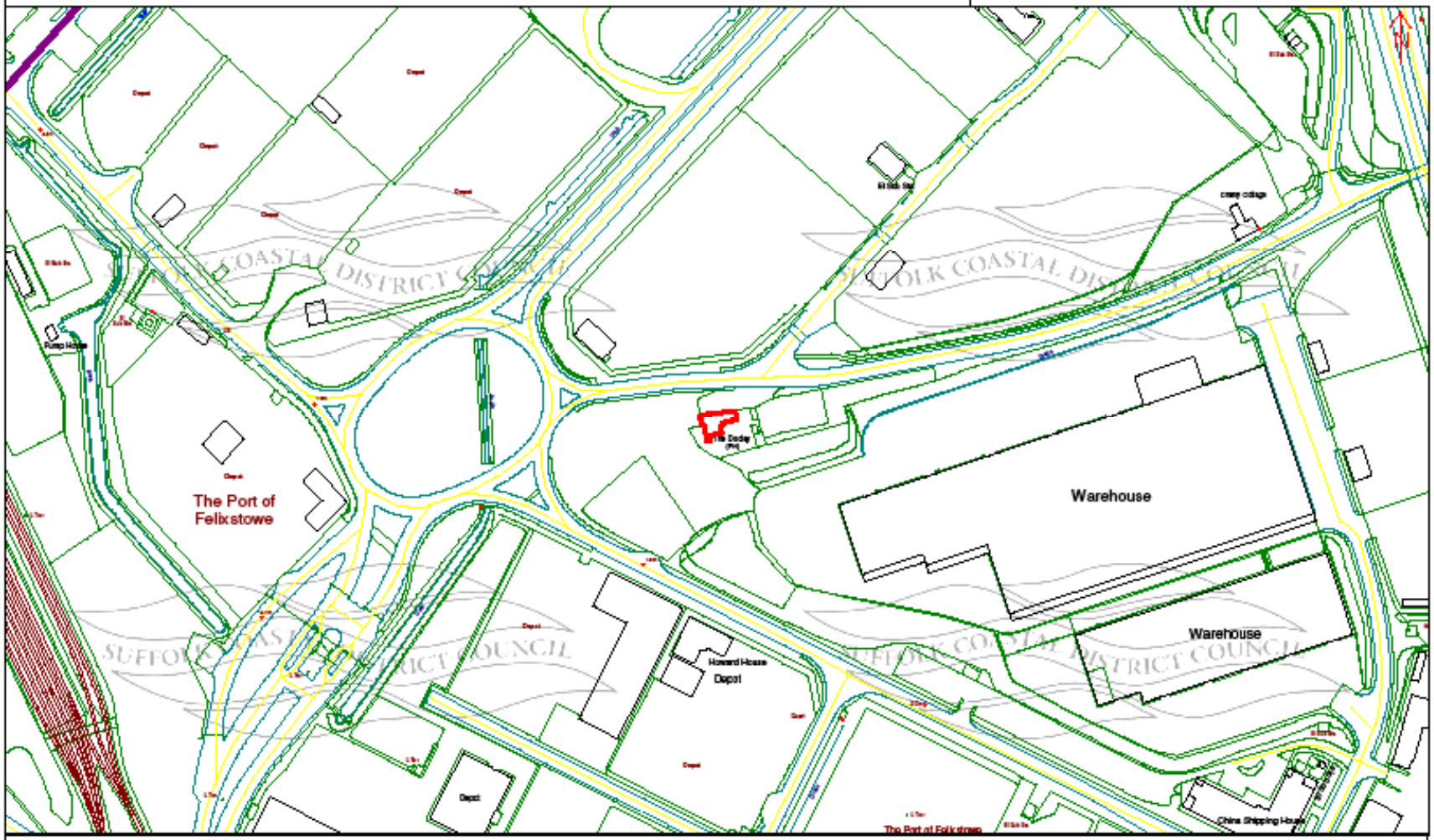
Simon Burridge
…… **CS** 9281
Authorised Officer

Dated 23rd April 2009

Dooley Inn, Ferry Lane, Felixstowe

Scale 0 25 50 75 100 125 m

Map produced on 29 April 2009 at 11:18



Suffolk Coastal District Council

Appendix C: QA:QC Data

Diffusion Tube Bias Adjustment Factors

The analytical laboratory used for supply and analysis of NO_2 diffusion tubes is Environmental Scientifics Group (ESG) based in Didcot. The monitoring is undertaken using Palmes passive diffusion tubes exposed on a monthly basis. The tubes are prepared by spiking acetone:triethanloamine (TEA) (50:50) onto the grids prior to the tubes being assembled. The tubes are then desorbed with distilled water and the extract analysed using a segmented flow auto-analyser with ultraviolet detection. The laboratory is formally accredited under the United Kingdom Accreditation Scheme (UKAS).

Combined "national" bias adjustment factors for UK diffusion tube laboratories, based upon Local Authority co-location studies throughout the UK, are provided on behalf of Defra and the Devolved Administrations. A database of these bias adjustment factors is available at http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html. The national bias adjustment factor given for ESG, Didcot in 2012, in the June 2013 edition of 'National Spreadsheet of Bias Adjustment Factors' was **0.79**, using results from 38 different studies.

Factor from Local Co-location Studies (if available)

There is a Kerbside automatic monitoring site recording NO_2 concentrations derived from road traffic emissions at the junction of Lime Kiln Quay Road, Thoroughfare, and St. John's Street in Woodbridge. The site is approximately 1 metre from the kerb and 14 metres from the traffic lights at the junction. This area of the junction is very narrow and enclosed by tall buildings, creating a canyon effect.

The bias adjustment factor was calculated using the Precision and Accuracy Spreadsheet available for download from http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html .

Based on 12 months for which there was a valid diffusion tube mean and a valid automatic mean -
Automatic analyser annual mean (2012) = 44 µg m^{-3} with 98% data capture.
Triplicate diffusion tube mean (2012) = 50 µg m^{-3} with a mean precision (expressed as the coefficient of variation) of 5.
Bias adjustment factor (2012) = 0.88 based on 12 months' data.

Discussion of Choice of Factor to Use

Historically, the local bias adjustment factor obtained from the Woodbridge co-location study has been used to adjust annual mean NO_2 concentrations from diffusion tube sites within Woodbridge only. This location is unusual, being a street canyon: it is considered representative of the other diffusion tube monitoring sites within Woodbridge, but not of diffusion tube locations elsewhere within the district. **The 2012 bias adjustment factor of 0.88 obtained at Woodbridge has been applied to the other sites within Woodbridge only.**

All diffusion tube monitoring sites elsewhere on the district have been adjusted for bias using the combined or "national" bias adjustment factor of 0.79.

Bias adjustment of the annual mean diffusion tube result for all sites is shown in Appendix F.

Short-term to Long-term Data adjustment

Some diffusion tube sites failed to achieve full data capture, mainly due to stolen tubes. Where there was less than 90% data capture for the year (because two or more diffusion tube results were missing or invalid), the mean of the 2012 data has been "annualised" using the procedure set out in LAQM.TG(09) to produce the best estimate of the annual mean. The method is as follows:

- Identify 2-4 nearby, long term, continuous monitoring sites, ideally those forming part of the national network. These should be background sites to avoid any very local effects that may occur, and should wherever possible lie within a radius of about 50 miles. The two sites used here are St. Osyth (Rural) and Wicken Fen (Rural). Both sites are part of the UK Automatic Urban and Rural Network (AURN).
- Obtain the unadjusted (not corrected for bias) annual mean (Am) for the calendar year for these sites. As this calculation is to estimate the annual mean for a diffusion tube site, the diffusion tube calendar year for 2012 was based on the diffusion tube exposure periods rather than 1st Jan – 31st Dec 2012.
- Work out the period mean (Pm) for each period (month) with diffusion tube results at each of the comparison sites separately.
- All data is presented in Tables A-1 to A-4 below.
- Calculate the ratio of the annual mean to the period mean (Am:Pm) for each period at each location.
- Calculate the average of these ratios (R_a). This is the adjustment factor.
- Multiply the measured period mean (M) for the short term monitoring location by the adjustment factor (R_a) to give the estimate of the annual mean for 2012.

  WBG 6: the (unadjusted) measured period mean (M) was 44.9 µg/m^3:
  44.9 µg/m^3 (M) x 1.02 (R_a) = **45.8 µg/m^3 (annualised mean)**
  WBG 8: the (unadjusted) measured period mean (M) was 47.0 µg/m^3:
  47.0 µg/m^3 (M) x 1.03 (R_a) = **48.4 µg/m^3 (annualised mean)**
  WBG 10: the (unadjusted) measured period mean (M) was 37.6 µg/m^3:
  37.6 µg/m^3 (M) x 0.93 (R_a) = **35.0 µg/m^3 (annualised mean)**
  STA 5: the (unadjusted) measured period mean (M) was 19.0 µg/m^3:
  19.0 µg/m^3 (M) x 1.21 (R_a) = **23.0 µg/m^3 (annualised mean)**

- This annualised mean will then be bias adjusted as for all other sites.

Table C-1 Annualisation of diffusion tube data from Woodbridge 6 (WBG 6)

Site name	Channel	Start date	Start time	End date	End time	Period Mean (Pm)	Number of records	Total concentration (units hours)	Data capture	Units	Annual Mean (Am)	Ratio (Am:Pm)	Adjustment Factor (R_a)
St Osyth	Nitrogen Dioxide	05/01/ 2012	0	03/02/ 2012	23	17.8	720	12428.9	97.1	µg m-3 (20'C 1013mb)	17.6	0.988764	
St Osyth	Nitrogen Dioxide	03/02/ 2012	0	02/03/ 2012	23	26.4	696	17602.9	95.7	µg m-3 (20'C 1013mb)	17.6	0.666667	
St Osyth	Nitrogen Dioxide	02/03/ 2012	0	27/03/ 2012	23	28.7	624	17859	99.7	µg m-3 (20'C 1013mb)	17.6	0.61324	
St Osyth	Nitrogen Dioxide	27/03/ 2012	0	26/04/ 2012	23	21.2	744	15286.8	97	µg m-3 (20'C 1013mb)	17.6	0.830189	
St Osyth	Nitrogen Dioxide	26/04/ 2012	0	31/05/ 2012	23	18	864	15050.3	96.6	µg m-3 (20'C 1013mb)	17.6	0.977778	
St Osyth	Nitrogen Dioxide	31/05/ 2012	0	27/06/ 2012	23	12.6	672	8444.4	99.4	µg m-3 (20'C 1013mb)	17.6	1.396825	
St Osyth	Nitrogen Dioxide	30/08/ 2012	0	26/09/ 2012	23	11.7	672	7823.9	99.3	µg m-3 (20'C 1013mb)	17.6	1.504274	
St Osyth	Nitrogen Dioxide	26/09/ 2012	0	01/11/ 2012	23	14.6	888	12954.3	99.7	µg m-3 (20'C 1013mb)	17.6	1.205479	
St Osyth	Nitrogen Dioxide	01/11/ 2012	0	27/11/ 2012	23	21	648	12251.7	90	µg m-3 (20'C 1013mb)	17.6	0.838095	
St Osyth	Nitrogen Dioxide	27/11/ 2012	0	02/01/ 2013	23	18.1	888	15929.9	99.1	µg m-3 (20'C 1013mb)	17.6	0.972376	
Wicken Fen	Nitrogen Dioxide	05/01/ 2012	0	03/02/ 2012	23	18.3	720	13024.9	98.6	µg m-3 (20'C 1013mb)	12.8	0.699454	
Wicken Fen	Nitrogen Dioxide	03/02/ 2012	0	02/03/ 2012	23	19.8	696	12625.5	91.5	µg m-3 (20'C 1013mb)	12.8	0.646465	
Wicken Fen	Nitrogen Dioxide	02/03/ 2012	0	27/03/ 2012	23	15.9	624	6151.5	61.9	µg m-3 (20'C 1013mb)	12.8	0.805031	
Wicken Fen	Nitrogen Dioxide	27/03/ 2012	0	26/04/ 2012	23	12.6	744	9112.5	96.9	µg m-3 (20'C 1013mb)	12.8	1.015873	
Wicken Fen	Nitrogen Dioxide	26/04/ 2012	0	31/05/ 2012	23	7.1	864	6126.6	99.7	µg m-3 (20'C 1013mb)	12.8	1.802817	
Wicken Fen	Nitrogen Dioxide	31/05/ 2012	0	27/06/ 2012	23	6.9	672	4631.6	99.3	µg m-3 (20'C 1013mb)	12.8	1.855072	
Wicken Fen	Nitrogen Dioxide	30/08/ 2012	0	26/09/ 2012	23	9.6	672	6418.3	99.3	µg m-3 (20'C 1013mb)	12.8	1.333333	
Wicken Fen	Nitrogen Dioxide	26/09/ 2012	0	01/11/ 2012	23	12.5	888	10967.6	99.1	µg m-3 (20'C 1013mb)	12.8	1.024	
Wicken Fen	Nitrogen Dioxide	01/11/ 2012	0	27/11/ 2012	23	18.6	648	12024.7	99.8	µg m-3 (20'C 1013mb)	12.8	0.688172	
Wicken Fen	Nitrogen Dioxide	27/11/ 2012	0	02/01/ 2013	23	21.2	888	9725.9	51.7	µg m-3 (20'C 1013mb)	12.8	0.603774	
													1.023384

Table C-2 Annualisation of diffusion tube data from Woodbridge 8 (WBG 8)

Suffolk Coastal District Council

Site name	Channel	Start date	Start time	End date	End time	Period Mean (Pm)	Number of records	Total concentration (units hours)	Data capture	Units	Annual Mean (Am)	Ratio (Am:Pm)	Adjustment Factor (R_a)
St Osyth	Nitrogen Dioxide	05/01/2012	0	03/02/2012	23	17.8	720	12428.9	97.1	µg m-3 (20'C 1013mb)	17.6	0.988764	
St Osyth	Nitrogen Dioxide	03/02/2012	0	02/03/2012	23	26.4	696	17602.9	95.7	µg m-3 (20'C 1013mb)	17.6	0.666667	
St Osyth	Nitrogen Dioxide	02/03/2012	0	27/03/2012	23	28.7	624	17859	99.7	µg m-3 (20'C 1013mb)	17.6	0.61324	
St Osyth	Nitrogen Dioxide	27/03/2012	0	26/04/2012	23	21.2	744	15286.8	97	µg m-3 (20'C 1013mb)	17.6	0.830189	
St Osyth	Nitrogen Dioxide	31/05/2012	0	27/06/2012	23	12.6	672	8444.4	99.4	µg m-3 (20'C 1013mb)	17.6	1.396825	
St Osyth	Nitrogen Dioxide	30/07/2012	0	30/08/2012	23	12.8	768	9625	97.7	µg m-3 (20'C 1013mb)	17.6	1.375	
St Osyth	Nitrogen Dioxide	30/08/2012	0	26/09/2012	23	11.7	672	7823.9	99.3	µg m-3 (20'C 1013mb)	17.6	1.504274	
St Osyth	Nitrogen Dioxide	26/09/2012	0	01/11/2012	23	14.6	888	12954.3	99.7	µg m-3 (20'C 1013mb)	17.6	1.205479	
St Osyth	Nitrogen Dioxide	01/11/2012	0	27/11/2012	23	21	648	12251.7	90	µg m-3 (20'C 1013mb)	17.6	0.838095	
St Osyth	Nitrogen Dioxide	27/11/2012	0	02/01/2013	23	18.1	888	15929.9	99.1	µg m-3 (20'C 1013mb)	17.6	0.972376	
Wicken Fen	Nitrogen Dioxide	05/01/2012	0	03/02/2012	23	18.3	720	13024.9	98.6	µg m-3 (20'C 1013mb)	12.8	0.699454	
Wicken Fen	Nitrogen Dioxide	03/02/2012	0	02/03/2012	23	19.8	696	12625.5	91.5	µg m-3 (20'C 1013mb)	12.8	0.646465	
Wicken Fen	Nitrogen Dioxide	02/03/2012	0	27/03/2012	23	15.9	624	6151.5	61.9	µg m-3 (20'C 1013mb)	12.8	0.805031	
Wicken Fen	Nitrogen Dioxide	27/03/2012	0	26/04/2012	23	12.6	744	9112.5	96.9	µg m-3 (20'C 1013mb)	12.8	1.015873	
Wicken Fen	Nitrogen Dioxide	31/05/2012	0	27/06/2012	23	6.9	672	4631.6	99.3	µg m-3 (20'C 1013mb)	12.8	1.855072	
Wicken Fen	Nitrogen Dioxide	30/07/2012	0	30/08/2012	23	8.9	768	4094.3	59.8	µg m-3 (20'C 1013mb)	12.8	1.438202	
Wicken Fen	Nitrogen Dioxide	30/08/2012	0	26/09/2012	23	9.6	672	6418.3	99.3	µg m-3 (20'C 1013mb)	12.8	1.333333	
Wicken Fen	Nitrogen Dioxide	26/09/2012	0	01/11/2012	23	12.5	888	10967.6	99.1	µg m-3 (20'C 1013mb)	12.8	1.024	
Wicken Fen	Nitrogen Dioxide	01/11/2012	0	27/11/2012	23	18.6	648	12024.7	99.8	µg m-3 (20'C 1013mb)	12.8	0.688172	
Wicken Fen	Nitrogen Dioxide	27/11/2012	0	02/01/2013	23	21.2	888	9725.9	51.7	µg m-3 (20'C 1013mb)	12.8	0.603774	
													1.025014

Table C-3 Annualisation of diffusion tube data from Woodbridge 10 (WBG 10)

Site name	Channel	Start date	Start time	End date	End time	Period Mean (Pm)	Number of records	Total concentration (units hours)	Data capture	Units	Annual Mean (Am)	Ratio (Am:Pm)	Adjustment Factor (R_a)
St Osyth	Nitrogen Dioxide	05/01/ 2012	0	03/02/ 2012	23	17.8	720	12428.9	97.1	µg m-3 (20'C 1013mb)	17.6	0.988764	
St Osyth	Nitrogen Dioxide	03/02/ 2012	0	02/03/ 2012	23	26.4	696	17602.9	95.7	µg m-3 (20'C 1013mb)	17.6	0.666667	
St Osyth	Nitrogen Dioxide	02/03/ 2012	0	27/03/ 2012	23	28.7	624	17859	99.7	µg m-3 (20'C 1013mb)	17.6	0.61324	
St Osyth	Nitrogen Dioxide	31/05/ 2012	0	27/06/ 2012	23	12.6	672	8444.4	99.4	µg m-3 (20'C 1013mb)	17.6	1.396825	
St Osyth	Nitrogen Dioxide	26/09/ 2012	0	01/11/ 2012	23	14.6	888	12954.3	99.7	µg m-3 (20'C 1013mb)	17.6	1.205479	
St Osyth	Nitrogen Dioxide	01/11/ 2012	0	27/11/ 2012	23	21	648	12251.7	90	µg m-3 (20'C 1013mb)	17.6	0.838095	
St Osyth	Nitrogen Dioxide	27/11/ 2012	0	02/01/ 2013	23	18.1	888	15929.9	99.1	µg m-3 (20'C 1013mb)	17.6	0.972376	
Wicken Fen	Nitrogen Dioxide	05/01/ 2012	0	03/02/ 2012	23	18.3	720	13024.9	98.6	µg m-3 (20'C 1013mb)	12.8	0.699454	
Wicken Fen	Nitrogen Dioxide	03/02/ 2012	0	02/03/ 2012	23	19.8	696	12625.5	91.5	µg m-3 (20'C 1013mb)	12.8	0.646465	
Wicken Fen	Nitrogen Dioxide	02/03/ 2012	0	27/03/ 2012	23	15.9	624	6151.5	61.9	µg m-3 (20'C 1013mb)	12.8	0.805031	
Wicken Fen	Nitrogen Dioxide	31/05/ 2012	0	27/06/ 2012	23	6.9	672	4631.6	99.3	µg m-3 (20'C 1013mb)	12.8	1.855072	
Wicken Fen	Nitrogen Dioxide	26/09/ 2012	0	01/11/ 2012	23	12.5	888	10967.6	99.1	µg m-3 (20'C 1013mb)	12.8	1.024	
Wicken Fen	Nitrogen Dioxide	01/11/ 2012	0	27/11/ 2012	23	18.6	648	12024.7	99.8	µg m-3 (20'C 1013mb)	12.8	0.688172	
Wicken Fen	Nitrogen Dioxide	27/11/ 2012	0	02/01/ 2013	23	21.2	888	9725.9	51.7	µg m-3 (20'C 1013mb)	12.8	0.603774	
													0.928815

Table C-4 Annualisation of diffusion tube data from Stratford St Andrew 5 (STA 5)

Site name	Channel	Start date	Start time	End date	End time	Period Mean (Pm)	Number of records	Total concentration (units hours)	Data capture	Units	Annual Mean (Am)	Ratio (Am:Pm)	Adjustment Factor (R_a)
St Osyth	Nitrogen Dioxide	27/03/2012	0	24/04/2012	23	21.9	696	14800.8	97	µg m-3 (20'C 1013mb)	17.6	0.803653	
St Osyth	Nitrogen Dioxide	24/04/2012	0	01/06/2012	23	17.6	936	15929.3	96.8	µg m-3 (20'C 1013mb)	17.6	1	
St Osyth	Nitrogen Dioxide	01/06/2012	0	26/06/2012	23	12.4	624	7657	99.4	µg m-3 (20'C 1013mb)	17.6	1.419355	
St Osyth	Nitrogen Dioxide	26/06/2012	0	31/07/2012	23	12	864	9960.6	96.3	µg m-3 (20'C 1013mb)	17.6	1.466667	
St Osyth	Nitrogen Dioxide	31/07/2012	0	30/08/2012	23	12.9	744	9333.7	97.6	µg m-3 (20'C 1013mb)	17.6	1.364341	
St Osyth	Nitrogen Dioxide	30/08/2012	0	26/09/2012	23	11.7	672	7823.9	99.3	µg m-3 (20'C 1013mb)	17.6	1.504274	
St Osyth	Nitrogen Dioxide	26/09/2012	0	01/11/2012	23	14.6	888	12954.3	99.7	µg m-3 (20'C 1013mb)	17.6	1.205479	
St Osyth	Nitrogen Dioxide	01/11/2012	0	27/11/2012	23	21	648	12251.7	90	µg m-3 (20'C 1013mb)	17.6	0.838095	
St Osyth	Nitrogen Dioxide	27/11/2012	0	02/01/2013	23	18.1	888	15929.9	99.1	µg m-3 (20'C 1013mb)	17.6	0.972376	
Wicken Fen	Nitrogen Dioxide	27/03/2012	0	24/04/2012	23	12.9	696	8654.4	96.7	µg m-3 (20'C 1013mb)	12.8	0.992248	
Wicken Fen	Nitrogen Dioxide	24/04/2012	0	01/06/2012	23	7.2	936	6706.5	99.7	µg m-3 (20'C 1013mb)	12.8	1.777778	
Wicken Fen	Nitrogen Dioxide	01/06/2012	0	26/06/2012	23	6.9	624	4275.5	99.2	µg m-3 (20'C 1013mb)	12.8	1.855072	
Wicken Fen	Nitrogen Dioxide	26/06/2012	0	31/07/2012	23	8.1	864	6945.8	99.3	µg m-3 (20'C 1013mb)	12.8	1.580247	
Wicken Fen	Nitrogen Dioxide	31/07/2012	0	30/08/2012	23	9	744	3921.1	58.5	µg m-3 (20'C 1013mb)	12.8	1.422222	
Wicken Fen	Nitrogen Dioxide	30/08/2012	0	26/09/2012	23	9.6	672	6418.3	99.3	µg m-3 (20'C 1013mb)	12.8	1.333333	
Wicken Fen	Nitrogen Dioxide	26/09/2012	0	01/11/2012	23	12.5	888	10967.6	99.1	µg m-3 (20'C 1013mb)	12.8	1.024	
Wicken Fen	Nitrogen Dioxide	01/11/2012	0	27/11/2012	23	18.6	648	12024.7	99.8	µg m-3 (20'C 1013mb)	12.8	0.688172	
Wicken Fen	Nitrogen Dioxide	27/11/2012	0	02/01/2013	23	21.2	888	9725.9	51.7	µg m-3 (20'C 1013mb)	12.8	0.603774	
													1.213949

QA/QC of automatic monitoring

NO_2 concentrations were monitored by ozone chemiluminescence. Quality assurance of the data from the continuous monitoring station was carried out by Ricardo-AEA following the same procedures used for sites within the Government's Automatic Urban and Rural Network. Calibrations were undertaken fortnightly by a Council Officer, the procedures adopted for the calibrations were modelled on those developed by AEA Energy & Environment for use in the national monitoring networks. The calibrations were undertaken using certified calibration gas provided by Air Liquide UK Limited with traceability to National Metrology Standards obtained via regular UKAS Quality Control Audits carried out by Ricardo-AEA. The audits provide a range of information that is utilised within the data management process for the data sets.

Audit tests are undertaken once a year by Ricardo-AEA. They include accredited audit zero and span calibrations, linearity, NO_x converter efficiency, flow and leak checks as well as checks of the instruments sampling system. Data presented in this report have been fully ratified by Ricardo-AEA. The ratified data summary reports are included in Appendix E.

The data set was screened, scaled and validated using all available routine site calibrations, audit results and service engineer records. This was an ongoing process with checks made daily to ensure high data capture is achieved. A final process of data ratification ensures that the data provide the most accurate record of the pollution concentrations across the measurement period. The data management process adopted is that evolved and implemented by Ricardo-AEA within the data management programme of the AURN UK national monitoring network. This process is expected to deliver data sets that meet the EU Data Quality Objective of a measurement uncertainty of better than 15%.

QA/QC of diffusion tube monitoring

The analysis of NO_2 diffusion tubes by Environmental Scientifics Group, Didcot meets the guidelines set out in Defra's 'Diffusion tubes for Ambient NO_2 Monitoring: Practical Guidance'. They participate in the Workplace Analysis Scheme for Proficiency (WASP) for analysis of diffusion tubes.

This is an independent proficiency testing study designed to assess the analytical performance of laboratories supplying diffusion tubes to Local Authorities for use in the context of air quality management. Defra advise that diffusion tubes should only be obtained from laboratories demonstrating a WASP classification of 'Satisfactory'.

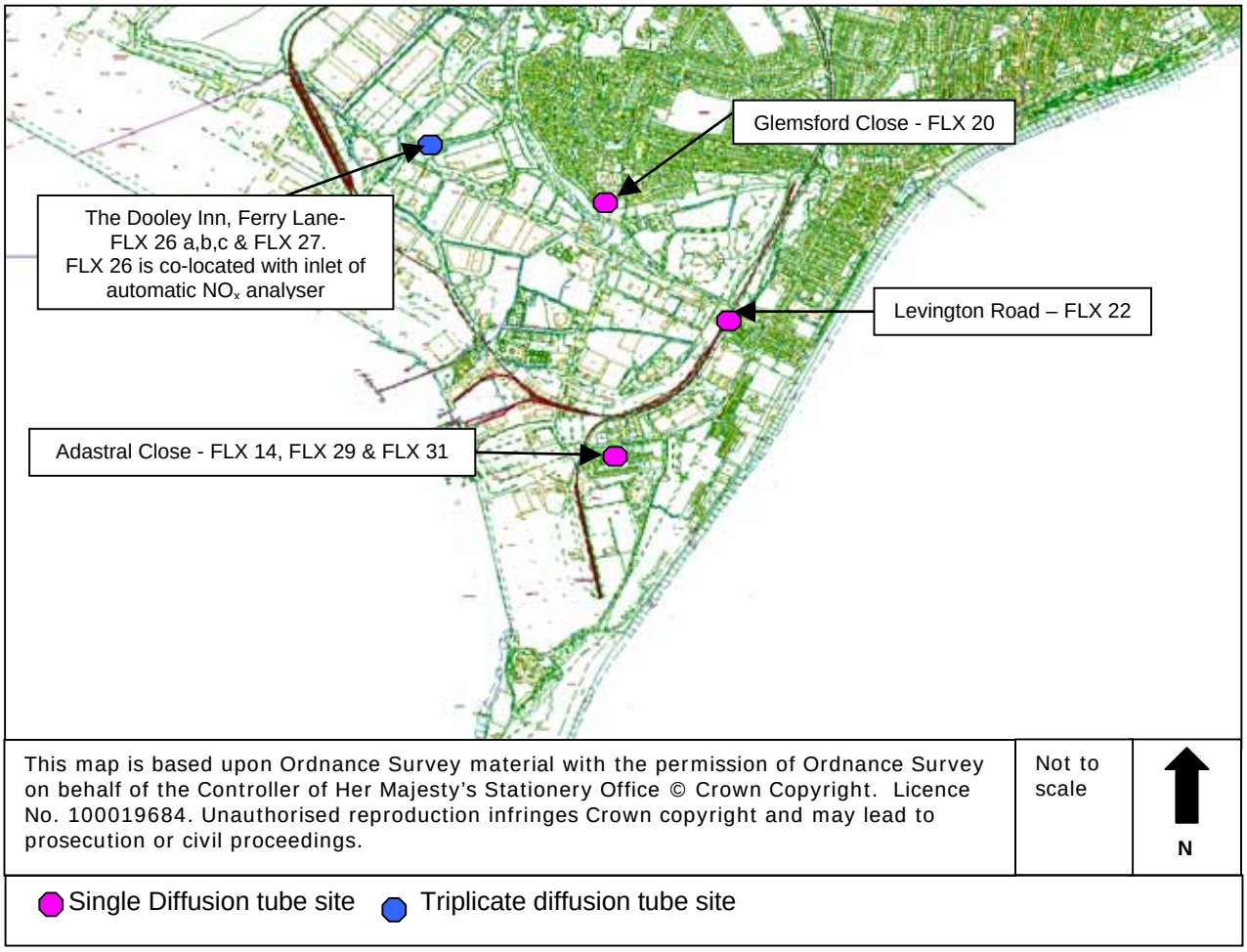
A statistical Z-score test is used to identify any deviation of participant results from reference results. The results indicated in the latest Defra WASP Summary show that in 2012 Environmental Services Group achieved a Z-score of **0.25**, well within the required limits of the 'Satisfactory' classification (see table overleaf), and attained a performance percentage of **100%**.
The table below shows the Classification that the Z-Score would put the laboratory into.

WASP Rankings

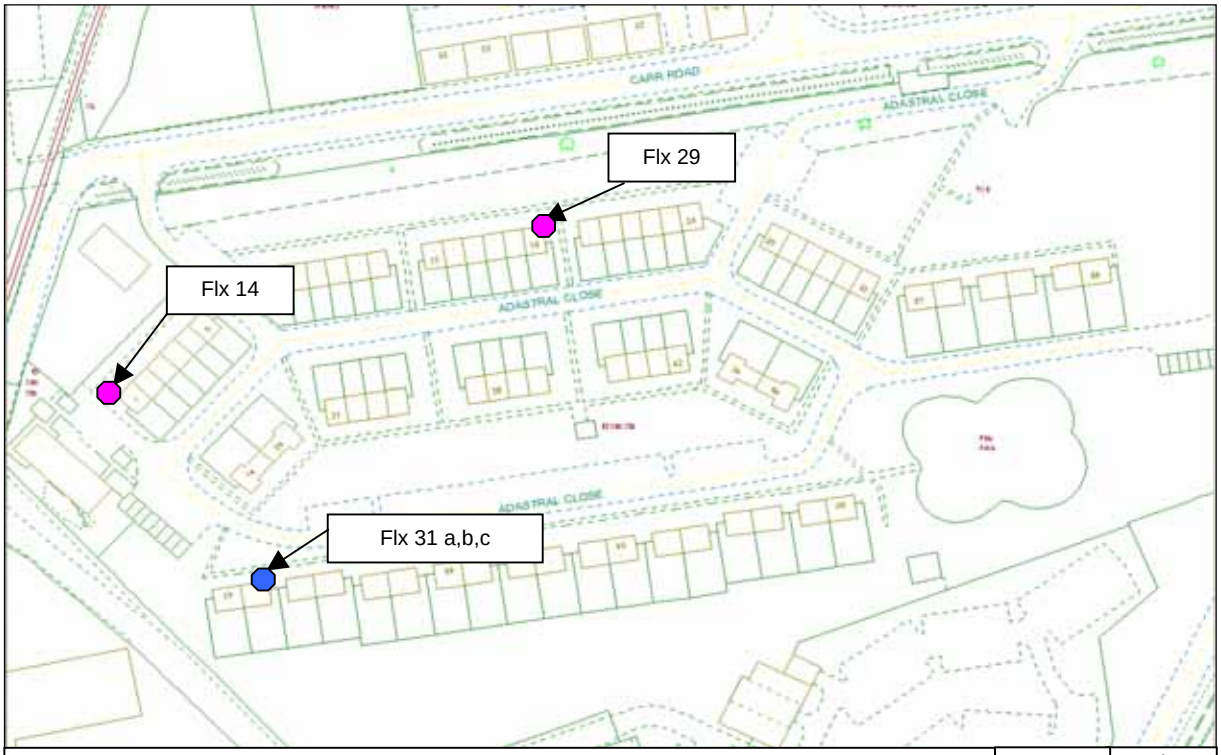
Z –Score	Classification
<2	Satisfactory
2-3	Questionable
>3	Unsatisfactory laboratory result

Appendix D:
Maps showing NO_2 diffusion tube locations

Felixstowe Maps



Map 1. Map of diffusion tube locations at Adastral Park, Levington Road, Glemsford Close and The Dooley Inn.



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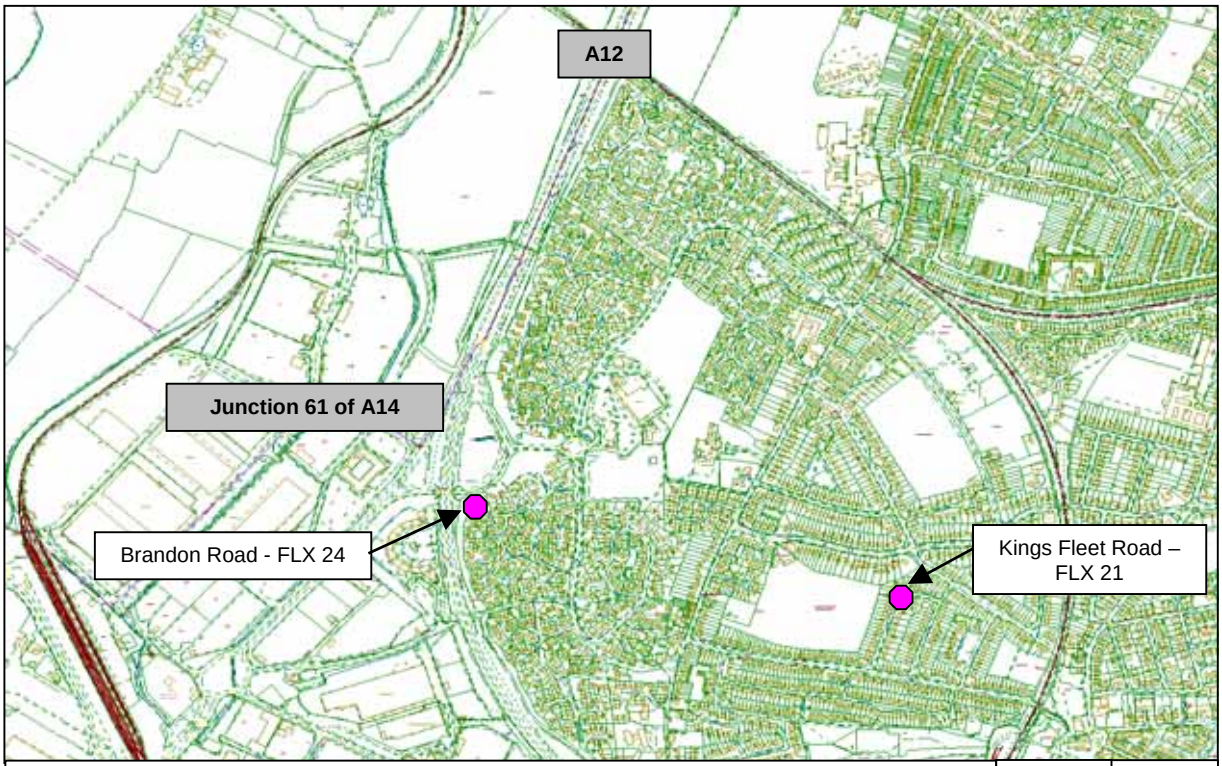
Not to scale

N

Single Diffusion tube site Triplicate diffusion tube site

Map 2. Detailed map of diffusion tube locations at Adastral Close.



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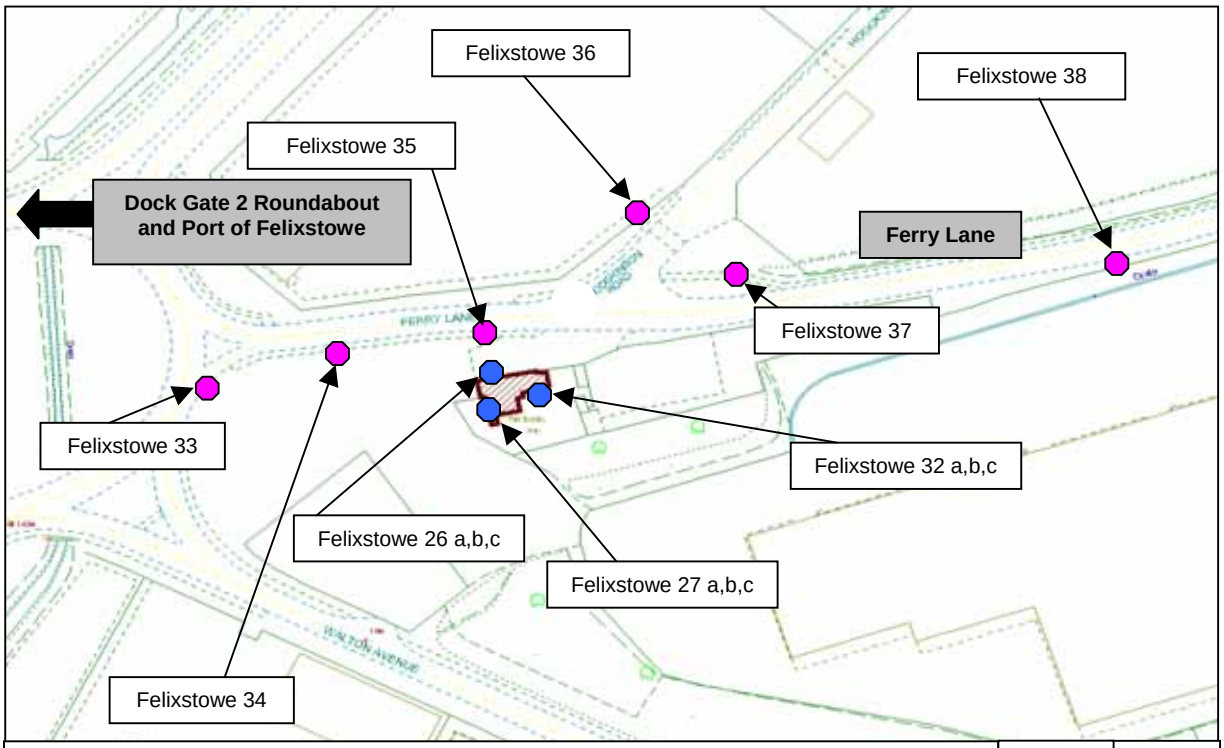
Not to scale

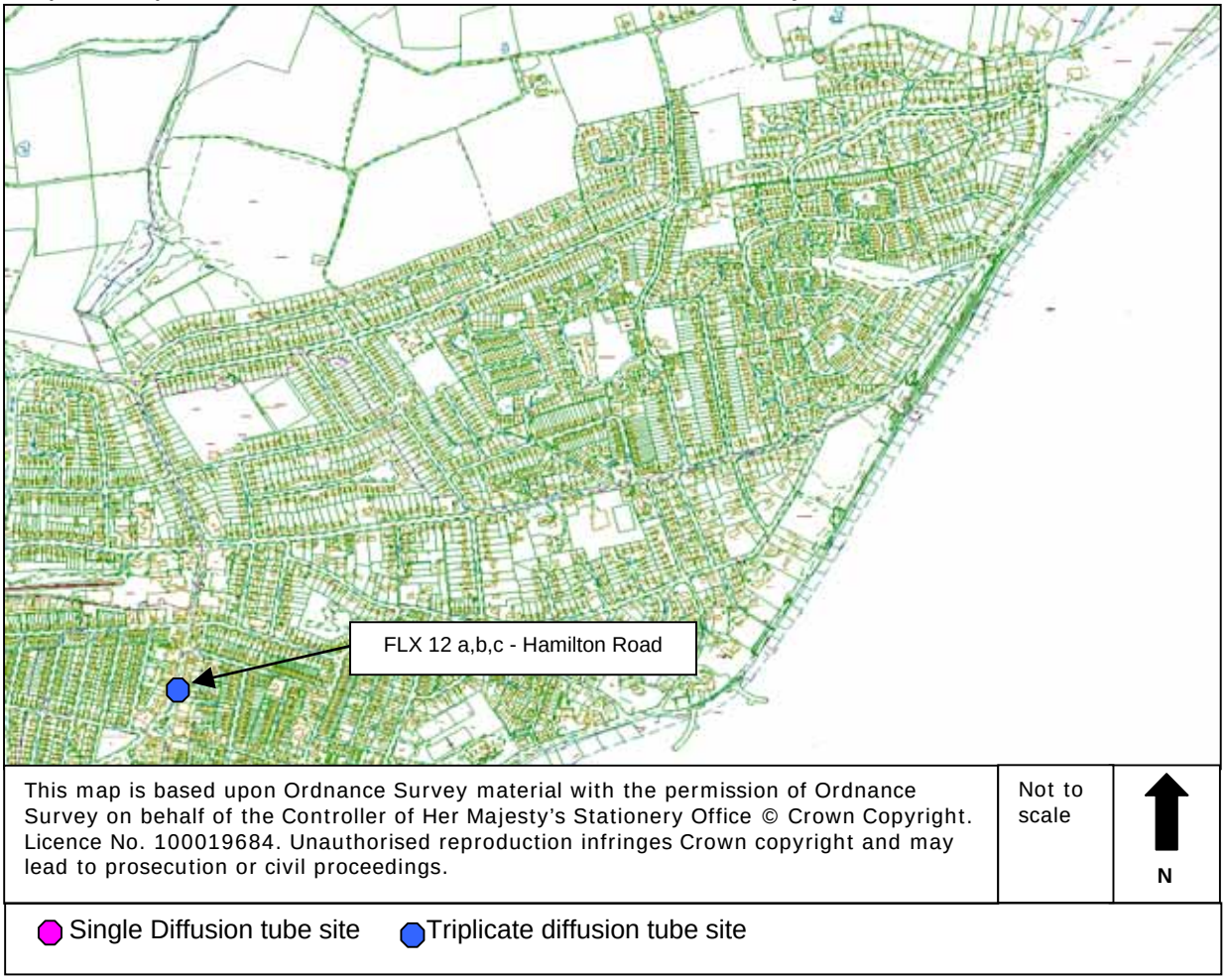
N

Single Diffusion tube site

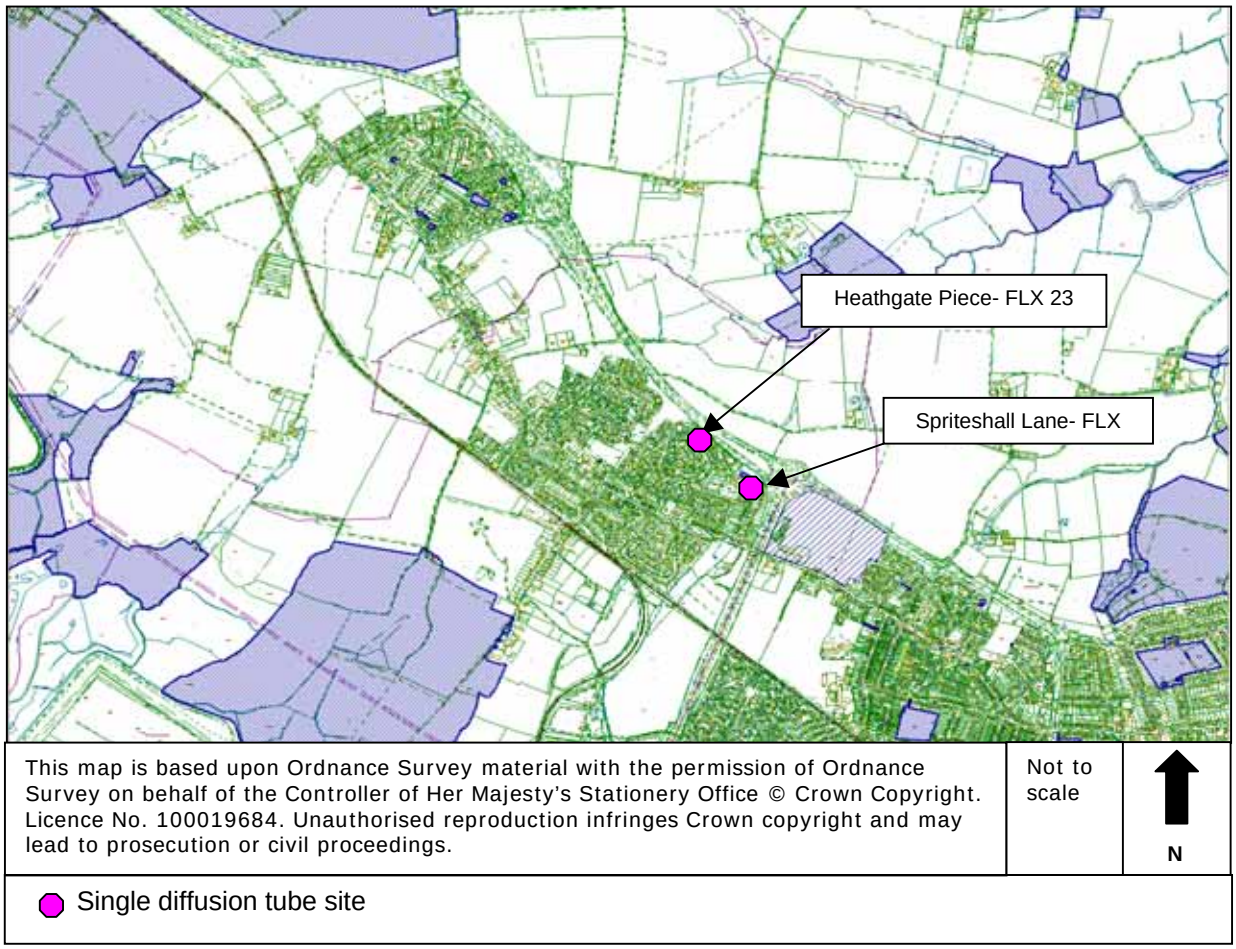
Map 3. Map of diffusion tube locations at Kingsfleet Road and Brandon Road.



Map 4. Map of diffusion tube locations around the Dooley Inn.



Map 5. Map of diffusion tube location at Hamilton Road.



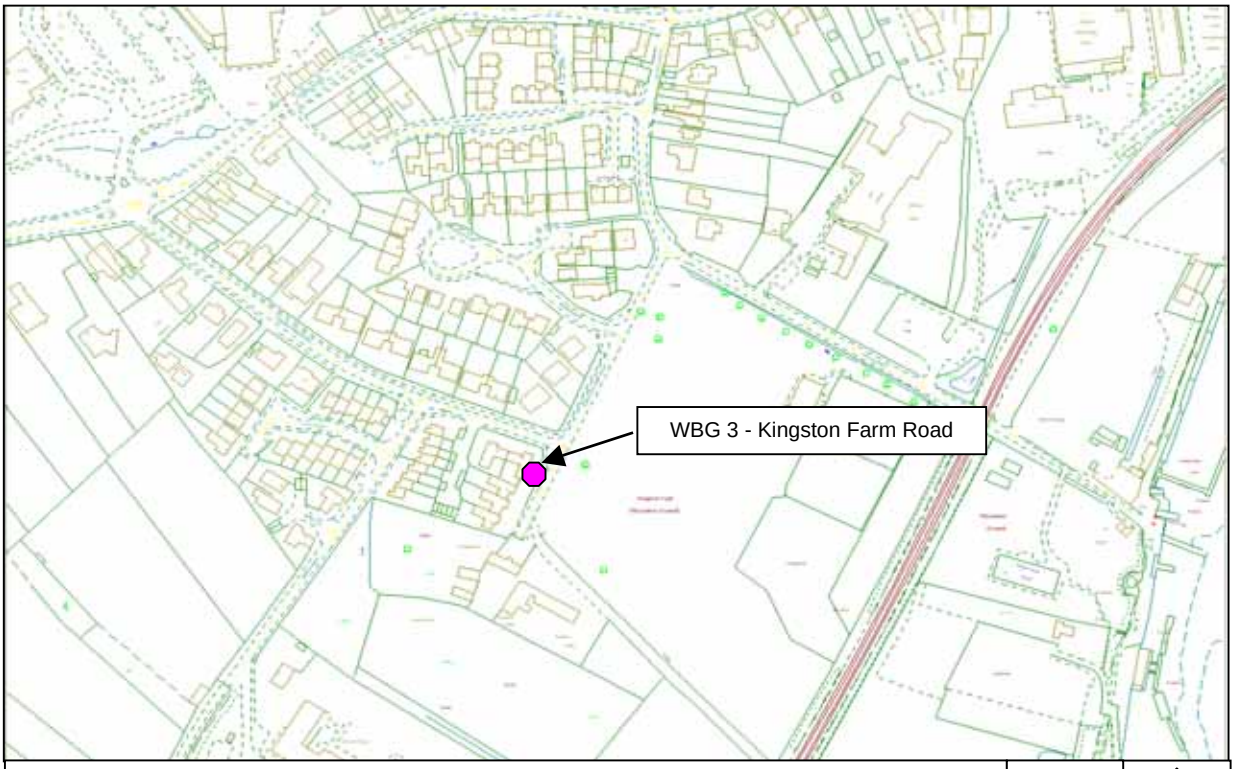
Not to scale

N

Single diffusion tube site

Map 6. Map of diffusion tube locations at Heathgate Piece and Spriteshall Lane.

Woodbridge Maps

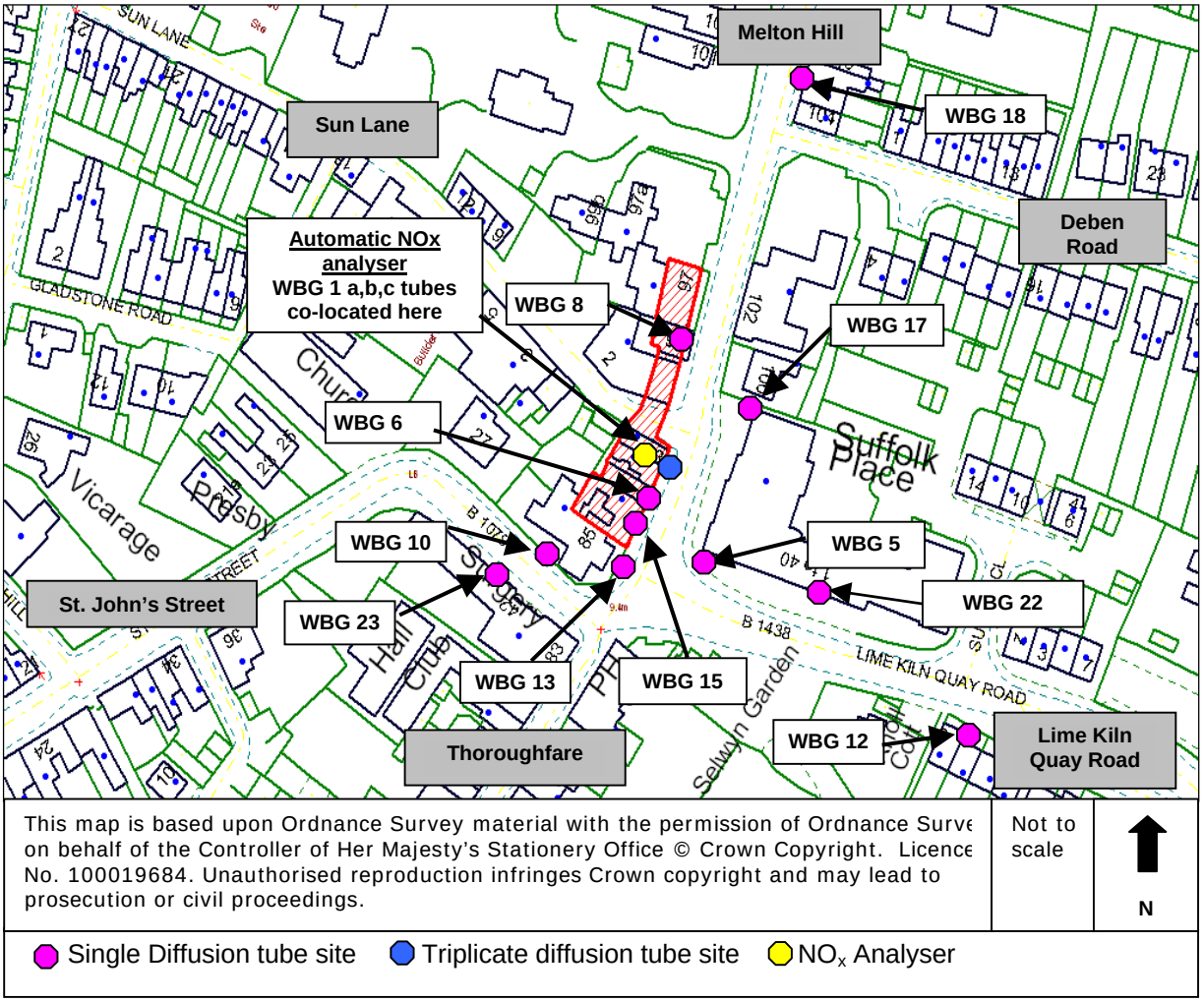


Not to scale

N

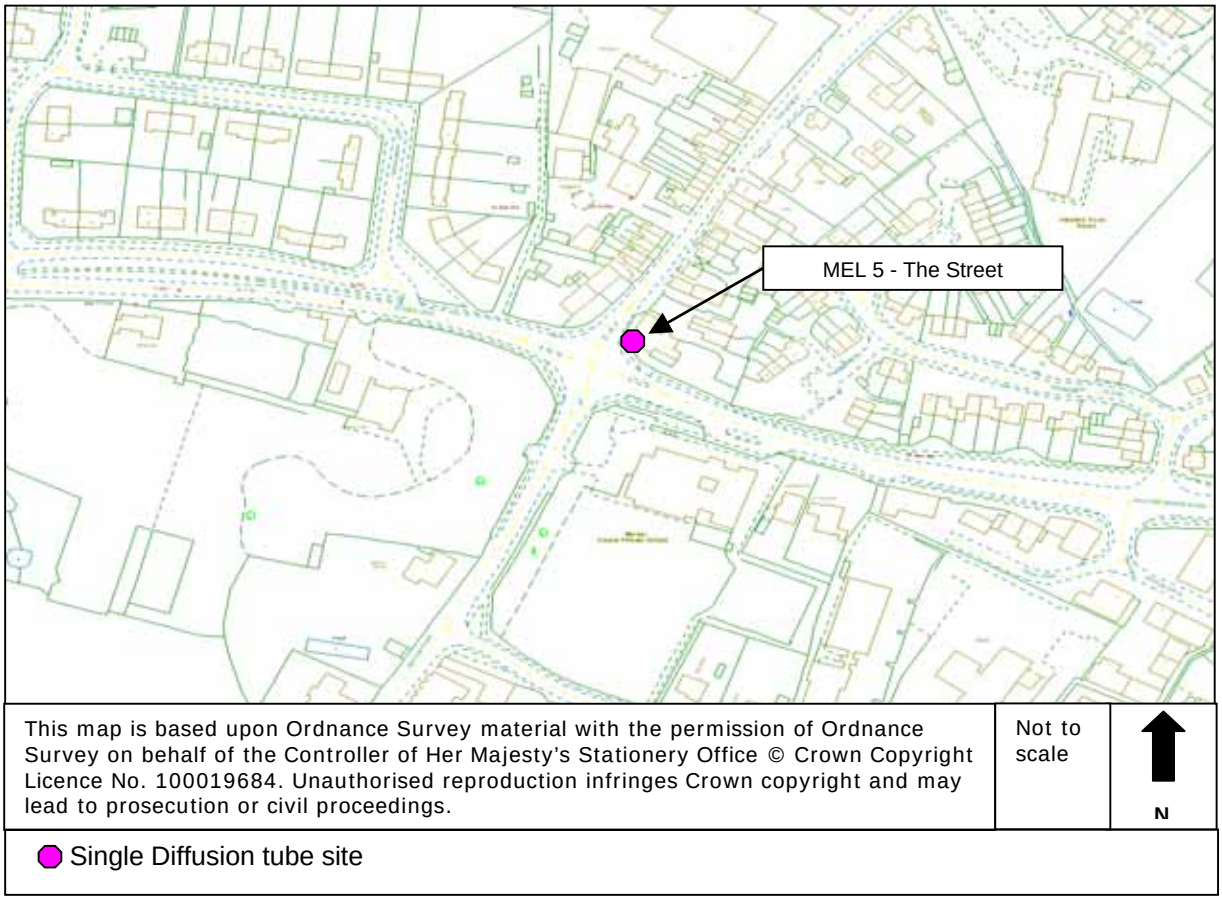
Single Diffusion tube site

Map 1. Map showing diffusion tube location at Kingston Farm Road.



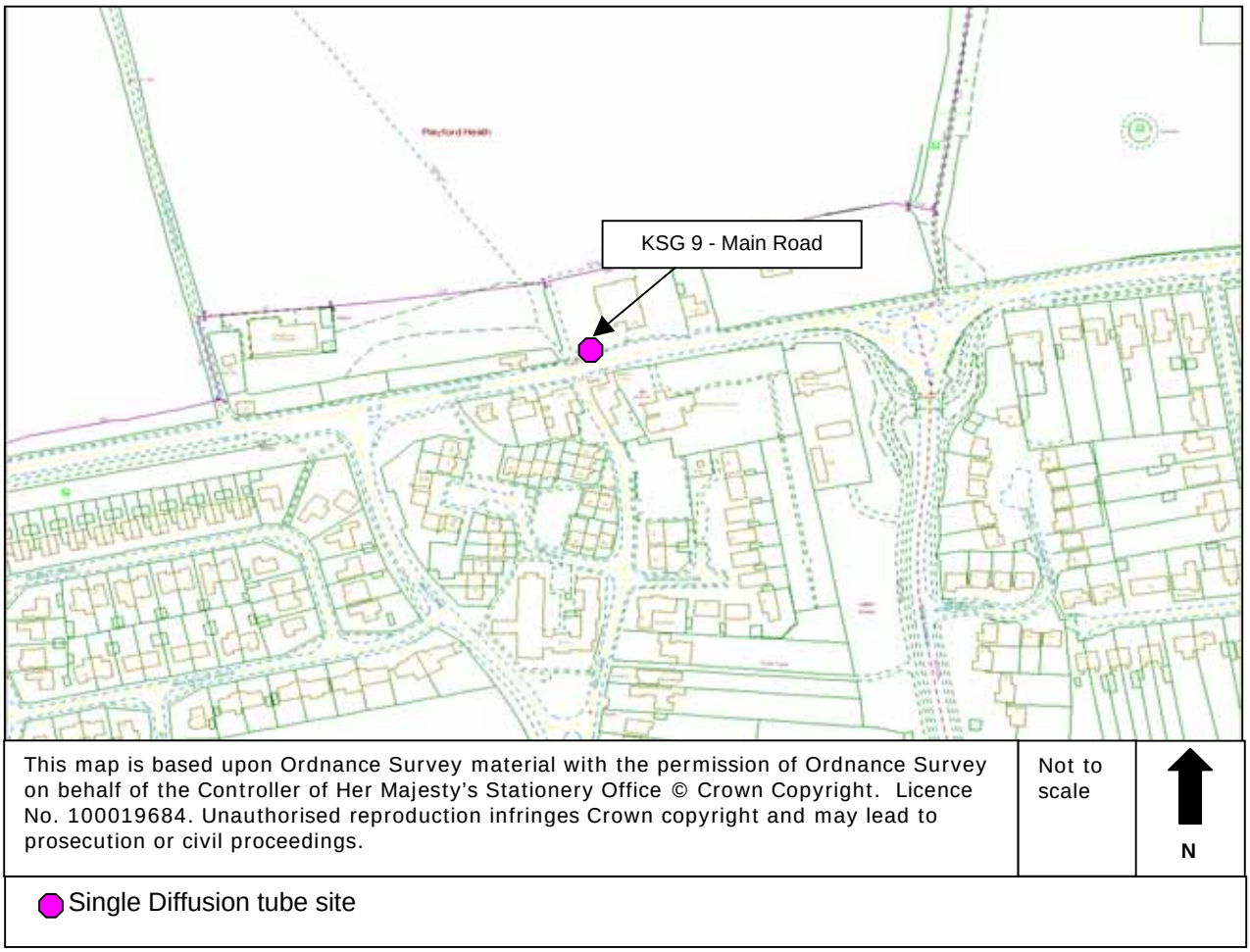
Map 2. Map showing diffusion tube locations around the AQMA

Melton Map



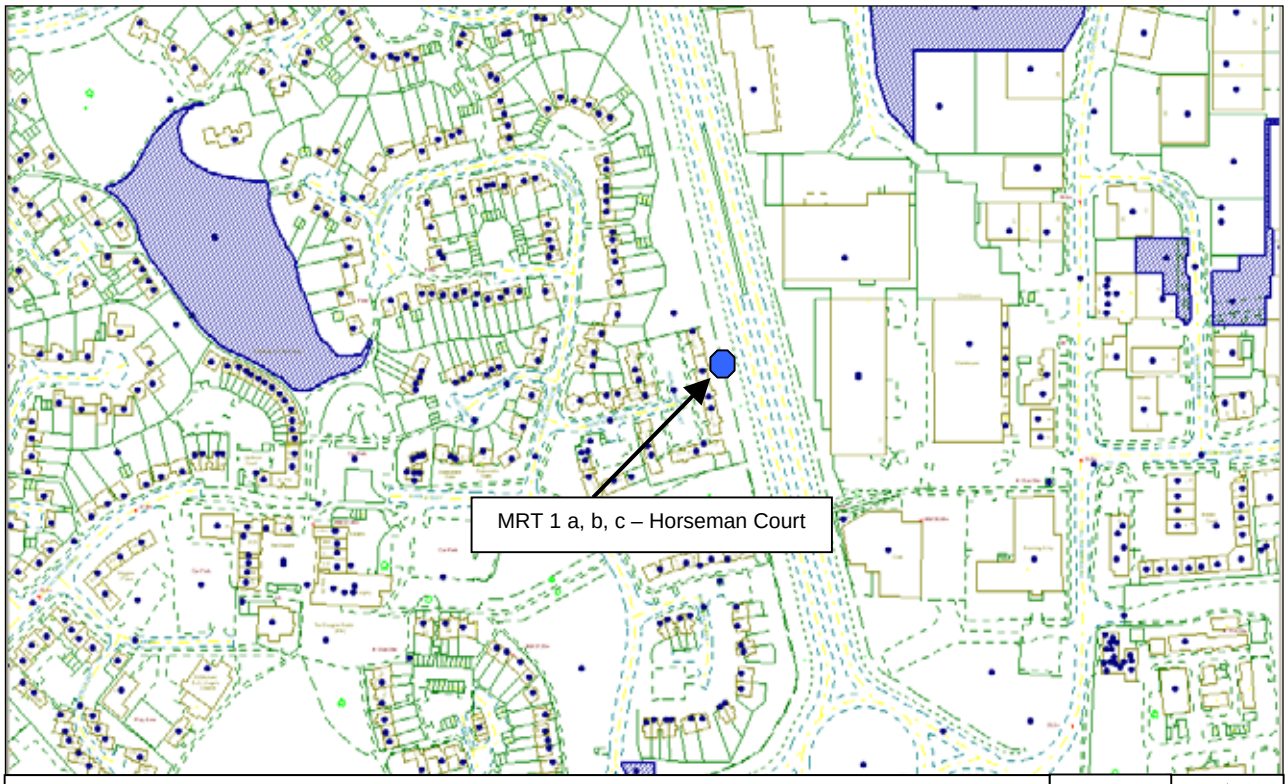
Map 1. Map showing location of the diffusion tube at Melton

Kesgrave Map



Map 1. Map showing location of the diffusion tube at Kesgrave

Martlesham Map



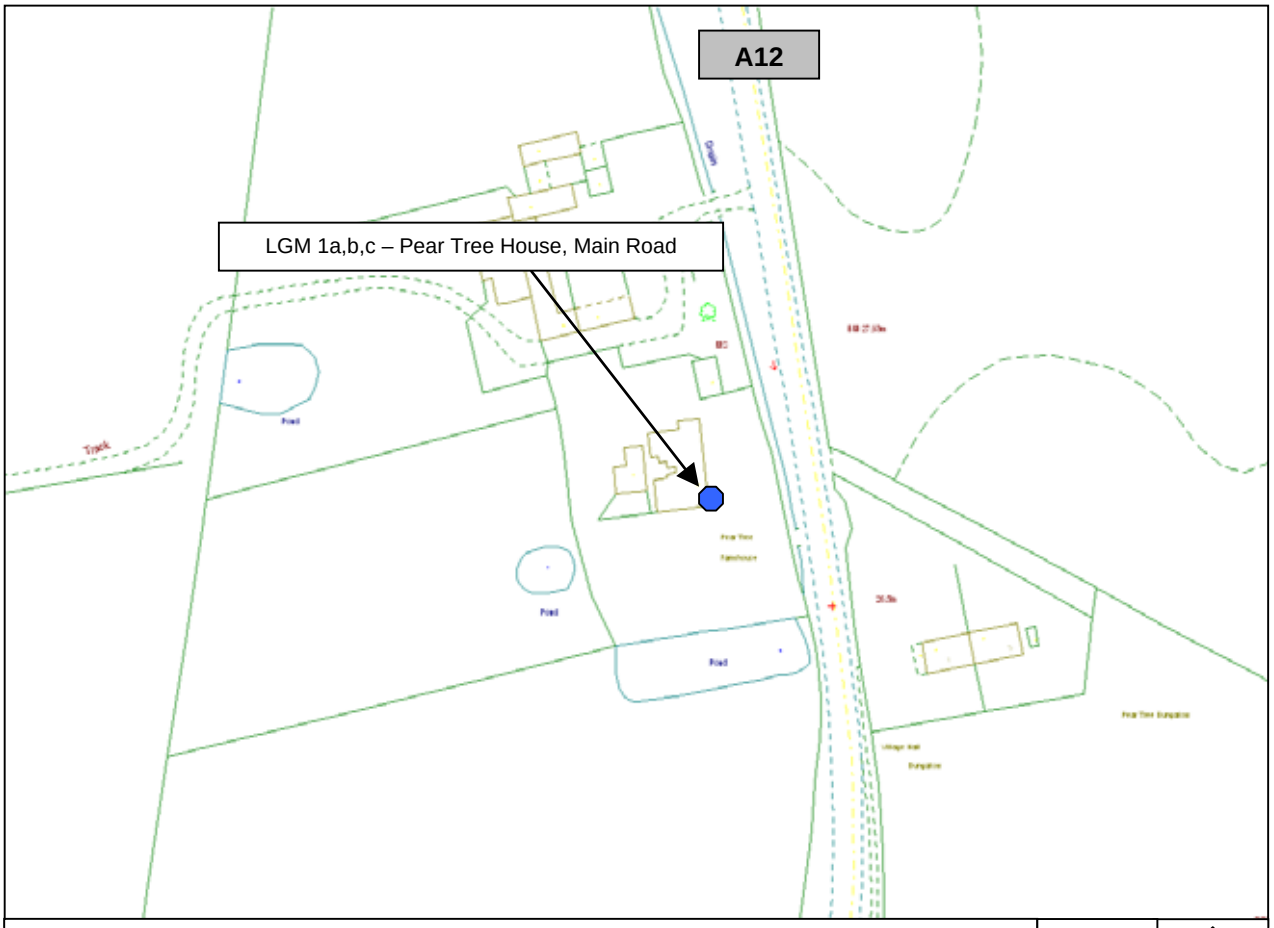
Not to scale

N

Triplicate diffusion tube site

Map 1. Map of diffusion tube location at Martlesham.

Little Glemham Map



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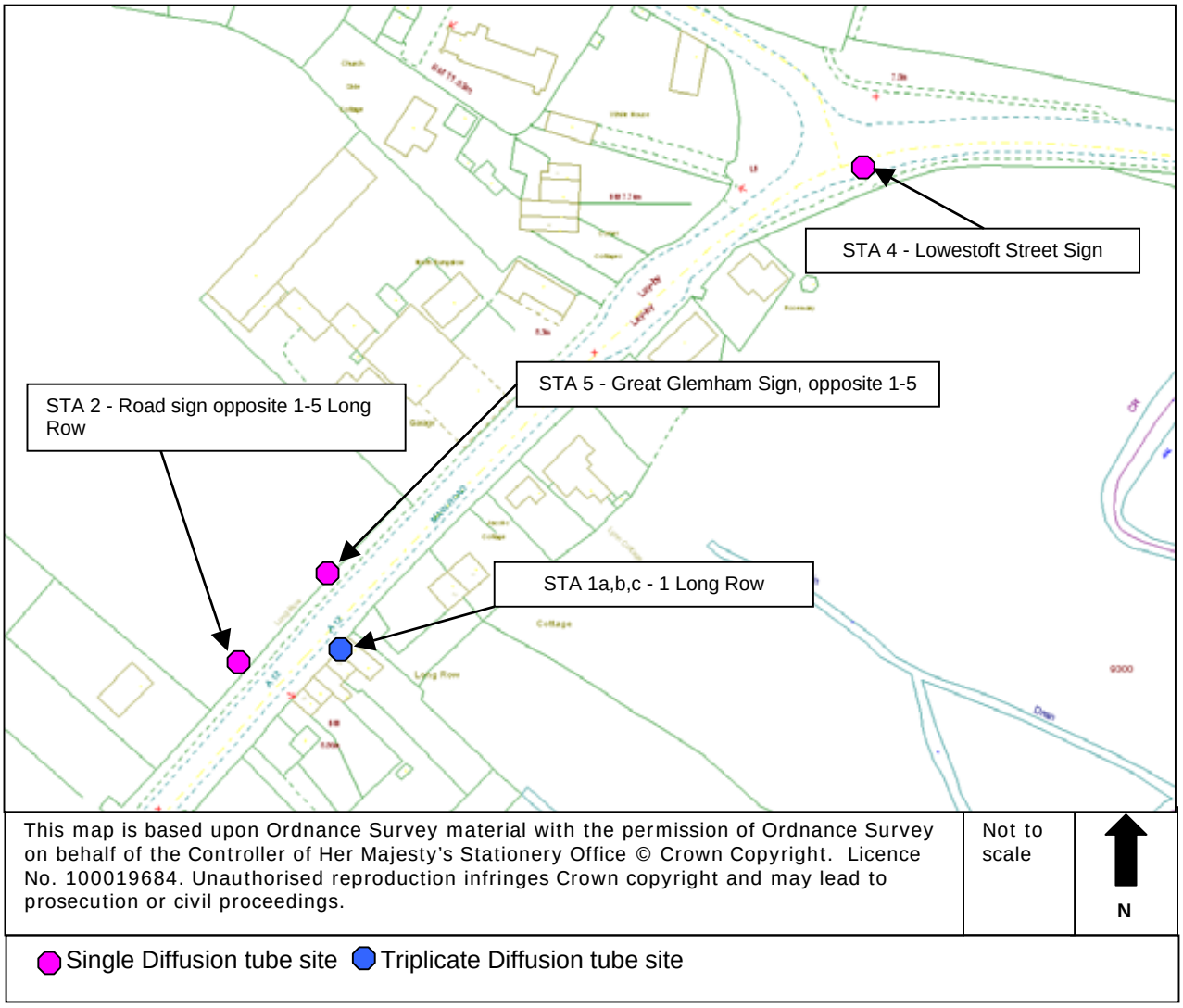
Not to scale

N

Triplicate Diffusion tube site

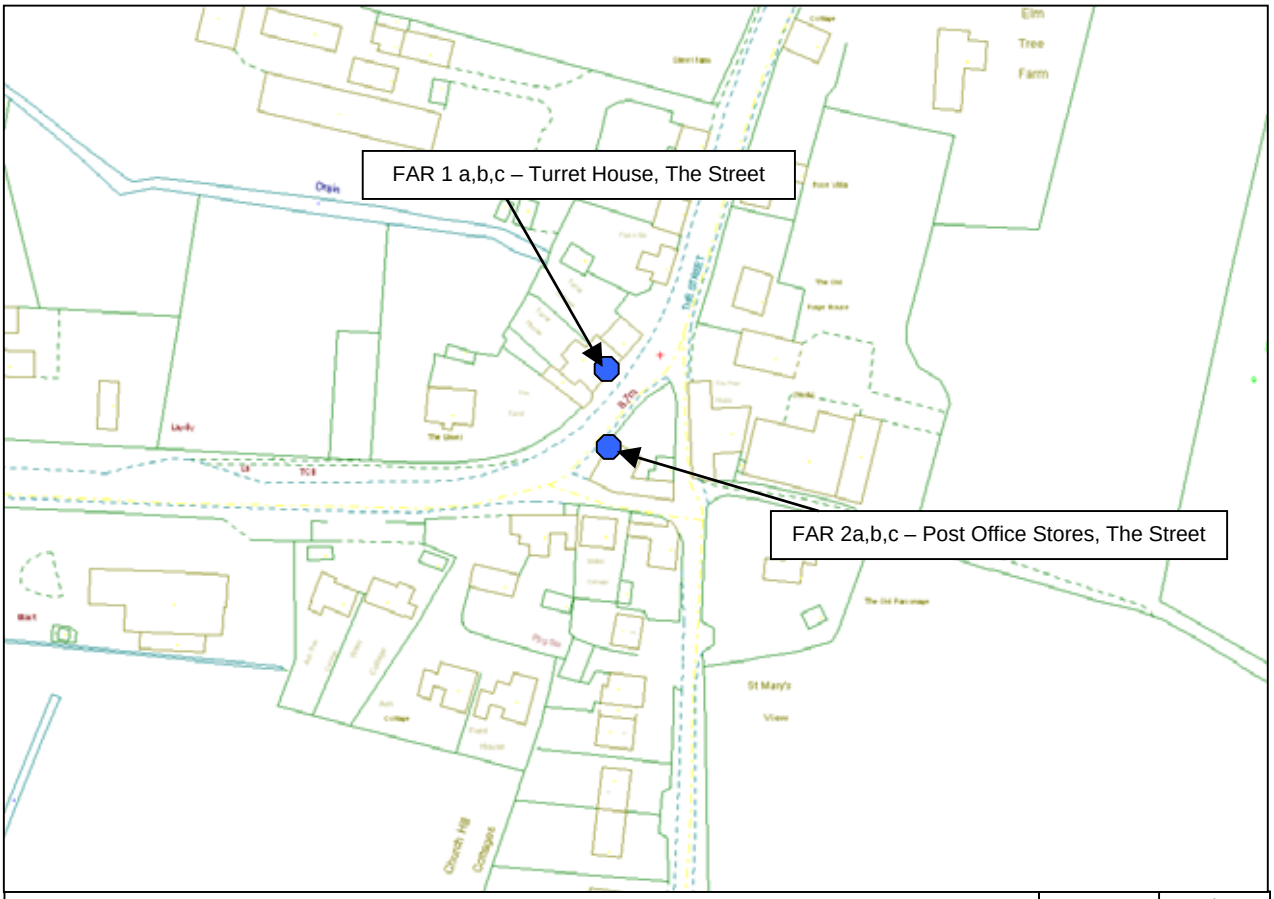
Map 1. Map of diffusion tube locations at Little Glemham.

Stratford St Andrew Map



Map 1. Map showing diffusion tube locations at Stratford St Andrew.

Farnham Map



Not to scale

N

Triplicate Diffusion tube site

Map 1. Map showing diffusion tube locations at Farnham.

Appendix E: NOx analyser results summary

Produced by Ricardo-AEA on behalf of Suffolk Coastal District Council

SUFFOLK COASTAL WOODBRIDGE 2
01 January to 31 December 2012

These data have been fully ratified by AEA

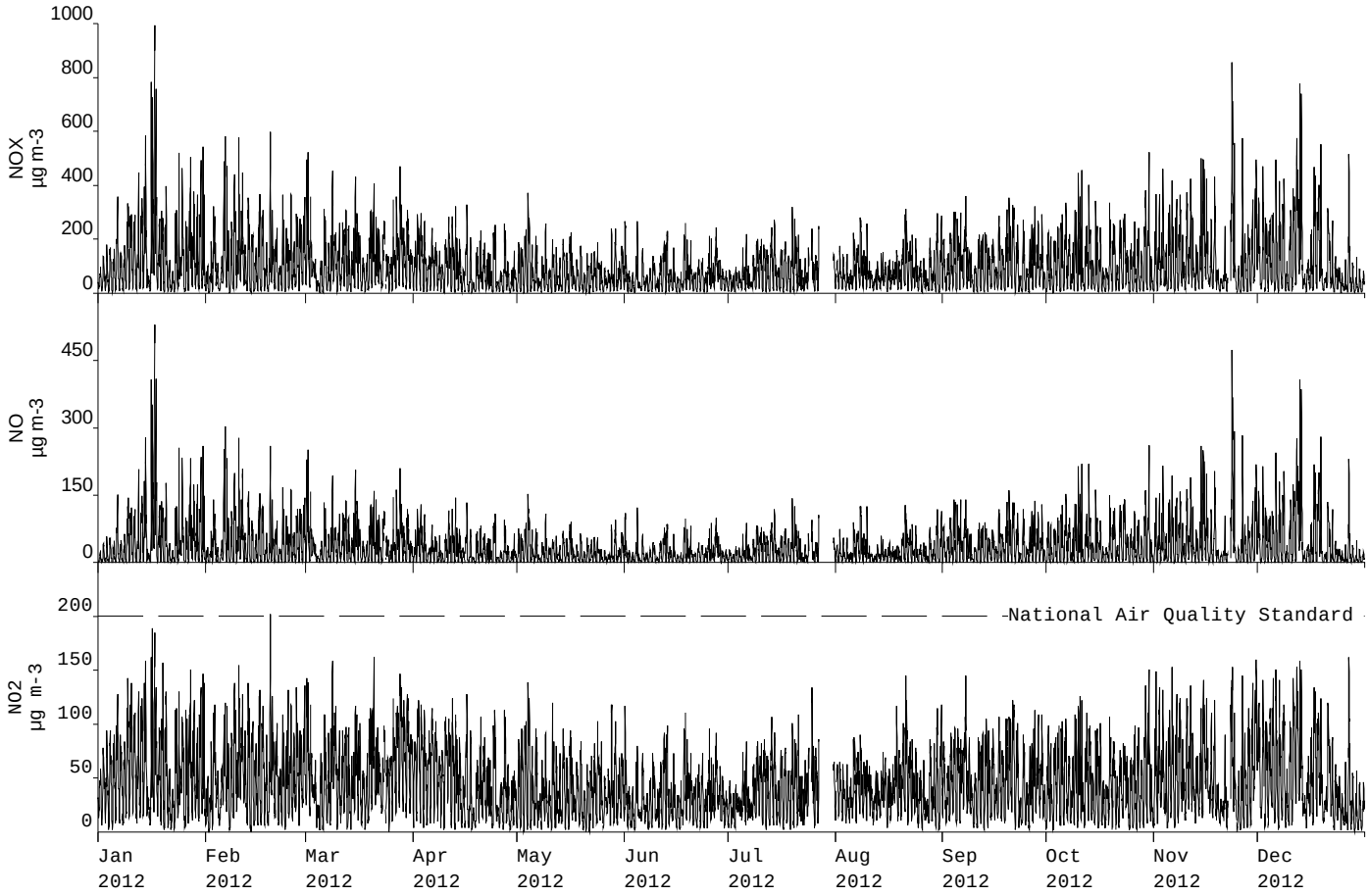
POLLUTANT	NO_X	NO	NO_2
Number Very High	-	-	0
Number High	-	-	0
Number Moderate	-	-	0
Number Low	-	-	8590
Maximum 15-minute mean	1351 µg m^{-3}	728 µg m^{-3}	300 µg m^{-3}
Maximum hourly mean	995 µg m^{-3}	530 µg m^{-3}	202 µg m^{-3}
Maximum running 8-hour mean	596 µg m^{-3}	310 µg m^{-3}	131 µg m^{-3}
Maximum running 24-hour mean	403 µg m^{-3}	196 µg m^{-3}	103 µg m^{-3}
Maximum daily mean	403 µg m^{-3}	196 µg m^{-3}	103 µg m^{-3}
Average	95 µg m^{-3}	34 µg m^{-3}	44 µg m^{-3}
Data capture	97.8 %	97.8 %	97.8 %

All gaseous pollutant mass units are at 20'C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.
NO_X mass units are NO_X as NO_2 µg m-3

Pollutant	Air Quality (England) Regulations 2000 and (Amendment) Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	1	1

Produced by Ricardo-AEA on behalf of Suffolk Coastal District Council

Suffolk Coastal Woodbridge 2
Hourly Mean Data for 01 January to 31 December 2012



For further information on air pollution monitoring please don't hesitate to contact:
Date Created: 05/02/2013

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OX11 0QJ

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e-mail David.Madle@ricardo-aea.com
http://www.airqualityengland.co.uk/

Appendix F: NO_2 Diffusion Tube Results

Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Felixstowe and the Trimleys during 2012. Figures in micrograms per cubic metre (µg/m^3). Annual mean concentration corrected for bias where relevant.

Site	Time in months												Annual Mean (µg/m3)	Annualisa-tion factor if applicable	Annual mean (annualised if applicable)	Bias correction Factor Used #	Bias corrected Annual Mean (µg/m^3)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
FLX 12a	47.2	44.1	42.1	36.6	28.1	28.2	33	30.5	36.9	37.7	44	41.7	see FLX 12 mean	~	~	~	~
FLX 12b	47.8	42.5	39.8	36.8	25.9	26.2	36.8	37.5	33.7	36.6	43.2	37.5	see FLX 12 mean	~	~	~	
FLX 12c	47.8	46.4	38.6	33.7	27.6	34.1	33.3	35.7	35.1	37.8	42.9	42.9	see FLX 12 mean	~	~	~	~
FLX 12 a,b,c-	47.6	44.3	40.2	35.7	27.2	29.5	34.4	34.6	35.2	37.4	43.4	40.7	**37.5**	n/a	n/a	**0.79**	**30**
FLX 14	34.8	38.1	33.9	29.1	24	21.9	23.2	25.3	32.4	31.2	37.5	52.2	**32.0**	n/a	n/a	**0.79**	**25**
FLX 17	36	36.1	28.7	33.3	28.6	26.2	29.0	28.5	25	27.7	36.2	35.6	**30.9**	n/a	n/a	**0.79**	**24**
FLX 20	41.1	35.6	30.1	27.4	21.3	22.5	25.4	28.1	30.0	27.5	36.8	30.3	**29.7**	n/a	n/a	**0.79**	**23**
FLX 21	41.5	39.7	31.9	24.1	16.5	17.5	22.0	27.4	28.6	21.9	36	30.8	**28.2**	n/a	n/a	**0.79**	**22**
FLX 22	38.4	37.6	34.3	26.5	20.3	21.4	21.9	25.6	29.2	29	34.1	37.8	**29.7**	n/a	n/a	**0.79**	**23**
FLX 23	33.5	38.8	39.4	36.1	38.9	29.9	27.9	30	26.5	29.1	30	29.4	**32.5**	n/a	n/a	**0.79**	**26**
FLX 24	47	44.1	32.7	34.9	27	25.1	29.5	30	36.0	36.3	41.1	40.4	**35.3**	n/a	n/a	**0.79**	**28**
FLX 26a	58.1	56.9	50.8	44.9	41.1	35.5	42.2	40.8	46.0	45.9	49.3	47	See FLX 26 Mean	~	~	~	~
FLX 26b	48.5	54.5	46.7	43.7	39.7	39.9	40.4	42.7	51.7	44.7	43	49.6	See FLX 26 Mean	~	~	~	~
FLX 26c	55.3	56.9	46.6	39.4	40.7	44.3	42.0	42.8	46.7	50.8	42.7	47.7	See FLX 26 Mean	~	~	~	~
FLX 26 a,b,c -	54.0	56.1	48.0	42.7	40.5	39.9	41.5	42.1	48.1	47.1	45.0	48.1	**46.1**	n/a	n/a	**0.79**	**36**
FLX 27a	54.1	48.8	41.2	41		32	35.2	36.3	51.7	44.4	46.3	44.9	See FLX 27 Mean	~	~	~	~
FLX 27b	56.7	47.5	40.6	40.7	38.1	33.9	31.8	37.1	41.9	42.8	51.1	42.6	See FLX 27 Mean	~	~	~	~
FLX 27c	53	49.4	41.2	43.1	32	31.8	33.8	37.5	40.9	46	49.8	47.1	See FLX 27 Mean	~	~	~	~
FLX 27 a,b,c-	54.6	48.6	41.0	41.6	35.1	32.6	33.6	37.0	44.8	44.4	49.1	44.9	**42.3**	n/a	n/a	**0.79**	**33**
FLX 29	40.7	39.3	28.9	26	22.3	19.5	23.3	23.6	27.2		32	38.3	**29.2**	n/a	n/a	**0.79**	**23**
FLX 31a	43.9	42.6	34.9	25.7	25.5	25.6	26.0	29.7	34.7	31	39.7	43.5	see FLX 31 mean	~	~	~	~
FLX 31b	42.5	37.6	36.2	29.1	24.6	22.1	26.7	30	35.2	36.6	37.2	37.3	see FLX 31 mean	~	~	~	~
FLX 31c	39.6	45.6	33.3	30.6	26.8	23.9	22.8	28.7	36.8	38.7	41.9	39.6	see FLX 31 mean	~	~	~	~
FLX 31 a,b,c-	42.0	41.9	34.8	28.5	25.6	23.9	25.2	29.5	35.6	35.4	39.6	40.1	**33.5**	n/a	n/a	**0.79**	**26**
FLX 32a	56.4	53.9	44.6	42.4	35.1	34.3	31.9	35.1	45.1	51.2	52.7	39.6	see FLX 32 mean	~	~	~	~
FLX 32b	53.7	50.1	44.7	44.3	32.7	33.0	27.2	33.2	43.9	45	50.7	54.5	see FLX 32 mean	~	~	~	~
FLX 32c	58.7	51.4	38.4	42.6	32.7	30.4	36	37.1	41.4	48.4	48	47.1	see FLX 32 mean	~	~	~	~
FLX 32 a,b,c-	56.3	51.8	42.6	43.1	33.5	32.6	31.7	35.1	43.5	48.2	50.5	47.1	**43.0**	n/a	n/a	**0.79**	**34**
FLX 33	97.6	91.5	74.9	75.1	65.2	59.1	67	69.8	77.5		81.3	75.7	**75.9**	n/a	n/a	**0.79**	**60**
FLX 34	65.8	66	64.1	51.5	55	49.4		52.2	53.2	56.4	62.1	59.2	**57.7**	n/a	n/a	**0.79**	**46**
FLX 35	65.8	72.4	68.7	57.4	47.9	46.4	48.3	50.3	48.7	54.4	56.9	55.5	**56.1**	n/a	n/a	**0.79**	**44**
FLX 36	50.7	55.1	45.8	45.5	38.2	40.3	34.4	42.9	46.7	48.3	56.5	52.4	**46.4**	n/a	n/a	**0.79**	**37**
FLX 37	70.5	63	45.2	52.5	43.3	44.4	46.5	51.7	58.4	58.7	59.9	62.4	**54.7**	n/a	n/a	**0.79**	**43**
FLX 38	50.4	53.1	41.4	47.4	39.6	36.5	39.4	36.5	46.7	42.8	44.6	45.1	**43.6**	n/a	n/a	**0.79**	**34**

Key:

FLX 12	Roadside site, drainpipe at 119 Hamilton Road, 'Ford Bros. Bike Shop' Felixstowe
FLX 14	Industrial site, drainpipe on 1 Adastral Close, Felixstowe.
FLX 17	Roadside site, drainpipe on 38 Spriteshall Lane, Trimley St. Mary.
FLX 20	Industrial/Roadside site, rear garden of 73 Glemsford Close, Felixstowe
FLX 21	Urban Background site, lampost at 4 Kings Fleet Road, Felixstowe
FLX 22	Industrial site, drainpipe on 13 Levington Road, Felixstowe
FLX 23	Roadside site, drainpipe on 23 Heathgate Piece, Trimley St. Mary.
FLX 24	Roadside site, rear garden of 22 Brandon Road, Felixstowe
FLX 26 a,b,c	Industrial/Roadside site, Kitchen drainpipe to rear of The Dooley Inn, Ferry Lane, Felixstowe.
FLX 27a,b,c	Industrial/Roadside site, first floor front window facing the Docks at The Dooley Inn, Ferry Lane, Felixstowe
FLX 29	Industrial Site, 18 Adastral Close, Felixstowe
FLX 31 a,b,c	Industrial Site, 44 Adastral Close, Felixstowe
FLX 32 a,b,c	Industrial Roadside Site, Guttering to rear of Dooley Inn PH
FLX 33	Roadside Site, Dock Gate 2 Roundabout
FLX 34	Industrial/Roadside Site Ferry Lane, Midway between roundabout and Dooley Inn PH
FLX 35	Industrial/ Roadside Site, The Dooley Inn Signpost at front of building
FLX 36	Industrial/ Roadside Site, Street Sign in Hodgkinson Road, Felixstowe
FLX 37	Industrial/ Roadside Site, Lampost at Ferry Lane on corner of Hodgkinson Road
FLX 38	Industrial/ Roadside Site, Lampost on Ferry Lane, past Hodgkinson Road

Diffusion tube annual mean data is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be a combined ("national") bias adjustment factor, or one calculated from a co-location study with a continuous analyser carried out by the authority themselves. The 2012 data from the Felixstowe sites were adjusted using a combined (national) bias adjustment factor of 0.79.

Monthly and annual mean nitrogen dioxide (NO_2) concentrations recorded at sites in Kesgrave during 2012, figures in micrograms per cubic metre ($\mu g/m^3$). Annual mean concentration corrected for bias where relevant.

Site	Time in months												Annual Mean (µg/m3)	Annualisation factor if applicable	Annual mean (annualised if applicable)	Bias correction Factor Used #	Bias corrected Annual Mean (µg/m3)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
KSG 9	48.3	47	41.5	27.4	25.7	32.2	33.6	46.7	39.9	42.3	44.2	45.5	**39.5**	n/a	n/a	**0.79**	**31**

Key:

KSG 9 Roadside site, roadside lampost at 118 Main Road, Kesgrave

Diffusion tube annual mean data is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be a combined ("national") bias adjustment factor, or one calculated from a co-location study with a continuous analyser carried out by the authority themselves. The 2012 data from the Kesgrave sites were adjusted using a combined (national) bias adjustment factor of 0.79.

Monthly and annual mean nitrogen dioxide (NO2) concentrations recorded at sites in Woodbridge during 2012, figures in micrograms per cubic metre (mg/m3). Annual mean concentration corrected for bias where relevant

Site	Time in months												Annual Mean (µg/m3)	Annualisation factor if applicable	Annual mean (annualised if applicable)	Bias correction Factor Used #	Bias corrected Annual Mean (µg/m^3)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
WBG 1a	56.6	57.8	57.3	46.1	45.3	36.5	44.9	44.8	49.6	46.7	57.9	48.1	see WBG 1 mean	~	~	~	~
WBG 1b	55.3	58.6	54.8	50.6	43.3	37.9	48.0	46.2	47.7	51.6	58.9	54.8	see WBG 1 mean	~	~	~	~
WBG 1c	45.9	59.6	56.9	42	43.9	43.6	46.3	44.2	50	49.5	58.6	55.9	see WBG 1 mean	~	~	~	~
WBG 1 a,b,c - mean	52.6	58.7	56.3	46.2	44.2	39.3	46.4	45.1	49.1	49.3	58.5	52.9	**49.9**	n/a	n/a	**0.88**	**44**
WBG 3	20.8	25.2	20.0	12.3	11.1	9.6	11.3	16.5	15.2	19.2	23.6	23.5	**17.4**	n/a	n/a	**0.88**	**15**
WBG 5	36.6	34.9	36.5	26.2	24.4	22.7	23.2	23.3	23.6	29.2	36	31.7	**29.0**	n/a	n/a	**0.88**	**26**
WBG 6	51.4	53.8	49.4	46.8	39.7	34.3			42.5	45.4	52.1	33.1	**44.9**	**1.02**	**45.8**	**0.88**	**40**
WBG 8	52.9	52.7	55.2	43.8		33.3		37.6	43.2	47.8	50.4	53.5	**47.0**	**1.03**	**48.4**	**0.88**	**43**
WBG 10	39.3	38.6	42.9			28.5				32.2	42.1	39.4	**37.6**	**0.93**	**35.0**	**0.88**	**31**
WBG 12	28.8	33.7	33.2	20.4	19.1	20.3	22.6	27.3	30.4	30.6	38.1	32.2	**28.1**	n/a	n/a	**0.88**	**25**
WBG 13	48.8	49.5	50.1	37.7	37.0	30.7	31.9	37.9	37.0	41.3	48.4	47.1	**41.5**	n/a	n/a	**0.88**	**36**
WBG 15	53.2	51.3	55.3	47.8	46.5	36.8	40.8	40.3	46.0	44.4	55.1	55.6	**47.8**	n/a	n/a	**0.88**	**42**
WBG 17	36.6	34.9	37.9	27.9	26.4	27	28.4	31.9	28.6	30.6	32	33.2	**31.3**	n/a	n/a	**0.88**	**28**
WBG 18	39.7	43.5	42.6	37.5	36.5	32.5	35.6	37.8	35.0	41.8	43.3	36.3	**38.5**	n/a	n/a	**0.88**	**34**
WBG 22	30.9	32.5	28.4	24.8	21.5	17.6	17.3	19.2	20.5	27.4	32	30.2	**25.2**	n/a	n/a	**0.88**	**22**
WBG 23	33.3	33.4	35.2	21.6	23.3	23.1	26.5	32.5	28.4	31.8	29	33.7	**29.3**	n/a	n/a	**0.88**	**26**

Key:

WBG 1a,b,c	Kerbside site, signpost outside 93 Thoroughfare, Woodbridge **(Triplicate site collocated with Continuous NOx Analyser)**
WBG 3	Urban Background site, lampost outside 8 Kingston Farm Road, Woodbridge
WBG 5	Roadside site, drainpipe on corner of Suffolk Place, Lime Kiln Quay Road, Woodbridge
WBG 6	Roadside site, drainpipe on 87 Thoroughfare, Woodbridge
WBG 8	Roadside site, drainpipe on 95 Thoroughfare, Woodbridge
WBG 10	Roadside site, signpost in St. John's Street (opposite Surgery), Woodbridge
WBG 12	Roadside site, drainpipe on 8 Lime Kiln Quay Road, Woodbridge.
WBG 13	Roadside site, traffic lights at front of 85 Thoroughfare, Woodbridge
WBG 15	Roadside site, Top guttering in middle of 87 Thoroughfare, Woodbridge
WBG 17	Roadside site, drainpipe at front Northern end of Suffolk Place, Lime Kiln Quay Road, Woodbridge
WBG 18	Roadside site, drainpipe between 106 / 108 Thoroughfare, Woodbridge
WBG 22	Roadside Site, first floor balcony on Suffolk Place facing Lime Kiln Quay Road.
WBG 23	Roadside Site, lampost o/s new buildings (number 50), St Johns Street, Woodbridge.

Diffusion tube annual mean data is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be a combined ("national") bias adjustment factor, or one calculated from a co-location study with a continuous analyser carried out by the authority themselves. The 2012 data from the Woodbridge sites were adjusted using the bias adjustment factor from the local co-location study carried out in Woodbridge of 0.88.

Monthly and annual mean nitrogen dioxide (NO2) concentrations recorded at sites in Melton during 2012, figures in micrograms per cubic metre (mg/m3). Annual mean concentration corrected for bias where relevant

Site	Time in months												Annual Mean (µg/m3)	Annualisation factor if applicable	Annual mean (annualised if applicable)	Bias correction Factor Used #	Bias corrected Annual Mean (µg/m3)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
MEL 5	43.5	43.8	37.3	30.5	29.9	43.9	48.8	33.6	39.4	33.9	41.5	39.3	**38.8**	n/a	n/a	**0.79**	**31**

Key:

MEL 5 Roadside site, 6 The Street, Melton. **(Duplicate site)**

Diffusion tube annual mean data is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be a combined ("national") bias adjustment factor, or one calculated from a co-location study with a continuous analyser carried out by the authority themselves. The 2012 data from the Melton site were adjusted using a combined (national) bias adjustment factor of 0.79.

Monthly and annual mean nitrogen dioxide (NO2) concentrations recorded at sites in Martlesham during 2012, figures in micrograms per cubic metre (mg/m3). Annual mean concentration corrected for bias where relevant.

Site	Time in months												Annual Mean (µg/m3)	Annualisation factor if applicable	Annual mean (annualised if applicable)	Bias correction Factor Used #	Bias corrected Annual Mean (µg/m3)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
MRT 1a	29.6	34.9	32.9	21.9	20.1	24.4	22.4	24	23.7	27.6	29.6	29.9	see MRT 1 mean	~	~	~	~
MRT 1b	33.4	33.7	29.5	22.9	22.9	22.5	23.3	25.7	24.0	26.1	28.4	26.7	see MRT 1 mean	~	~	~	~
MRT 1c	29.3	30.3	32.1	25.8	23.7	22.3	21.8	24.6	22.8	26.6	28.4	27.7	see MRT 1 mean	~	~	~	~
MRT 1a,b, c-Mean	30.8	33.0	31.5	23.5	22.2	23.1	22.5	24.8	23.5	26.8	28.8	28.1	**26.5**	n/a	n/a	**0.79**	**21**

Key:

MRT 1a,b,c Site located on drainpipe behind Horseman court, off Eagle Way, Martlesham. **(Triplicate Site)**

Diffusion tube annual mean data is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be a combined ("national") bias adjustment factor, or one calculated from a co-location study with a continuous analyser carried out by the authority themselves. The 2012 data from the Martlesham sites were adjusted using a combined (national) bias adjustment factor of 0.79.

Monthly and annual mean nitrogen dioxide (NO2) concentrations recorded at sites along the A12 during 2012, figures in micrograms per cubic metre (mg/m3). Annual mean concentration corrected for bias where relevant.

Site	Time in months												Annual Mean (µg/m3)	Annualisa-tion factor if applicable	Annual mean (annualised if applicable)	Bias correction Factor Used #	Bias corrected Annual Mean (µg/m3)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
LGM 1a	19.8	19	21.8	9.4	16.9	15.3	13.9	15.5	12.7	19.2	21.3	14.2	see LGM 1 mean	~	~	~	~
LGM 1b	19.8	20.5	22.8	14.4	16.5	14.5	15.3	16.7	13.7	19	21.4	16.7	see LGM 1 mean	~	~	~	~
LGM 1c	18.0	18.3	24.6	14.6	12.7	15.7	28.9	17.9	14.6	20.2	21.4	18.6	see LGM 1 mean	~	~	~	~
LGM 1a,b,c-mean	19.2	19.3	23.1	12.8	15.4	15.2	19.4	16.7	13.7	19.5	21.4	16.5	**17.7**	n/a	n/a	**0.79**	**14.0**
FAR 1a	35.0	37.1	35.0	32.1	33.8	26.3	28.9	30.6	32.9	35.3	34.0	32.1	see FAR 1 mean	~	~	~	~
FAR 1b	33.4	36.0	37.6	26.5	29.9	30.8	26.8	31.3	33.1	36.0	32.2	32.5	see FAR 1 mean	~	~	~	~
FAR 1c	29.3	37.4	37.1	31.5	30.7	28.9	28.6	30.9	31.1	37.1	33.3	39.5	see FAR 1 mean	~	~	~	~
FAR 1a,b,c-mean	32.6	36.8	36.6	30.0	31.5	28.7	28.1	30.9	32.4	36.1	33.2	34.7	**32.6**	n/a	n/a	**0.79**	**25.8**
FAR 2a	39.7	45.2	44.7	36.1	32.8	32.2	31.8	42.9	38.2	43.6	40.1	43.3	see FAR 2 mean	~	~	~	~
FAR 2b	43.3	45.2	39	36	34.9	34.8	32.9	41.9	36.8	47.7	38.3	41.8	see FAR 2 mean	~	~	~	~
FAR 2c	38	44.7	41.2	35.6	32.2	33.3	34.5	44.2	38.6	43	34	38.3	see FAR 2 mean	~	~	~	~
FAR 2a,b,c- mean	40.3	45.0	41.6	35.9	33.3	33.4	33.1	43.0	37.9	44.8	37.5	41.1	**38.9**	n/a	n/a	**0.79**	**30.7**
STA 1a	33.4	54.2	57.9	52.5	44.9	45.1	54.5	67.9	51.7	58.1	57.5	48.5	See STA 1 mean	~	~	~	~
STA 1b	56.4	57.5	48.4	50.7	44.8	46.6	53.4	63.2	53	61.3	59.8	49.7	See STA 1 mean	~	~	~	~
STA 1c	55.2	52.8	52.8	53.3	44.5	49.7	54.5	67.6	52.8	54.7	67.6	53.9	See STA 1 mean	~	~	~	~
STA 1a,b,c- mean	48.3	54.8	53.0	52.2	44.7	47.1	54.1	66.2	52.5	58.0	61.6	50.7	**53.6**	n/a	n/a	**0.79**	**42.4**
STA 2	30.3	35.2	37.6	28.3	24.5	25.8	31	39.8	35.5	40.6	41.6	27	**33.1**	n/a	n/a	**0.79**	**26.1**
STA 3	29.9	28.4	34.9										n/a	~	~	~	
STA 4	25	28	26.3	29.5	26.3	26.9	31.1	38.8	30.3	35.5	38.3	29	**30.4**	n/a	n/a	**0.79**	**24.0**
STA 5				20.3	17.4	15	15.6	16.2	17	19.7	21.4	28.5	**19.0**	**1.21**	**23.0**	**0.79**	**18.2**

Key:

LGM 1a,b,c	Roadside Site, Drainpipe on Pear Tree House, Main Road, Little Glemham
FAR 1a,b,c	Roadside Site, Turret House, The Street, Farnham
FAR 2a,b,c	Roadside Site, Post Office Stores, The Street, Farnham,
STA 1 a,b,c	Roadside Site, 1 Long Row, Main Road, Stratford (Triplicate)
STA 2	Roadside Site, Road Sign opposite 1-5 Long Row, Main Road, Straford
STA 3	Roadside Site, Slippery Road Sign near garage, Main Road, Stratford **(removed March 2012)**
STA 4	Roadside Site, Lowestoft Street Sign on bend, Main Road, Stratford
STA 5	Roadside Site, Great Glemham Sign, opposite 1-5 Long Row, Stratford **(new site as of March 2012)**

Diffusion tube annual mean data is ratified to improve accuracy. The bias adjustment factor for the diffusion tubes must either be a combined ("national") bias adjustment factor, or one calculated from a co-location study with a continuous analyser carried out by the authority themselves. The 2012 data from the North sites were adjusted using a combined (national) bias adjustment factor of 0.79.

Appendix G:

Air Quality Detailed Assessment for Stratford St Andrew

Air Quality Detailed Assessment

Stratford St Andrew

November 2013

The findings of the attached Detailed Assessment report were approved at Suffolk Coastal District Council's Cabinet meeting on 4th November 2013.

The Council will declare an Air Quality Management Area (AQMA) to cover the area of exceedence - the AQMA boundary will encompass the four houses at 1-5 Long Row, Main Road, Stratford St Andrew, Suffolk.

Once Defra approval has been received the AQMA Order will be made.

Denise Lavender
Environmental Protection Officer
Suffolk Coastal District Council

Transport Research Laboratory
Creating the future of transport


CLIENT PROJECT REPORT CPR2628

Air Quality Detailed Assessment

Stratford St Andrew

Savage, A., and Turpin, K.

Prepared for: Suffolk Coastal District Council, Environmental Protection

Project Ref:

Quality approved:

Julie Austin (Project Manager)

Kevin Turpin (Technical Referee)

Disclaimer

This report has been produced by the Transport Research Laboratory under a contract with Suffolk Coastal District Council. Any views expressed in this report are not necessarily those of Suffolk Coastal District Council.

Contents amendment record

This report has been amended and issued as follows:

Version	Date	Description	Editor	Technical Referee
1	June 2013	First draft	AS	KT
2	July 2013	Final report	AS	KT

Executive summary

This report constitutes a detailed assessment of annual mean nitrogen dioxide (NO_2) concentrations in Stratford St. Andrew, a village located on the A12 within Suffolk Costal District Council.

The detailed assessment methodology takes into account the results from the NO_2 diffusion tube monitoring data collected by the local authority. In addition to this, a spatial analysis has been conducted to firstly determine the likely emissions profile owing to the traffic activity and secondly to understand the relationship between this profile and the monitoring data. A spatial buffer zone has been applied to confirm the extent of exceedence of the annual mean objective with confidence.

Based on the results of this analysis and a precautionary approach, it is recommended that an Air Quality Management Area (AQMA) should be declared along the extent of the buffer zone. This would include the area of exceedence of the annual mean NO_2 objective and the zone in which any low emission or traffic management measures could apply. Alternatively, the local authority may choose to declare the AQMA to include the area of exceedence only. In this case, the AQMA boundary would encompass the four houses at 1-5 Long Row.

Following the AQMA declaration, the local authority is required to produce a further assessment of air quality within 12 months and to develop an Air Quality Action Plan with targeted measures to improve air quality along this stretch of the A12.

Contents

1 Introduction

This report constitutes a detailed assessment of air quality for Stratford St. Andrew, a village located on the A12, approximately 27 kilometres north east of Ipswich within Suffolk Coastal District Council (SCDC). The detailed assessment focuses on the annual mean nitrogen dioxide (NO_2) objective. This detailed assessment report fulfils the requirements of the Local Air Quality Management (LAQM) framework, introduced under Part IV of the Environment Act 1995. Under this framework, local authorities are required to assess concentrations of specified air pollutants against standards and objectives listed in the Air Quality Strategy (AQS) document for England, Scotland, Wales and Northern Ireland (Defra, 2007). In England, the air quality objectives applicable to LAQM are implemented by the Air Quality (England) Regulations 2000 (SI 928) and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043). A summary of the regulated pollutants and the relevant AQS objectives is presented in Appendix A.

SCDC has completed four rounds of air quality review and assessment as part of this LAQM process and is currently undergoing round five. A summary of the main findings from each review and assessment report is given in Appendix B. To date, SCDC has declared two Air Quality Management Areas (AQMAs) for the annual mean NO_2 objective. The first is in the market town of Woodbridge around the junction with The Thoroughfare, Lime Kiln Quay Road and St John's Street and the second is for a single property on Ferry Lane close to the Port of Felixstowe. Action plans have been developed and are being implemented for both AQMAs.

The most recent Updating and Screening Assessment report produced in 2012 (SCDC, 2012) identified that there was a risk of exceedence of the annual mean NO_2 objective at Stratford St. Andrew on the A12. The local authority increased monitoring during 2012 with triplicate diffusion tubes which confirmed this exceedence and the need to proceed to a detailed assessment.

2 Aims of detailed assessment

In situations where a risk of an air quality objective being exceeded has been identified at a location with relevant public exposure, the local authority is required to undertake a detailed assessment (Defra, 2009). The purpose of the detailed assessment is to determine with reasonable certainty whether or not a likely exceedence will occur. Where a likely exceedence is identified, then the local authority will need to determine the magnitude and geographical extent of the exceedence in order to declare an AQMA. Although there are no prescribed methodologies for a detailed assessment, a local authority should have confidence in their results and conclusions.

A detailed assessment will need to consider points of maximum relevant public exposure (i.e. those locations with the highest concentrations) and estimate the population exposed to concentrations above the objective.

The detailed assessment methodology for Stratford St. Andrew takes into account the results from the nitrogen dioxide (NO_2) diffusion tube monitoring data collected by SCDC. Based on the data it is likely that the location of adjacent houses to the diffusion tube STA1 would be subject to exceedences of the annual mean objective. The detailed assessment presents this data and predicts the likelihood of exceedences further along the road to provide confidence in the AQMA boundary.

In summary, the detailed assessment involves the following methodologies;

1. Appraisal of the characteristics of the traffic activity assumed for the assessment area (Section 3);
2. Presentation of the annual mean NO_2 concentration recorded at the existing monitoring sites (Section 4)
3. Determining the likely emissions profile owing to the traffic activity (Section 5);
4. Understanding of the relationship between the diffusion tube monitoring data recorded at the various monitoring sites and emissions profile (Section 5);
5. Developing a robust methodology which incorporates the findings in (3) to produce a map confirming the extent of exceedences at relevant locations as the basis for the AQMA boundary (Section 5).

2.1

3 Description of Stratford St. Andrew

3.1 Location

Stratford St. Andrew is a small village located on the A12 in the Suffolk Coastal District (see Figure 1). There are approximately 15 houses located along the A12 itself, a filling station and a garage. The speed limit entering the village when approaching from the north is 30 mph (see Figure 2) and this increases to 50 mph leaving the village, when leaving towards the south (see Figure 3).

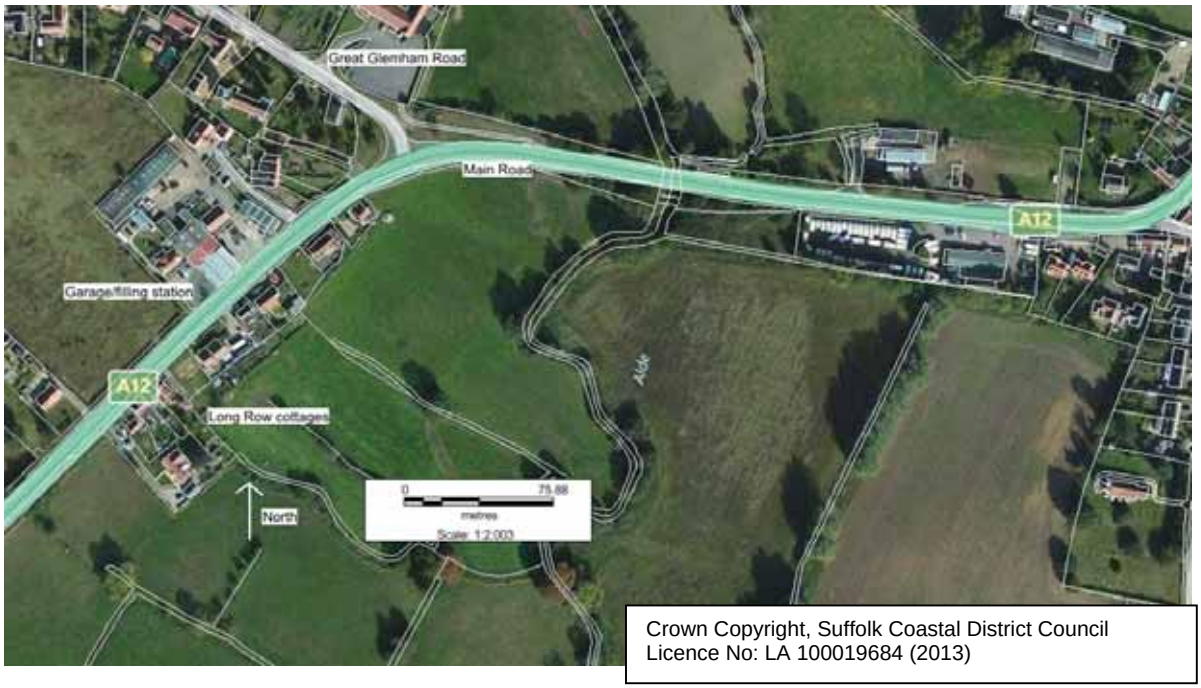

Figure 1: Location of Stratford St Andrew.

Figure 2: Approach to Stratford St. Andrew from the north.

Figure 3: 50 mph speed limit leaving village towards the south.

3.2 Traffic characteristics

Given the characteristic of weather patterns it is expected that pollutant concentrations to the east of the road would be higher than the west. This is perhaps marginal given the trajectory of the road at this location which runs south west to north east. Under these conditions emissions would tend to disperse more so along the length of the road. A certain amount of recirculation and entrainment of emissions close to the terraced houses (Long Row) is likely to lead to elevated concentrations.

The average annual traffic flow along this stretch of the A12 is approximately 15,000 vehicles per day with 6 percent of heavy goods vehicles. A traffic survey that was conducted in May 2013 recorded a 7 day average daily traffic flow of 15,132 at Long Row cottages[1]. There tends to be little congestion in the village, although some queues can form when vehicles turn right into the garage, when approaching from the north.

The speed limit changes from 30 mph as you approach the village from the north to 50 mph as you leave to the south. This change in speed limit occurs at a point fairly close to the end terrace (Long Row). The traffic survey conducted in May 2013 had two count sites; one at Long Row cottages and one at the garage/filling station (see Figure 1). The average 7 day speed at the cottages was found to be 33 mph in both directions and 29 miles per hour at the garage/filling station. However, there were more vehicles that exceeded the 30 mph speed limit by more than 5 mph at Long Row Cottages (26 percent of vehicles approaching the village from the south) compared to 6 percent at the garage/filling station.

It is reasonable to conclude therefore that vehicles accelerate adjacent to Long Row cottages before actually reaching the permitted 50 mph section of road. Conversely, vehicles approaching the village from the south are decelerating from 50 mph down to 30 mph. Under these conditions emissions will increase in the south-westerly wind direction but decrease in the north-easterly wind direction.

3.3 Relevant exposure

The nearest properties to the road are a row of 4 cottages (1-5 Long Row). These are situated 2 metres from the kerb, approaching the village from the south (see Figure 4). Other properties in the village are set back from the road. The local authority has had diffusion tubes located on the façade of 1 Long Row since 2011 with triplicate tubes since 2012.

Figure 4: Long row cottages, approaching from the south.

[1] Survey date 11-17 May 2013. Data sent by D Lavender, SCDC (June 2013).

4 Monitoring data

4.1 Summary of monitoring undertaken

NO_2 diffusion tube monitoring took place at six locations along the A12 close to Stratford St. Andrew in 2012 and at three sites in 2011. Details of diffusion tube site locations are provided in Table 1. These represent worst-case exposure and are located on property facades where possible.

A map showing the locations of the diffusion tubes that were operational during 2012 along the A12 is provided in Figure 5.

The diffusion tubes are supplied and analysed by Environmental Scientifics Group (ESG), Didcot, using the 50% v/v TEA (triethanolamine) in acetone method. Diffusion tubes can over or under read and the annual average obtained needs to be corrected to take account of laboratory bias thus improving accuracy. This can be done either by using a combined 'national' bias adjustment factor for the laboratory for the specific year or a local factor from diffusion tubes co-located with automatic monitoring sites. In the absence of any automatic monitoring sites, the local authority using the national bias adjustment factor to correct the data. In 2012 this was 0.79 based on the June 2013 version of the national bias adjustment factor spreadsheet[2] (see Appendix C).

[2] http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

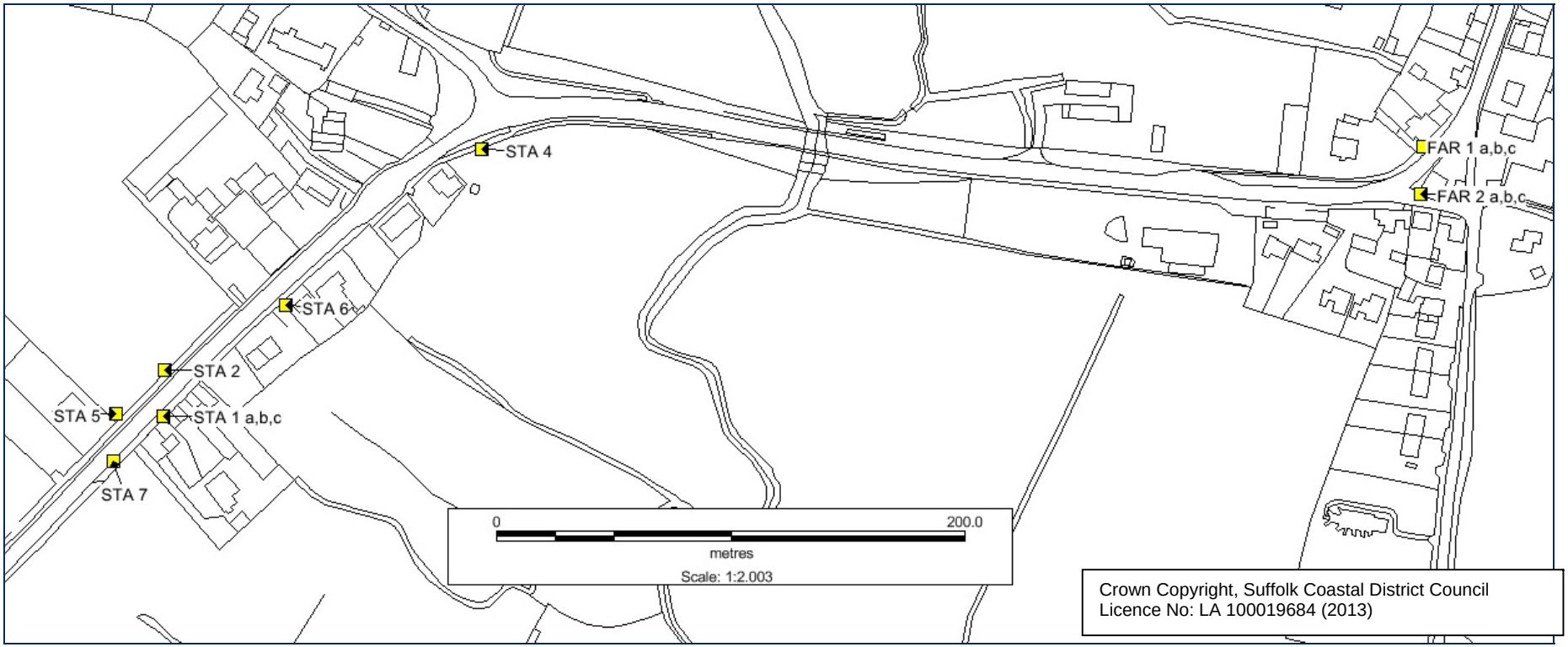

Figure 5: Location of NO_2 diffusion tubes in Stratford St. Andrew.

Table 1: Details of diffusion tube monitoring sites.

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
FAR1 a,b,c	Farnham 1	Roadside	63627	26013	1.76	NO_2	No	N	Y 0m	3	Yes
FAR2 a,b,c	Farnham 2	Roadside	63627	26011	1.92	NO_2	No	N	Y 0m	2	Yes
STA1 a,b,c	Stratford St. Andrew 1	Roadside	63574	25999	1.62	NO_2	No	N	Y 0m	2	Yes
STA2	Stratford St. Andrew 2	Roadside	63574	26001	1.78	NO_2	No	N	N 23m	1.72	Yes
STA4	Stratford St. Andrew 4	Roadside	63587	26011	1.78	NO_2	No	N	N 35m	3.8	Yes
STA5	Stratford St. Andrew 5	Roadside	63572	25999	1.20	NO_2	No	N	N 38m	2	No
STA6	Stratford St. Andrew 5	Roadside	63579	26004	1.71	NO_2	No	N	Y	6.9	No
STA7	Stratford St. Andrew 5	Roadside	63572	25997	1.56	NO_2	No	N	N 19m	1.85	Yes

*STA6 and 7 were installed in 2013.

4.2 Comparison of monitoring results with air quality objectives

This section presents the annual mean NO_2 concentrations measured at the diffusion tube sites during 2011 and 2012 (see Table 2).

Table 2: Annual mean NO_2 concentrations, 2011-2012.

Site ID	Location	Triplicate or Collocated Tube	Data Capture 2012 (%)	Annual mean concentration (bias adjusted) µg/m^3	
				2012	2011
FAR1 a,b,c	Turret House, The Street, Farnham	Triplicate	100	25.8	28.6
FAR2 a,b,c	Post Office Stores, The Street, Farnham,	Triplicate	100	30.7	32.6
STA1 a,b,c	1 Long Row, Main Road, Stratford St. Andrew	Triplicate	100	**42.4**	**43.3**
STA2	Opposite 1-5 London Row, Main Road	-	100	26.1	-
STA4	Lowestoft Street sign, on bend of Main Road.	-	100	24.0	-
STA5	Great Glemham sign, opposite 1-5 London Row (from March 2012).	-	75	18.2	-

*Note site STA3 was taken down in March 2012 and replaced with STA5, so no data were available.

The results show that the annual mean objective of 40 µg/m^3 was only exceeded at site STA1, which is located approximately 2 metres from the roadside and directly on the façade of the property at 1 Long Row. Concentrations in 2012 were slightly lower than those measured in 2011 but were still above the objective. Concentrations at all other diffusion tube sites are well below the objective. This includes the two diffusion tubes at the neighbouring village of Farnham which are located on properties at a similar distance to the road as STA1. The traffic flow is similar to that in Stratford St. Andrew and the speed limit in Farnham is also 30 mph.

Data for 2013 are available for the first four months of the year. These are presented as indicative only in Table 3 and have been adjusted by the 2012 bias adjustment factor of 0.79.

Table 3: Indicative NO_2 concentrations Jan-April 2013.

Site ID	Concentration (bias adjusted) Jan-April 2013 (µg/m^3)
FAR 1a,b,c	31.7
FAR2 a,b,c	31.9
STA1 a,b,c	39.7
STA2	25.3
STA4	19.1
STA5	N/A
STA6	24.1
STA7	34.1

5 Spatial Analysis

5.1 Introduction

This section of the report involves a spatial analysis of the 2012 annual mean monitoring concentrations in order to confirm or otherwise the extent to which the annual mean objective for NO_2 is being exceeded. There is no prescribed methodology developed to interpolate air quality concentration values between measurements. There are however a number of techniques that can be applied if sufficient point data are made available. For example these techniques include natural-neighbour interpolation which enables the creation of optimal surfaces for air pollution data (Northwood Technologies, 2001). However, for this particular location, data points were too limited to conduct interpolation modelling. Therefore under the circumstances it was considered more appropriate to conduct a semi-quantitative analysis examining the recorded concentrations in the context of space and the existing traffic situation.

All monitoring sites are located within 10 metres of the road centre line and within a 240 metre relatively straight section of the A12 as it passes through Stratford St. Andrew (see Figure 5). The road is slightly elevated (by less than two metres over a 200 metre section) as described by Figure 6. The road section levels out slightly at the junction of Great Glemham Road. Typically the gradient ranges from an ascent of 0.5 percent to a decent of 1.5 percent

The characterisation of the traffic situation for an average weekday is described as follows. Traffic approaching from the south will naturally slowdown in order to meet the 30 mph limit resulting in slower vehicle operation (indicated by the slower average speeds) travelling on the section of road adjacent to Great Glemham Road. Conversely, traffic approaching from the north will slow down adjacent to Great Glemham Road but then appear to gradually increase their speed as they approach the 50 mph limit just ahead of diffusion tube monitoring sites STA1 and STA5.

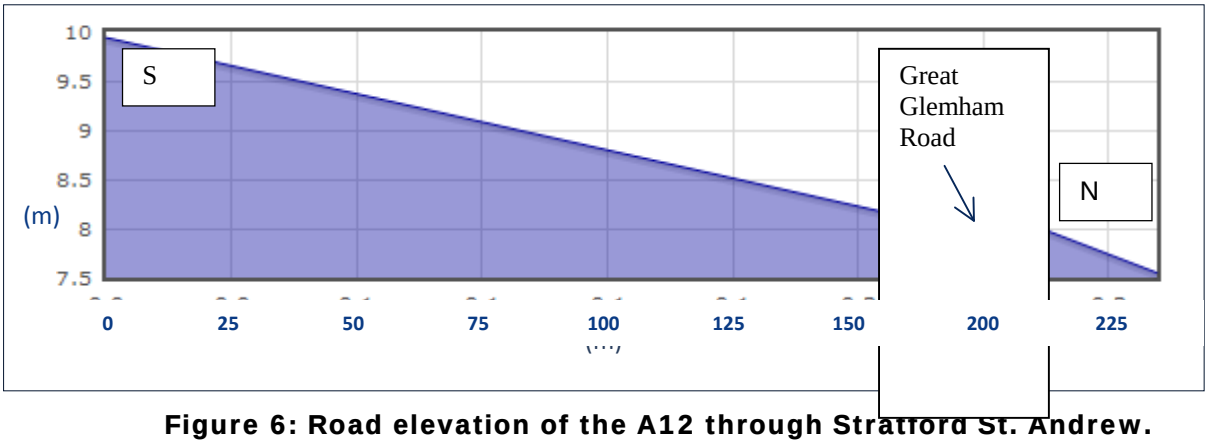

Figure 6: Road elevation of the A12 through Stratford St. Andrew.

5.2 Concentration profiles

To further understand the monitoring observations in the context of the monitoring site locations, the road geometry, built morphology and the traffic situation it was considered useful to examine concentration profiles. In this respect, an analysis was conducted to compare the concentration at the monitoring site with the likely concentration along the road centre line adjacent to each monitoring site respectively. In order to achieve this various input values were applied to the annual mean NO_2 concentration fall off with distance calculator provided on the LAQM website[3]. The purpose of this approach was to try to gain a better understanding of what level of concentration might be expected at the source to achieve the observed roadside annual mean NO_2 concentrations and to highlight the level of consistency between the source contribution and observed values. The results of this exercise are shown in Figure 7 and Table 4. Figure 7 shows the estimated drop off in concentration from the road centre line to the STA1 monitoring site. The road centre line is considered

[3] http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

appropriate to represent the source as emissions are generated by traffic moving in both directions. For site STA1 the calculator estimates a centre line annual mean NO_2 concentration of ~85 µg/m^3. This is in contrast if measured concentrations are used from the other monitoring sites where estimates of a road centre line concentration ranged from ~30 µg/m^3 (using site STA5) to ~50 µg/m^3 (using site STA2). A background concentration of 10.5 µg/m^3 was considered in all cases.[4]

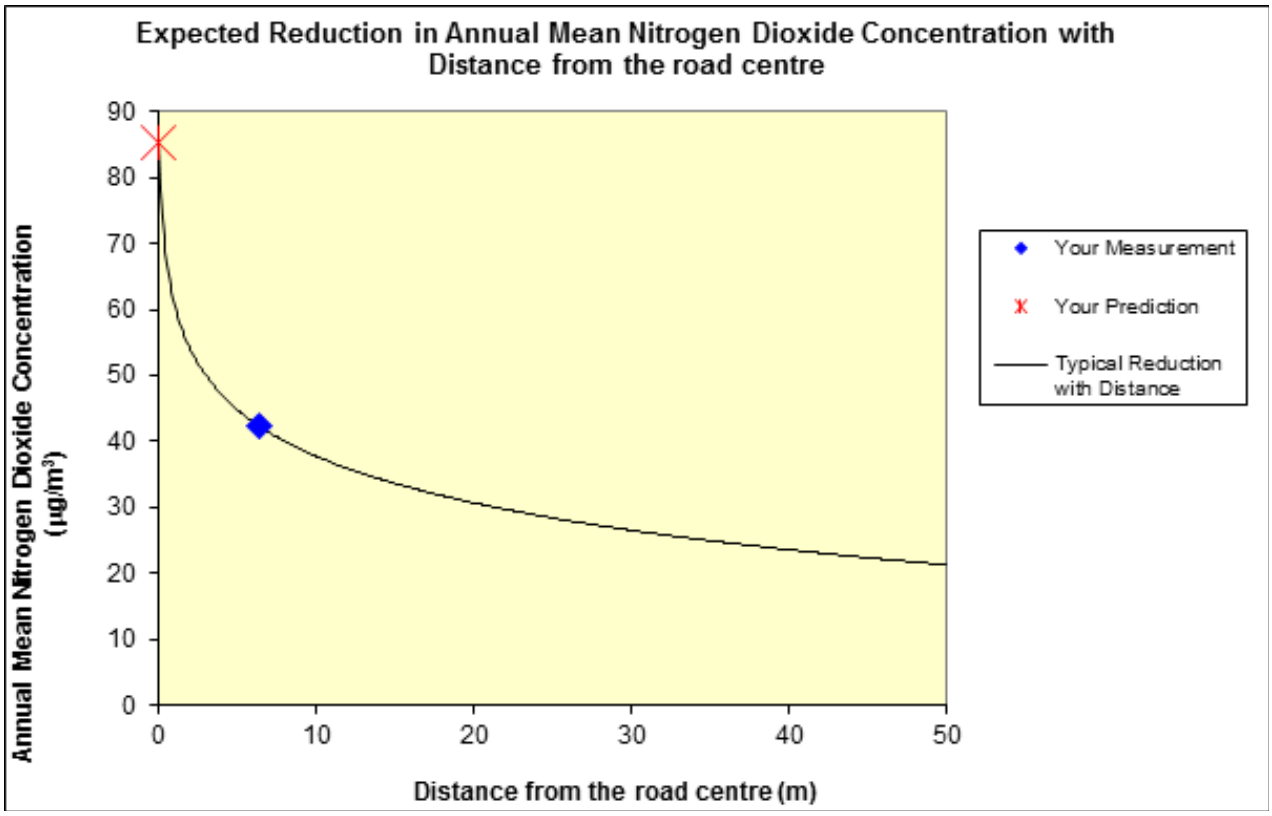

Figure 7: Estimate of monitoring site STA1 annual mean NO_2 contribution

Table 4: Estimated annual mean NO_2 concentrations at road centre lines adjacent to each monitoring site.

Monitoring site ID	2012 Annual Mean NO_2 (µg/m^3)	Background Annual Mean NO_2 (µg/m^3)	Distance from the road centre line to the monitoring site (m)	Estimated Annual Mean NO_2 (µg/m^3) at road centre line using drop off calculator
STA1a,b,c	42.4	10.5	6.5	85.7
STA2	26.1	10.5	8.0	49.9
STA4	24.0	10.5	9.7	47.1
STA5	18.2	10.5	9.4	31.1

[4] Taken from Defra background maps available from the LAQM website for year 2012

Of the other three monitoring sites, STA2 and 5 are located opposite STA1 in locations with similar geography. STA4 is located on the same side of the road as STA1 with geography similar to that of sites STA2 and 5. It is also worth noting that the predominant wind direction is along the trajectory of the road from the south-west to the north-east. Hence, emissions from road traffic are more likely to be confined to the road rather than being dispersed to any particular relevant location.

The results of this exercise appear to suggest site STA1 exhibits a substantial difference in terms of drop-off characteristics to the other three monitoring sites. Moreover, the drop-off characteristics of the other three sites cannot be explained by the curve shown in Figure 7. It is therefore suggested that the measured annual mean NO_2 concentrations are somewhat influenced by the physical attributes of the site (i.e. assuming that all monitoring sites are subject to identical regional weather patterns).

Given the analysis above it is reasonable to suggest that the exceedence of the annual mean NO_2 objective recorded at STA1 is influenced more so by the physical attributes of the monitoring location. More specifically, it is likely that the built form and orientation of Long Row cottages combined with localised weather patterns create unfavourable dispersion characteristics which elevate concentrations.

There is also another confounding factor which cannot be taken into account within this analysis. Vehicles leaving the village to the south will have a tendency to accelerate on the section of road directly adjacent to Long Row cottages as the speed limit changes from 30 to 50 mph. Conversely, deceleration events occur by the traffic approaching Stratford St. Andrew from the south. It is the net effect on emissions which need to be characterised in order to fully understand the contribution from the traffic at this particular location. It is likely that these effects can only be fully resolved by monitoring the traffic situation using driving cycle analysis.

5.3 Proposed area of exceedence

The traffic flow is similar through the village in the target section of the A12. Based on the recent traffic survey, average speeds change from 33 mph entering from the south to 29 mph towards Great Glemham Road. An exceedence of the annual mean NO_2 objective is consistent with the physical and geographical attributes associated with the diffusion tube; STA1. By applying a buffer or zone using the precise distance between the road centre line and STA1 provides a reasonable indication of other relevant locations where similar affects may be expected (i.e. similar physical attributes would need to be assessed). Figure 8 indicates this buffer zoning based on two buffer zones. The red buffer zone represents the distance between the road centre line and the STA1 monitoring site (6.5 metres) and the blue buffer zone represents the average distance between the road centre line and site STA2 and STA5 (8.7 metres). By having two zones the methodology attempts to extend the consistency of interpretation.

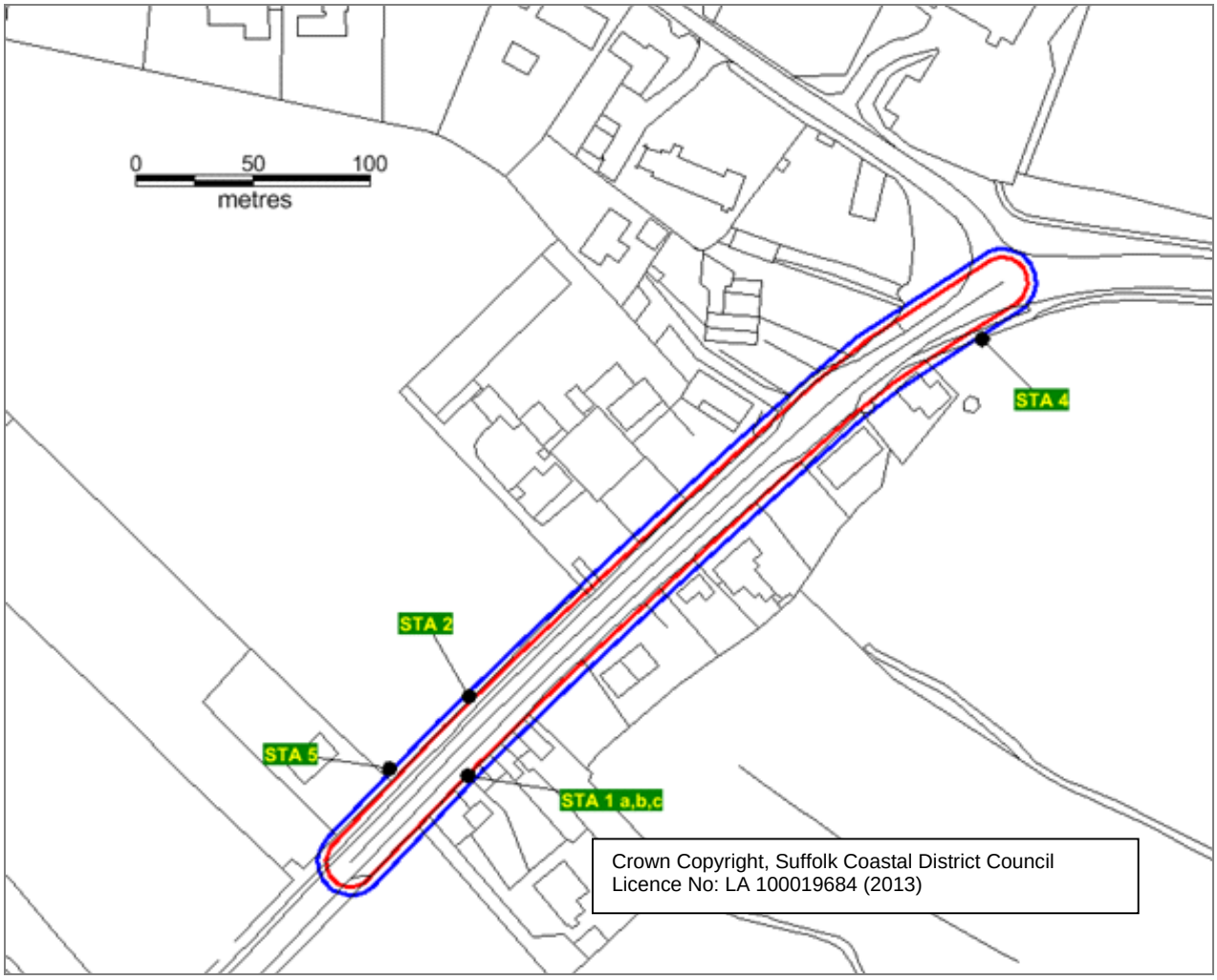

Figure 8: Air quality based buffer zones applied to the A12 at Stratford St. Andrew.

In the first instance, the red buffer zone indicates that the facades of all the cottages on Long Row would be subject to an exceedence of the annual mean NO_2 objective. Currently, no other relevant receptors are indicated as having exceedences along the section of road according to this methodology. Extending the methodology to the blue buffer zone provides an indication of relevant receptors that may be subject to annual mean NO_2 concentrations similar to those recorded at sites STA2 and STA5 and not of concern in terms of impact to health.

Although the monitoring data suggest that the exceedence of the annual mean NO_2 objective is confined to Long Row cottages, the methodology applied in this detailed assessment has taken a precautionary approach to suggest elevated NO_2 concentrations at this location may extend beyond Long Row cottages as defined by the red buffer zone.

The technical Guidance LAQM.TG(09) (Defra, 2009) requires local authorities to estimate the number of people exposed to concentrations above the relevant air quality objectives. Therefore based on the red buffer zone, there are currently four properties in the exceedence area (1-5 Long Row), with an estimate of two people per property, the population exposure would be eight people.

6 Conclusions and actions

Based on the analysis shown in Section 5 it is recommended that an AQMA for annual mean NO_2 is declared with the boundary corresponding to the red buffer zone. The buffer takes a precautionary approach to include the zone where an exceedence of the annual mean NO_2 objective may occur but also the zone in which any low emission or traffic management measures would apply in order to influence an improvement in air quality. This would allow emission reductions to be pursued along the entire length of the road and not just adjacent to Long Row. In this respect, it is less likely that exceedences would not be transferred to other properties, as a result of introducing traffic management measures.

Alternatively, SCDC may decide to declare an AQMA for the area of exceedence only. In this case, the AQMA boundary would encompass the four properties in 1-5 Long Row rather than be extended along the red buffer zone.

Under the current LAQM system, the local authority is required to conduct a Further Assessment (FA) of air quality within 12 months of the AQMA declaration. The FA is intended to supplement the information provided in the detailed assessment to confirm the exceedence, define the improvement in air quality and provide information on source contributions. The local authority is then required to develop an Air Quality Action Plan providing appropriate measures to improve NO_2 concentrations within the AQMA.

As part of this process, the local authority has installed two new diffusion tubes in 2013, one in the 50 mph zone (STA7) and another (STA6) further into the village at a property at a similar distance to STA1.

In addition, other sites to consider for further monitoring include;

- At further residential properties in close proximity to the road (i.e. those indicated by the blue buffer zone).
- At the same distance from the road as STA1 but approximately 5 metres from Long Row cottages to avoid the effect of building-wake.
- Further into the 50 mph zone in order to assist any future analysis of low emission transport measures.
- Siting diffusion tubes at different heights from the ground.

As part of the Further Assessment and action plan process, the local authority could also consider a more detailed analysis of vehicle driving patterns using instantaneous emissions modelling to help target the development of mitigation measures.

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Glossary of terms and abbreviations

AADT	Annual average daily traffic
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
Defra	Department for Environment, Food and Rural Affairs
LAQM	Local air quality management
LAQM TG	Local air quality management technical guidance
LDV	Light duty vehicle (between 3.5 tonnes and 7.5 tonnes)
LGV	Light goods vehicle
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_X	Oxides of nitrogen
O_3	Ozone
PM	Particulate matter
PM_{10}	Particulate matter with an aerodynamic diameter less than 10 microns
SCDC	Suffolk Coastal District Council
SO_2	Sulphur dioxide
TEA	Triethanloamine
TRL	Transport Research Laboratory
UKAS	United Kingdom Accreditation Service

Appendix A Air quality pollutants and objectives

The air quality objectives applicable to LAQM in England are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre μg/m^3 (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 μg/m^3	Running annual mean	31.12.2003
	5.00 μg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 μg/m^3	Annual mean	31.12.2004
	0.25 μg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 μg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 μg/m^3	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 μg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 μg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350 μg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 μg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

Appendix B LAQM process

Report and reference	Main outcomes
First stage review and assessment (SCDC, 1999)	Negligible risk of exceedence of the air quality objectives for benzene and 1,3-butadiene and no further action needs to be taken. The risk of exceedence of the air quality objectives for lead, carbon monoxide (CO), NO_2, PM_{10} and sulphur dioxide (SO_2). Proceed to a second stage review and assessment.
Second stage review and assessment (SCDC, 2000)	Negligible risk of exceedence of the air quality objectives for lead and CO. Significant risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at relevant locations and further review and assessment is necessary.
Third stage review and assessment (SCDC, 2001)	Insufficient information to date and therefore further review and assessment required for: • SO_2 and PM_{10} emissions from shipping at the Port of Felixstowe. • PM_{10} emissions from the combined emission 'footprint' of Roadworks (1952) Limited and Sinks Pit Quarry. Risk of NO_2 air quality objectives being exceeded and further review and assessment required for: • Emissions from traffic using the A1152 (specifically the crossroads of the A1152 and B1438 at Melton) • Emissions from traffic using Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge.
Air quality review and assessment stage 3 (AEA Technology, 2001)	Unlikely risk of exceedence of the air quality objectives for NO_2 at the Melton and Woodbridge road junctions and an AQMA is not required.
USA report (SCDC, 2003)	Potential risk of exceedence of the air quality objectives for lead, NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary.
Detailed assessment and USA report (SCDC, 2004)	Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations. Further investigation is necessary for: • Emissions of NO_2 from traffic using the junction of Lime Kiln Quay Road/The Thoroughfare St John's Street junction, Woodbridge. • Emissions of NO_2, PM_{10} and SO_2 from activities on and associated with the Port of Felixstowe.
Progress report (SCDC, 2005)	Outlines the findings of detailed modelling undertaken as part of the FSR planning application. Exceedence of the air quality objective for annual mean NO_2 in 2005 at receptor locations situated in The Downs (close to the Port of Felixstowe Road), Spriteshall Lane (close to Dock Spur roundabout) and the Dooley Inn, Ferry Lane.
Detailed assessment of the Woodbridge road junction (AEA Technology,	**Declaration of an AQMA for the annual mean NO_2 objective for Lime Kiln Quay Road/The Thoroughfare/St John's Street junction, Woodbridge**

2005)	**junction, Woodbridge.**
USA report (SCDC, 2006)	Potential risk of exceedence of the air quality objectives for NO_2, PM_{10} and SO_2 at receptor locations resulting from emissions from activities on and associated with the Port of Felixstowe. A detailed assessment is required to investigate these emissions.
Detailed assessment for Adastral Close and Ferry Lane, Felixstowe (SCDC, 2008a)	Exceedence of the annual mean objective for NO_2 at the Dooley Inn, Ferry Lane, Felixstowe. Risk of exceedence of the annual mean objective for NO_2 at fifteen properties at the west end of Adastral Close in 2010 and beyond following the FSR. Source apportionment studies indicated that container handling operations by rubber tyred gantry (RTG) crane and internal movement vehicles (IMVs) will potentially make the greatest contribution to oxides of nitrogen (NO_X) concentrations in 2010 both at Adastral Close and the Dooley Inn, Ferry Lane. **Declaration of an AQMA for the annual mean NO_2 objective for the Dooley Inn, Ferry Lane, Felixstowe.**
Progress report (SCDC, 2008b)	Work on production of the draft action plan for Woodbridge is continuing. Public consultation will be undertaken following Defra's approval of the completed draft action plan.
USA report (SCDC, 2009)	No requirement to proceed to a Detailed Assessment for any pollutant. Risk of exceedence in AQMAs remains. Ongoing work to identify biomass combustion plant within the district.
Progress report (SCDC, 2010)	No requirement to proceed to a Detailed Assessment for any pollutant. Risk of exceedence in AQMAs remains. 21 sites that have biomass plant with a thermal output greater than 50Kw within the district have been identified.
Further assessment for Adastral Close and Ferry Lane, Felixstowe (TRL, 2010)	Confirmed detailed assessment with exceedence of the NO_2 annual mean objective concentration predicted at the Dooley Inn public house on Ferry Lane. There are no predicted exceedences of the PM_{10} or SO_2 objectives in the base year of 2008. The existing AQMA boundary is valid and should be maintained. A source apportionment exercise determined that container handling activities in the port and heavy duty vehicles (HDVs) on roads external to the port made the greatest contribution to NO_X concentrations at this receptor.
Progress report (SCDC, 2011)	Risk of exceedence of the annual mean NO_2 objective in AQMAs remains. Risk of exceedence of annual mean NO_2 objective in Stratford St. Andrew. Two existing industrial installations identified which require further emission information to be collected to determine whether a Detailed Assessment is required. Biomass screening assessment conducted. Four boilers required additional investigation to be presented in next annual report (2013).
Final air quality action plan for Woodbridge junction AQMA (SCDC, 2011b)	The plan confirms the likely source of NO_2 from transport and in particular from HGVs and suggests that a 16 percent reduction in traffic emissions of NO_x is required to achieve the objective. The Action Plan recommended 20 measures for implementation to aim to reduce emissions by 10 percent by 2015. It also sets out a framework of

	partnership working with other organisations and the requirement to balance the requirements of local businesses and community against improving local air quality.
Final air quality action plan for Ferry Lane, Felixstowe (TRL, 2012)	The action plan identifies measures to be adopted as part of the formal action plan. There are five main measures to be pursued by the local authority and Port Authority.
USA report (SCDC, 2012)	No requirement to proceed to a Detailed Assessment for any pollutant. Risk of exceedence in AQMAs remains. Risk of exceedence of annual mean NO_2 objective at Stratford St. Andrew on A12. SCDC to increase monitoring with triplicate tubes before determining whether detailed assessment is required. Report includes an update on progress made on the Woodbridge and Felixstowe action plans.

Appendix C Diffusion tube bias adjustment factors

The analytical laboratory used for supply and analysis of NO_2 diffusion tubes in 2012 was ESG Didcot (previously Harwell Scientifics). The monitoring is undertaken using Palmes passive diffusion tubes exposed on a monthly basis. The tubes are prepared by spiking acetone:triethanloamine (TEA) (50:50) onto the grids prior to the tubes being assembled. The tubes are then desorbed with acetone and the extract analysed using a segmented flow auto-analyser with ultraviolet detection. The laboratory is formally accredited under the United Kingdom Accreditation Scheme (UKAS).

Combined "national" bias adjustment factors for UK diffusion tube laboratories, based upon Local Authority co-location studies throughout the UK, are provided on behalf of Defra and the Devolved Administrations. The national bias adjustment factor given for ESG (Didcot) in 2012, in the June 2013 edition of 'National Spreadsheet of Bias Adjustment Factors' was **0.79**, using results from 38 different studies (as seen in the screenshot below).

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 06/13

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of September 2013
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List
If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List
If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List
If a year is not shown, we have no data[2]

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.
If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To see your selection, choose (All) from the pop-up list)	Year[1] (To see your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[5]	Bias Adjustment Factor (A) (Cm/Dm)
ESG Didcot	50% TEA in acetone	2012	UB	Falkirk Council	12	27	24	10.8%	G	0.90
ESG Didcot	50% TEA in acetone	2012	R	Thanet District Council	12	32	25	27.2%	G	0.79
ESG Didcot	50% TEA in acetone	2012	KS	Marylebone Road Intercompariran	11	127	95	34.1%	G	0.75
ESG Didcot	20% TEA in Water	2012	KS	Marylebone Road Intercompariran	11	129	95	36.2%	G	0.73
ESG Didcot	50% TEA in acetone	2012	B	Stockton on Tees	12	28	21	33.8%	G	0.75
ESG Didcot	50% TEA in acetone	2012	R	Stockton on Tees	11	22	17	29.9%	G	0.77
ESG Didcot	50% TEA in acetone	2012	SU	Thanet District Council	12	21	18	16.6%	G	0.86
ESG Didcot	50% TEA in acetone	2012	UB	CITY OF YORK COUNCIL	12	28	24	15.3%	P	0.87
ESG Didcot	50% TEA in acetone	2012	R	CITY OF YORK COUNCIL	12	41	32	30.5%	P	0.77
ESG Didcot	50% TEA in acetone	2012	R	CITY OF YORK COUNCIL	12	37	28	31.4%	G	0.76
ESG Didcot	50% TEA in acetone	2012	R	CITY OF YORK COUNCIL	12	41	30	34.4%	G	0.74
ESG Didcot	50% TEA in Acetone	2012	KS	Suffolk Coastal District Council	12	50	44	13.8%	G	0.88
ESG Didcot	50% TEA in Acetone	2012	R	Maidstone Borough Council	12	48	44	11.2%	P	0.90
ESG Didcot	50% TEA in Acetone	2012	B	Maidstone Borough Council	12	20	14	45.3%	G	0.69
ESG Didcot	50% TEA in acetone	2012	R	Armagh City and District Council	12	40	27	45.3%	G	0.69
ESG Didcot	50% TEA in acetone	2012	R	Dumfries and Galloway Council	12	38	33	14.2%	G	0.88
ESG Didcot	50% TEA in acetone	2012	R	Cambridge City Council	12	46	35	31.5%	G	0.76
ESG Didcot	50% TEA in Acetone	2012	R	Slough Borough Council	11	44	32	38.7%	G	0.72
ESG Didcot	50% TEA in acetone	2012	R	Northumberland County Council	12	36	28	31.1%	S	0.76
ESG Didcot	50% TEA in acetone	2012	R	North Down Borough Council	12	45	33	36.6%	G	0.73
ESG Didcot	50% TEA in acetone	2012	R	Medway Council	11	38	32	18.7%	G	0.84
ESG Didcot	50% TEA in acetone	2012	UB	Medway Council	11	25	24	2.3%	G	0.98
ESG Didcot	50% TEA in acetone	2012	B	Medway Council	10	29	19	51.3%	P	0.66
ESG Didcot	50% TEA in acetone	2012	R	Lisburn City Council	9	28	25	13.4%	P	0.88
ESG Didcot	50% TEA in acetone	2012	R	Down District Council	11	50	38	32.1%	G	0.76
ESG Didcot	50% TEA in acetone	2012	R	Castlereagh Borough Council	12	48	30	61.9%	G	0.62
ESG Didcot	50% TEA in acetone	2012	R	Bridgend County Borough Council	12	28	27	4.5%	G	0.96
ESG Didcot	50% TEA in acetone	2012	R	Tunbridge Wells BC	12	62	49	27.0%	G	0.79
ESG Didcot	50% TEA in Acetone	2012	R	West Oxfordshire District Council (WODC)	11	48	36	32.3%	G	0.76
ESG Didcot	20% TEA in water	2012		Overall Factor[3] (2 studies)				Use		0.69
ESG Didcot	50% TEA in acetone	2012		Overall Factor[3] (38 studies)				Use		0.79

Appendix H:

Detailed Assessment of a Straw Burning Biomass Boiler for Suffolk Coastal – Geaters, West End Nurseries, Leiston

Air Quality CONSULTANTS

Detailed Assessment of a Straw Burning Biomass Boiler for Suffolk Coastal District Council

March 2013

Experts in air quality management & assessment

Document Control

Client	Suffolk Coastal District Council	**Principal Contact**	Denise Lavender

Job Number	J1661

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Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
1661/1/F1	20th March 2013	Final Report	Stephen Moorcroft

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Contents

Suffolk Coastal Council confirms that it accepts the recommendations made in this report.

1 Introduction

1.1 Air Quality Consultants Ltd has been commissioned by Suffolk Coastal District Council to undertake a Detailed Assessment of a biomass boiler in Leiston. In 2009, Suffolk Coastal District Council completed an Updating and Screening Assessment, which identified that there were likely to be a number of biomass boilers within the local authority area which would need to be identified and assessed. A number of biomass boilers have now been identified and a screening assessment carried out by the Council concluded that a Detailed Assessment was required for the biomass boiler at West End Nurseries, Leiston.

1.2 The aim of this Detailed Assessment is to determine whether the 1-hour mean nitrogen dioxide and daily mean PM_{10} objectives are likely to be exceeded at relevant locations and, if so, the extent of those exceedences in order to determine the boundary of the Air Quality Management Area (AQMA) that would be required.

Background

1.3 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra, 2007) sets out a framework for air quality management, which includes a number of air quality objectives. National and international measures are expected to achieve these objectives in most locations, but where areas of poor air quality remain, air quality management at a local scale has a particularly important role to play. Part IV of the Environment Act 1995 requires local authorities to periodically review and assess air quality in their areas. The role of this process is to identify areas where it is unlikely that the air quality objectives will be achieved. These locations must be designated as AQMAs and a subsequent Air Quality Action Plan (AQAP) developed in order to reduce pollutant emissions in pursuit of the objectives.

1.4 Review and Assessment is a long-term, ongoing process, structured as a series of 'rounds'. Local Authorities in England, Scotland and Wales have now completed the first, second and third rounds of Review and Assessment, with the fourth round underway.

1.5 Technical Guidance for Local Air Quality Management (LAQM.TG(09)) (Defra, 2009) sets out a phased approach to the Review and Assessment process. This prescribes an initial Updating and Screening Assessment (USA), which all local authorities must undertake. It is based on a checklist to identify any matters that have changed since the previous round. If the USA identifies any areas where there is a risk that the objectives may be exceeded, which were not identified in the previous round, then the Local Authority should progress to a Detailed Assessment.

1.6 The purpose of the Detailed Assessment is to determine whether an exceedence of an air quality objective is likely and the geographical extent of that exceedence. If the outcome of the Detailed Assessment is that one or more of the air quality objectives are likely to be exceeded, then an

AQMA must be declared. Subsequent to the declaration of an AQMA, a Further Assessment should be carried out to confirm that the AQMA declaration is justified; and that the appropriate area has been declared; to ascertain the sources contributing to the exceedence; and to calculate the magnitude of reduction in emissions required to achieve the objective. This information can be used to inform an Air Quality Action Plan, which will identify measures to improve local air quality.

1.7 This report represents a Detailed Assessment in the fourth round of Review and Assessment, following the findings of Suffolk Coastal District Council's USA published in 2009. The USA concluded that there was a possibility that emissions from biomass combustion may lead to an exceedence of the nitrogen dioxide or PM_{10} objectives at locations of relevant exposure (Suffolk Coastal District Council, 2009). The Council has since carried out investigations which suggest that emissions from the Straw Biomass Burner at West End Nurseries, Leiston, may lead to an exceedence of 1-hour mean nitrogen dioxide and daily mean PM_{10} objectives at locations of relevant exposure. In order to be thorough, the assessment has included the annual mean objectives of both pollutants as well as the short term objectives.

The Air Quality Objectives

1.8 The Government's Air Quality Strategy (Defra, 2007) provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. The 'standards' are set as concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of a particular pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of the costs, benefits, feasibility and practicality of achieving the standards. The objectives are prescribed within The Air Quality (England) Regulations 2000 (Stationery Office, 2000) and The Air Quality (England) (Amendment) Regulations 2002 (Stationery Office, 2002). Table 1 summarises the objectives which are relevant to this report. Appendix 1 provides a brief summary of the health effects of nitrogen dioxide and PM_{10}.

Table 1: Air Quality Objectives for Nitrogen Dioxide

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour mean	200 μg/m^3 not to be exceeded more than 18 times a year[a]
	Annual mean	40 μg/m^3
Fine Particles (PM_{10})	24-hour mean	50 μg/m^3 not to be exceeded more than 35 times a year[b]
	Annual mean	40 μg/m^3

[a] This approximates to the 99.8th percentile of the hourly mean concentrations

[b] This approximates to the 90th percentile of the daily mean concentrations

1.9 For a year of complete data, the 99.8th percentile of 1-hour mean concentrations corresponds with the 19th highest hour - which in turn corresponds with the 1-hour mean objective for nitrogen dioxide (which allows 18 exceedences of 200 μg/m^3 as a 1-hour mean). Similarly, the 90th percentile of 24-hour mean concentrations corresponds with the 36th highest daily mean - which in turn corresponds with the 24-hour objective for PM_{10} (which allows no more than 35 exceedences of 50 μg/m^3 as a daily mean concentration).

1.10 The air quality objectives only apply where members of the public are likely to be regularly present for the averaging time of the objective (i.e. where people will be exposed to pollutants). For annual mean objectives, relevant exposure is limited to residential properties, schools and hospitals. The 1-hour mean objective applies at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1 hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed. The 24-hour mean objective applies at all locations where the annual mean objective would apply, together with hotels and the gardens of residential properties.

2 Assessment Methodology

Monitoring

2.1 Suffolk Coastal District Council does not carry out any air quality monitoring in the vicinity of Leiston; therefore this assessment has been based on dispersion modelling.

Modelling

2.2 Concentrations of nitrogen dioxide and PM_{10} have been predicted using detailed dispersion modelling (ADMS-5). ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. Entrainment of the plume into the wake of buildings has been simulated within the model. The input data used are described in Appendix 2.

2.3 Concentrations have been predicted for a grid of receptors across the study area to allow concentration isopleths to be plotted. In addition, concentrations have been predicted at a number of worst-case receptor locations (Figure 1).

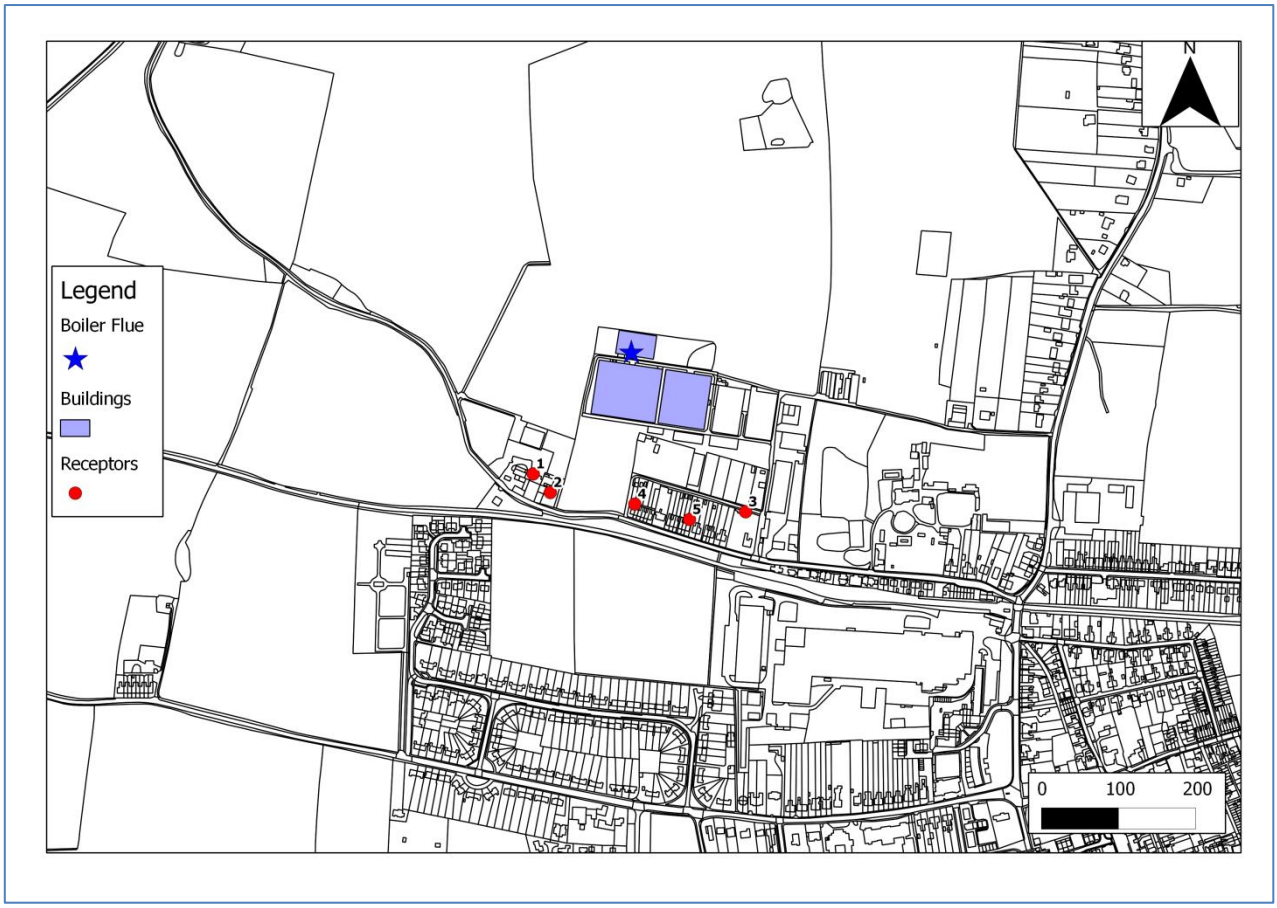

Figure 1 Location of Specific Receptors, Flue and Buildings

Uncertainty

2.4 Uncertainty is inherent in all measured and modelled data. All values presented in this report are the best possible estimates, but uncertainties in the results might cause over- or under-predictions. The model results rely on emissions data provided by the LAQM Helpdesk and operational data provided to Suffolk Coastal District Council by West End Nurseries who operate the boiler, and any uncertainties inherent in these data will carry into this assessment. There will be additional uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example: it has been assumed that wind conditions measured at Wattisham Airfield during 2012 will have occurred throughout the study area; and it has been assumed that the dispersion of emitted pollutants will conform to a Gaussian distribution over flat terrain.

2.5 The limitations to the assessment should be borne in mind when considering the results set out in the following sections. While the model should give an overall accurate picture, i.e. one without bias, there will be uncertainties for individual receptors. The results are 'best estimates' and have been treated as such in the discussion.

2.6 It should be noted that a number of worst case assumptions have been made regarding the emissions from the biomass boiler in order to ensure this is a conservative assessment. Details of the assumptions used in this assessment are provided in Appendix 2.

3 Results

Modelling

3.1 Predicted annual mean nitrogen dioxide concentrations together with the predicted 99.8th percentile of 1-hour mean concentrations in 2012 at each of the receptor locations shown in Figure 1, are set out in Table 2. Predicted concentrations are well below the relevant objective at all receptors.

Table 2: Modelled Nitrogen Dioxide Concentrations at Specific Receptors

Receptor	Location	Annual mean (µg/m^3)	99.8th percentile of hourly means (µg/m^3)
1	Wood Farm Cottages, Buckleswood Road	14.5	74
2		14.4	74
3	30 Westwood Ho	14.5	74
4	84 Westwood Ho	14.5	74
5	50 Westwood Ho	14.5	74
Objective		**40**	**200**

3.2 Predicted annual mean PM_{10} concentrations as well as the 90th percentile of daily average concentrations in 2012 at each of the receptor locations are set out in Table 3. Predicted concentrations are well below the relevant objective at all receptors.

Table 3: Modelled PM_{10} Concentrations at Specific Receptors

Receptor	Location	Annual mean (µg/m^3)[a]	90th percentile of daily means (µg/m^3)[a]
1	Wood Farm Cottages, Buckleswood Road	17.0	28.0
2		16.8	27.8
3	30 Westwood Ho	17.8	28.7
4	84 Westwood Ho	17.0	27.9
5	50 Westwood Ho	17.7	28.5
Objective		**40**	**50**

3.3 Predicted annual mean and 99.8th percentile of 1-hour mean concentrations of nitrogen dioxide are well below the relevant objectives at all locations modelled across the grid of receptors and isopleth maps have therefore not been produced.

3.4 Isopleth maps of the modelled annual mean and 90th percentile of daily mean PM_{10} concentrations at ground-floor level are presented in Figures 2 and 3 respectively. These show that neither objective is likely to be exceeded in areas where there is relevant exposure.

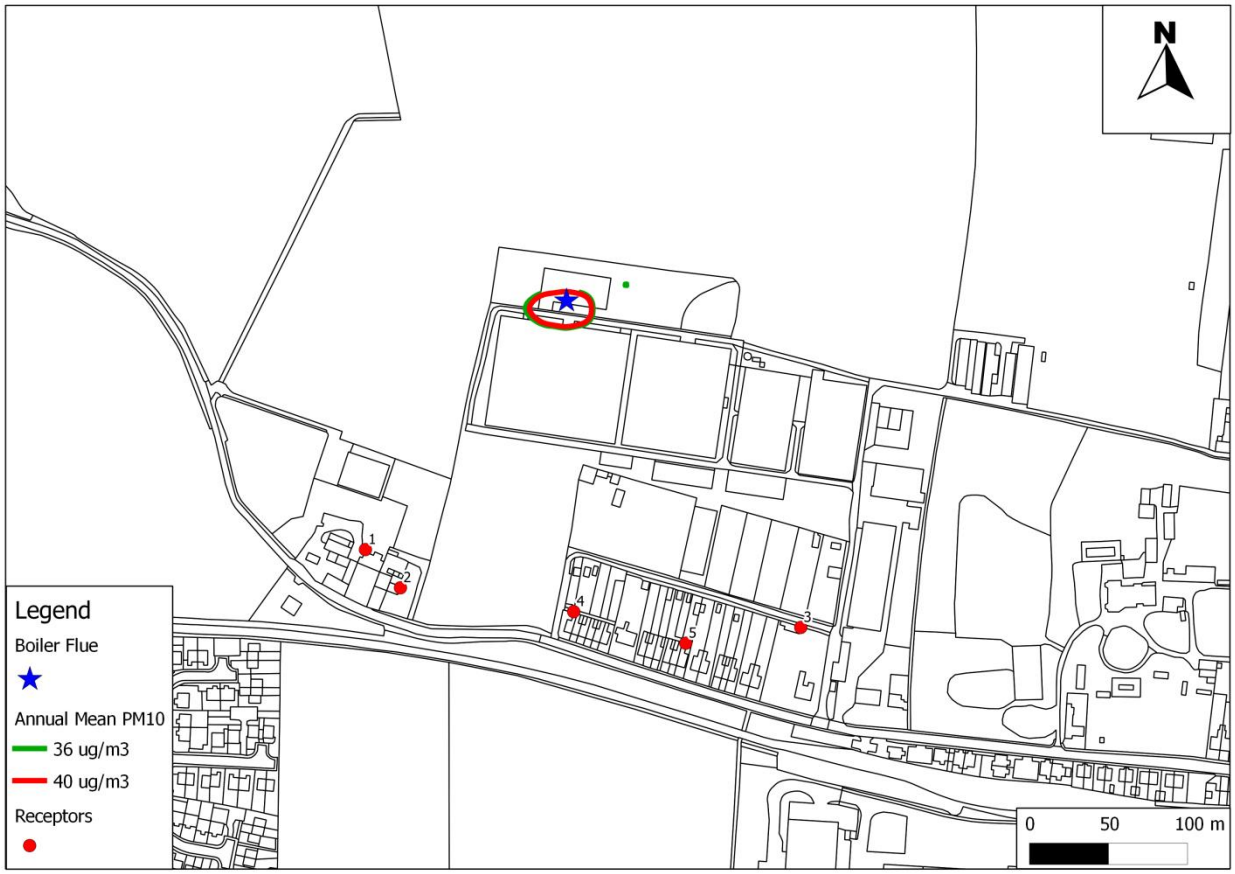

Figure 2 Extent of the Modelled 40μg/m^3 Contour and 36 μg/m^3 Contour of Annual Mean PM_{10} Concentrations in 2012 (modelled at 1.5 m).

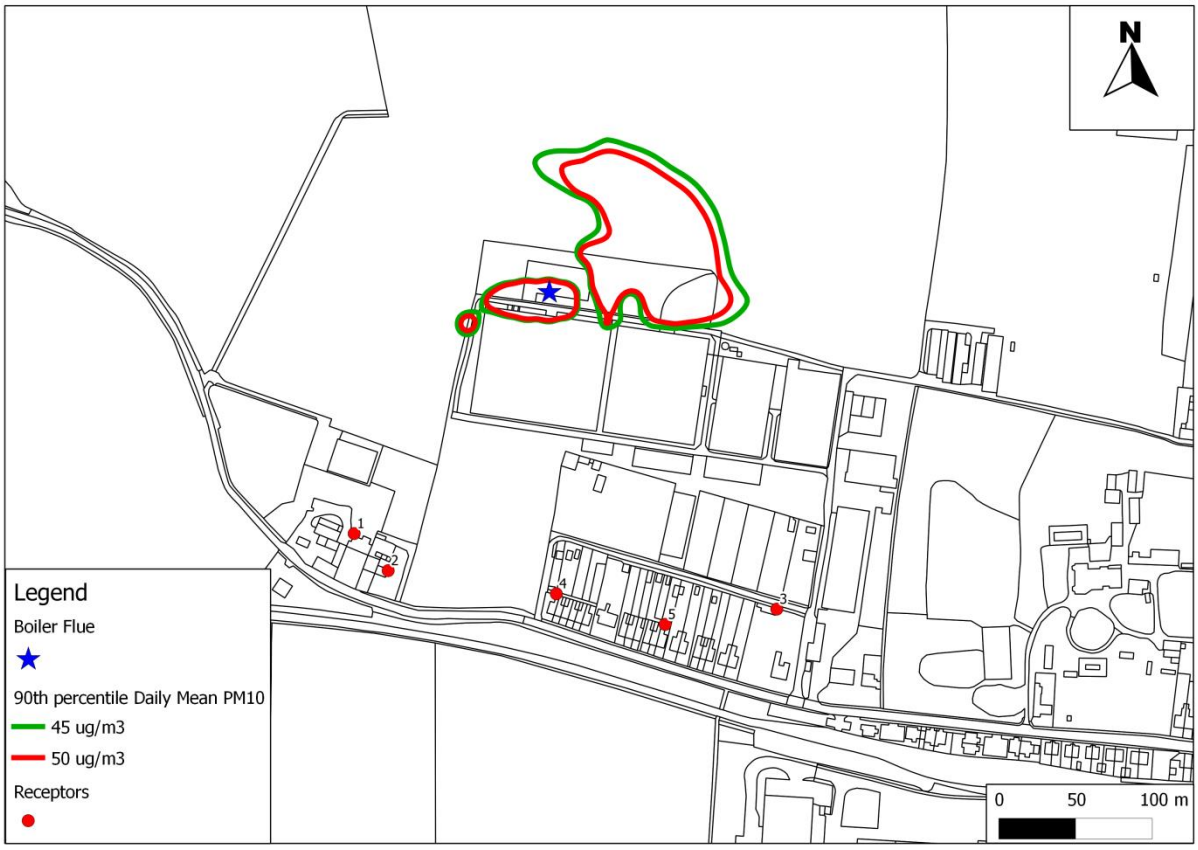

Figure 3 Extent of the Modelled 50μg/m^3 Contour and 45 μg/m^3 Contour of 90th percentile of daily mean PM_{10} Concentrations in 2012 (modelled at 1.5 m).

4 Conclusions and Recommendations

4.1 A Detailed Assessment has been carried out for nitrogen dioxide and PM_{10} in the area surrounding West End Nurseries, Leiston. This area was identified as being at risk of exceeding air quality objectives for nitrogen dioxide and PM_{10} following scoping assessments carried out by Suffolk Coastal District Council.

4.2 The Detailed Assessment has been carried out based on modelled concentrations. Concentrations of nitrogen dioxide and PM_{10} have been modelled for 2012 using the ADMS-5 dispersion model.

4.3 The assessment has identified that nitrogen dioxide and PM_{10} objectives are not exceeded at any relevant locations in the vicinity of the Straw Biomass Boiler in Leiston. Concentrations of both pollutants are well below the relevant objectives.

4.4 Given the low concentrations of both nitrogen dioxide and PM_{10} predicted in the area, further monitoring is not deemed necessary. No additional action with regard to emissions from the Biomass Boiler at West End Nurseries, Leiston is required. Suffolk Coastal District Council should proceed with the completion of a Progress Report for 2013.

5 References

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6 Glossary

ADMS-5	Atmospheric Dispersion Modelling System for Point Sources
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
Defra	Department for Environment, Food and Rural Affairs
Exceedence	A period of time where the concentration of a pollutant is greater than the appropriate air quality objective.
LAQM	Local Air Quality Management
$\mu g/m^3$	Microgrammes per cubic metre
NO_X	Nitrogen oxides (taken as NO + NO_2)
NO	Nitric Oxide
NO_2	Nitrogen dioxide.
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date, taking into account costs, benefits, feasibility and practicality. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides.
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal.

A1 Appendix 1 – Summary of Health Effects of Nitrogen Dioxide and PM_{10}

Table A1: Summary of Health Effects of Nitrogen Dioxide and PM_{10}

Pollutant	Main Health Effects
Nitrogen Dioxide	Short-term exposure to high concentrations may cause inflammation of respiratory airways. Long term exposure may affect lung function and enhance responses to allergens in sensitised individuals. Asthmatics will be particularly at risk (Defra, 2007).
Particulate Matter (PM_{10})	Both short-term and long-term exposure to ambient levels of PM are consistently associated with respiratory and cardiovascular illness and mortality as well as other ill-health effects. The associations are believed to be causal. It is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health (Defra, 2007).

A2 Appendix 2 – Dispersion Modelling Methodology

Meteorological Data

A2.1 The model has been run using a full year of meteorological data for 2012 derived from the meteorological station near Wattisham Airport.

Background Concentrations

A2.2 Two separate sources have been used to estimate background pollutant concentrations; national pollution maps published by Defra (2013a) and background concentrations measured at the Urban Background Automatic Monitor run by AURN in Norwich, Lackenfields. Details of the calculations used for each source of background data are provided below. The backgrounds used in this assessment are shown in Table A2.

Table A2: Background Concentrations (2012) [a]

	Measured (µg/m^3)	Mapped (µg/m^3)[b]
NO_2 Annual Mean	**14.3**	9.5 – 10.8
Total oxidant (NO_2 + O_3) 99.8th percentile of hourly concentrations	**138.0**	-
NO_2 99.8th percentile of 1-hour mean concentrations	**71.0**	-
PM_{10} Annual Mean	14.0[a]	**14.0 – 15.4**
PM_{10} 90th percentile of 24-hour mean concentrations	**26.0**	-

[a] Where data are available from both sources the higher concentration has been used in order to make this assessment worst case. The background concentrations used in the assessment are shown in bold.

[b] The area lies within a number of grid squares.

Mapped Backgrounds

A2.3 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2013a). These cover the whole country on a 1x1 km grid and are published for each year from 2010 until 2025. The maps include the influence of emissions from a range of different sources; one of which is road traffic. There are some concerns that Defra may have over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future. The maps currently in use were verified against measurements made during 2010 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2010. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

A2.4 In order to calculate background nitrogen dioxide and nitrogen oxides concentrations in 2012, it is assumed that there was no reduction in the road traffic component of backgrounds between 2010[1] and 2012. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2013a). For each grid square, the road traffic component has been held constant at 2010 levels, while 2012 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2013a) publishes to accompany the maps. The result is a set of 'adjusted 2012 background' concentrations.

A2.5 As an additional step, the background maps have been calibrated against national measurements made as part of the AURN during 2011 (Defra, 2013b). The published background maps were

[1] This approach assumes that has been no reduction in emissions per vehicle but also that traffic volumes have remained constant. This is not the same as the assumption made for dispersion modelling, in which emissions per vehicle are held constant while traffic volumes are assumed to change year on year. Overall, this discrepancy is unlikely to influence the overall conclusions of the assessment.

calibrated against 2010 monitoring data. 2010 was identified as a 'high pollution' year, as a result the background maps may over predict the local background concentrations. Therefore a comparison between the 2011 annual mean nitrogen dioxide concentration at all background monitoring sites within the AURN and the background mapped concentrations has been carried out (see Figure A1). Based on the 68 sites with more than 75% data capture for 2011 the maps over-predict the background concentrations by 5%, on average. This has been allowed for in production of the calibrated 'adjusted' 2011 background concentrations.

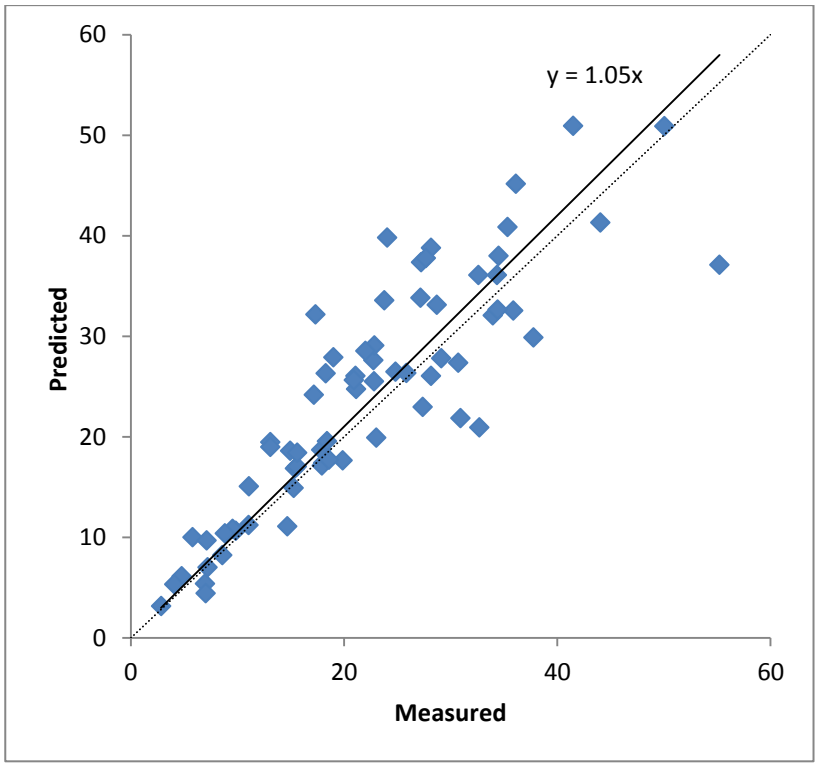

Figure A1: Predicted Mapped versus Measured Concentrations at AURN Background Sites in 2011

A2.6 For PM_{10}, there is no strong evidence that Defra's predictions are unrealistic and so the year-specific mapped concentrations have been used in this assessment.

A2.7 The mapped background concentrations are presented in Table A2.

Measured Backgrounds

A2.8 Background concentrations measured at the Norfolk Lakenfields AURN site have been downloaded from the Defra AURN website (Defra, 2013b). These data have been used to calculate the NO_2 and PM_{10} annual mean. The 99.8th percentile of hourly 'background' total oxidant, the 99.8th percentile of hourly 'background' NO_2 and the 90th percentile of 24-hour 'background' PM_{10} concentrations were also calculated from these data.

A2.9 The background concentrations are presented in Table A2.

Model Inputs

A2.10 The impacts of emissions from the biomass boiler have been predicted using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the art understanding of the dispersion processes within the atmospheric boundary layer. The model was run to predict the contribution of the biomass boiler emissions to annual mean concentrations of nitrogen oxides and PM_{10}, the 99.8th percentile of 1-hour mean nitrogen oxides concentrations, and the 90th percentile of 24-hour mean PM_{10} concentrations.

A2.11 The emission factors were provided by the LAQM helpdesk and further input parameters were taken from the emissions tests data, provided by Suffolk Coastal District Council. The building dimensions and flue location were obtained from drawings provided by Suffolk Coastal District Council. The location of the flue is shown in Figure 1. The flue has been modelled at a height of 10.45 m (2.95 m above the barn roof level).

A2.12 The following assumptions have been made regarding the Straw Biomass Boiler:

(a) The boiler operates for 8 months of the year;
(b) The boiler burns fuel at a constant rate of 1.5 x 0.5 tonne bales per hour;
(c) The boiler operates between 9 am and 7pm every day; and
(d) The boiler operates at 100% capacity during its operating hours.

A2.13 These assumptions are likely to overestimate the usage of the boiler which was operating at less than 60% of capacity at the last emissions test. Based on the amount of straw burned during the previous winter (2011-2012) is it estimated that the boiler was only used on average for 9 hours per day, however, there were fluctuations between days and therefore a conservative assumption has been used.

A2.14 The parameters entered into the model are shown in Table A3.

Table A3: Biomass Boiler Model Input Parameters

Parameter	NOx	PM_{10}
Emission rate (g/s)	0.34[a]	2.33[a]
Boiler capacity (MW)	1.5	
Temperature (deg C)	140	
Flue height above ground (m)	10.45	
Stack Diameter (m)	0.3	
Exit Velocity (m/s)	10	
Operation	8 months per year, 9 hrs per day	

[a] Calculated using the emission rate provided by LAQM helpdesk in ktonne pollutant / Mtonne fuel, assuming fuel is consumed at capacity (1.5 x 0.5 tonne bales / hr).

A2.15 Entrainment of the plume into the wake of the barn (which houses the boiler and is 7.5 m high) and the two nearest buildings (5.8 and 4.8 m high) has been taken into account in the model. This entrainment is known as the building downwash effect. The buildings included in the model are shown in Figure 1.

Post-Processing

A2.16 Emissions from the Straw Burning Biomass plant will be predominantly in the form of nitrogen oxides (NO_x) and PM_{10}.

A2.17 ADMS-5 was run to predict the contribution of the boiler emissions to annual mean concentrations of nitrogen oxides and PM_{10} as well as to the 99.8th percentiles of 1-hour mean nitrogen oxides and 90th percentiles of 24-hour mean concentrations. For the initial screening of the process contributions, the approach recommended by the Environment Agency (Environment Agency, 2005) was used to predict annual mean nitrogen dioxide concentrations and 99.8th percentiles of 1-hour mean nitrogen dioxide concentrations. This assumes that:

- Annual mean nitrogen dioxide concentrations = Annual mean nitrogen oxides x 0.7; and
- 99.8th percentiles of 1-hour mean nitrogen dioxide concentrations = 99.8th percentiles of 1-hour mean nitrogen oxides x 0.35.

Long-term

A2.18 Where long-term (annual mean) objectives need to be assessed the following post-processing has been carried out:

- Nitrogen dioxide – calculated as the sum of the local nitrogen dioxide background concentration and the nitrogen dioxide process contribution;

- PM_{10} - calculated as the sum of the local PM_{10} background concentration and the PM_{10} process contribution.

Short-term

A2.19 In order to predict total 1-hour mean nitrogen dioxide concentrations, the worst-case approach set out in LAQM TG(09) has been followed, which is summarised as follows: The 99.8th percentile of total hourly nitrogen dioxide concentrations is equal to the minimum of either G or H, where H is the maximum of either H1 or H2, and where:

G = 99.8th percentile hourly 'background' total oxidant + 0.05 x 99.8th percentile process contribution NOx concentration

H1 = 99.8th percentile process contribution NOx + 2 x 'background' annual mean nitrogen dioxide concentration

H2 = 99.8th percentile hourly 'background' nitrogen dioxide + 2 x annual mean process contribution NOx concentration

A2.20 In order to predict the 90th percentile of 24-hour mean PM_{10} concentrations to determine compliance with the 24-hour objective, the worst-case approach set out by (Defra, 2009) has been followed. This states that the 90th percentile total 24-hour mean PM_{10} concentration is equal to the maximum of either A or B where:

A = 90th percentile 24-hour mean 'background' PM_{10} + annual mean process PM_{10}

B = 90th percentile 24-hour mean process contribution + annual mean 'background' contribution

Appendix I:

Results of Queue length surveys undertaken at the Woodbridge Junction

Average queue lengths on all arms of junction for each hour

	Time	Average queue length (m) Pre-MOVA 26/11/2009	Average queue length (m) Post-MOVA 25/04/2013
Melton Hill	08:00-09:00	43	52
	09:00-10:00	78	78
	10:00-11:00	35	46
	11:00-12:00	41	53
	12:00-13:00	33	49
	13:00-14:00	31	43
	14:00-15:00	32	43
	15:00-16:00	38	46
	16:00-17:00	45	48
	17:00-18:00	25	41
Lime Kiln Quay	08:00-09:00	24	43
	09:00-10:00	35	39
	10:00-11:00	28	40
	11:00-12:00	43	54
	12:00-13:00	44	52
	13:00-14:00	50	43
	14:00-15:00	48	46
	15:00-16:00	72	55
	16:00-17:00	50	58
	17:00-18:00	49	75
St John's	08:00-09:00	28	36
	09:00-10:00	38	35
	10:00-11:00	22	33
	11:00-12:00	41	33
	12:00-13:00	25	43
	13:00-14:00	38	31
	14:00-15:00	35	30
	15:00-16:00	59	43
	16:00-17:00	49	41
	17:00-18:00	18	36

Lime Kiln Quay Road Comparison of 2009 SCC and 2013 TSP data

Time	Queue length in m	
	2009 SCC	2013 TSP
08:00	0	25
08:05	0	20
08:10	60	60
08:15	0	25
08:20	30	35
08:25	50	30
08:30	50	35
08:35	40	40
08:40	10	75
08:45	10	50
08:50	20	65
08:55	20	60
09:00	60	45
09:05	100	60
09:10	20	40
09:15	10	25
09:20	0	20
09:25	50	40
09:30	0	30
09:35	10	50
09:40	50	25
09:45	50	45
09:50	50	45
09:55	25	45
10:00	30	45
10:05	30	25
10:10	0	25
10:15	30	55
10:20	20	45
10:25	40	35
10:30	40	30
10:35	0	40
10:40	10	20
10:45	50	65
10:50	30	50
10:55	50	50
11:00	10	30
11:05	50	40
11:10	0	30
11:15	70	60
11:20	110	30
11:25	50	35
11:30	30	55
11:35	10	40
11:40	20	60
11:45	40	70
11:50	60	120
11:55	65	80

Time	Queue length in m	
	2009 SCC	2013 TSP
12:00	50	40
12:05	50	50
12:10	10	50
12:15	60	65
12:20	90	40
12:25	30	45
12:30	10	50
12:35	20	50
12:40	60	40
12:45	80	40
12:50	50	80
12:55	20	75
13:00	50	30
13:05	70	35
13:10	100	35
13:15	80	45
13:20	40	40
13:25	50	35
13:30	30	50
13:35	10	45
13:40	40	50
13:45	30	60
13:50	60	45
13:55	40	45
14:00	70	50
14:05	50	45
14:10	60	60
14:15	40	40
14:20	50	60
14:25	0	35
14:30	0	30
14:35	50	60
14:40	30	45
14:45	40	55
14:50	130	45
14:55	50	30
15:00	60	40
15:05	100	45
15:10	50	45
15:15	40	45
15:20	90	80
15:25	60	50
15:30	70	45
15:35	60	80
15:40	100	45
15:45	100	55
15:50	70	80
15:55	60	50

Time	Queue length in m	
	2009 SCC	2013 TSP
16:00	80	90
16:05	60	70
16:10	30	65
16:15	50	80
16:20	40	50
16:25	80	45
16:30	40	60
16:35	30	45
16:40	70	20
16:45	20	45
16:50	50	55
16:55	50	70
17:00	40	100
17:05	40	120
17:10	150	120
17:15	10	120
17:20	60	120
17:25	5	45
17:30	60	25
17:35	5	30
17:40	90	65
17:45	45	50
17:50	40	55
17:55	40	45
18:00	50	70

Melton Hill Comparison of 2009 SCC and 2013 TSP data

Time	Queue length in m	
	2009 SCC	2013 TSP
08:00	20	60
08:05	10	30
08:10	50	45
08:15	70	40
08:20	50	80
08:25	60	40
08:30	50	60
08:35	60	40
08:40	10	60
08:45	50	65
08:50	40	25
08:55	50	75
09:00	30	120
09:05	30	120
09:10	100	75
09:15	190	120
09:20	210	120
09:25	80	40
09:30	50	75
09:35	100	20
09:40	50	40
09:45	50	75
09:50	30	55
09:55	10	70
10:00	20	50
10:05	10	50
10:10	40	30
10:15	60	30
10:20	50	35
10:25	30	45
10:30	50	70
10:35	50	60
10:40	10	35
10:45	0	75
10:50	50	35
10:55	50	40
11:00	10	30
11:05	80	65
11:10	40	40
11:15	30	55
11:20	80	60
11:25	50	80
11:30	40	60
11:35	60	65
11:40	20	50
11:45	20	55
11:50	55	50
11:55	10	25

Time	Queue length in m	
	2009 SCC	2013 TSP
12:00	30	65
12:05	30	30
12:10	40	60
12:15	30	55
12:20	20	20
12:25	0	40
12:30	80	60
12:35	60	50
12:40	20	55
12:45	50	50
12:50	20	40
12:55	20	65
13:00	60	50
13:05	20	35
13:10	20	30
13:15	0	35
13:20	110	50
13:25	10	60
13:30	0	35
13:35	10	35
13:40	40	55
13:45	20	50
13:50	60	45
13:55	20	40
14:00	70	35
14:05	30	60
14:10	10	35
14:15	10	40
14:20	0	65
14:25	30	20
14:30	50	40
14:35	20	45
14:40	30	20
14:45	40	45
14:50	50	45
14:55	40	65
15:00	0	50
15:05	20	60
15:10	10	40
15:15	30	30
15:20	90	55
15:25	50	55
15:30	50	40
15:35	40	50
15:40	80	50
15:45	0	30
15:50	40	45
15:55	40	45

Time	Queue length in m	
	2009 SCC	2013 TSP
16:00	100	45
16:05	20	50
16:10	10	50
16:15	50	55
16:20	40	45
16:25	70	45
16:30	20	35
16:35	100	40
16:40	50	55
16:45	10	40
16:50	60	50
16:55	10	65
17:00	40	40
17:05	20	60
17:10	80	45
17:15	10	70
17:20	30	35
17:25	0	25
17:30	30	40
17:35	10	35
17:40	10	45
17:45	0	35
17:50	20	35
17:55	50	30
18:00	0	30

St John's Road Comparison of 2009 SCC and 2013 TSP data

Time	Queue length in m	
	2009 SCC	2013 TSP
08:00	5	20
08:05	20	35
08:10	25	25
08:15	0	25
08:20	0	35
08:25	20	20
08:30	0	50
08:35	75	50
08:40	45	45
08:45	100	25
08:50	20	40
08:55	20	60
09:00	50	55
09:05	50	30
09:10	10	30
09:15	15	50
09:20	65	35
09:25	65	20
09:30	50	35
09:35	45	10
09:40	20	30
09:45	45	35
09:50	45	35
09:55	0	50
10:00	10	30
10:05	40	40
10:10	50	20
10:15	10	20
10:20	10	30
10:25	10	25
10:30	50	35
10:35	0	40
10:40	10	35
10:45	30	35
10:50	30	30
10:55	10	60
11:00	40	20
11:05	65	30
11:10	0	30
11:15	5	45
11:20	30	45
11:25	45	30
11:30	50	30
11:35	30	30
11:40	55	35
11:45	45	20
11:50	65	45
11:55	65	40

Time	Queue length in m	
	2009 SCC	2013 TSP
12:00	60	40
12:05	10	45
12:10	25	30
12:15	40	35
12:20	10	30
12:25	10	35
12:30	20	55
12:35	40	45
12:40	40	50
12:45	10	65
12:50	30	55
12:55	10	25
13:00	20	40
13:05	50	35
13:10	60	20
13:15	20	30
13:20	20	30
13:25	30	30
13:30	40	15
13:35	20	55
13:40	30	30
13:45	40	30
13:50	65	25
13:55	60	30
14:00	30	20
14:05	20	25
14:10	40	40
14:15	30	25
14:20	30	50
14:25	100	35
14:30	40	10
14:35	40	25
14:40	30	20
14:45	15	30
14:50	40	50
14:55	5	35
15:00	50	45
15:05	45	30
15:10	45	25
15:15	60	50
15:20	45	25
15:25	95	35
15:30	40	35
15:35	60	50
15:40	85	55
15:45	50	55
15:50	55	60
15:55	75	50

Time	Queue length in m	
	2009 SCC	2013 TSP
16:00	60	65
16:05	100	15
16:10	100	55
16:15	30	50
16:20	25	60
16:25	80	60
16:30	5	55
16:35	10	15
16:40	40	30
16:45	20	15
16:50	80	35
16:55	40	35
17:00	0	75
17:05	80	35
17:10	40	45
17:15	35	50
17:20	20	35
17:25	0	35
17:30	0	20
17:35	0	15
17:40	25	45
17:45	0	35
17:50	15	20
17:55	5	25
18:00	0	30

Appendix J:

Air Pollution Mitigation Options for Ports – State of the Art Review of options being considered in Ports worldwide

Transport Research Laboratory
Creating the future of transport



CLIENT PROJECT REPORT CPR2510

Air pollution mitigation options for ports

State of the art review of options being considered in ports worldwide

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Prepared for: Suffolk Coastal District Council, Environmental Protection

Project Ref:

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Contents amendment record

This report has been amended and issued as follows:

Version	Date	Description	Editor	Technical Referee
1	March 2013	First draft	MS/AS	KT
2	March 2013	Final	MS	KT

Executive summary

This report provides a review of air pollution mitigation options for ports in the UK, Europe and worldwide. Suffolk Coastal District Council commissioned TRL to conduct this review to fulfil one of the measures proposed in their Local Air Quality Management Action Plan for their Air Quality Management Area (AQMA) at Ferry Lane, Felixstowe (Price & Turpin, 2012).

Air pollution in and around ports is associated with different sources from shipping, portside handling activities and surface access to the port. Most of these vessels and vehicles are conventionally powered by diesel engines, which emit the greenhouse gas carbon dioxide (CO_2) and the harmful gases nitrogen oxides (NO_x), sulphur oxides (SO_x), hydrocarbons (HC), carbon monoxide (CO) and particulate matter (PM).

A wide-ranging literature review and an email enquiry of 10 ports in Europe, USA and Asia were conducted and the following 27 different measures were identified:

- Measures related to ocean going vessels and harbour craft
    - Shore-based power
    - Hybridisation of harbour craft
    - Vessel speed reduction
    - Clean fuels
    - Automated mooring system
    - Replace, repair, rebuild, repower
    - Emission control technologies
- Measures related to cargo handling equipment
    - Electrification and hybridisation
    - Clean fuels
    - Emission control technologies
    - Replace, repair, rebuild, repower
- Measures related to lorries, trains and construction equipment
    - Clean fuels
    - Emission control technologies
    - Replace, repair, rebuild, repower
    - On-dock or near-dock rail
    - Operational improvements
    - Idle-reduction technologies
- Management measures
    - Air quality monitoring
    - Gate procedure improvements
    - Container, freight and cargo management and handling

    - Idle-time restrictions
    - Environmental management system
    - Operational improvements for vessels
- Broader measures
    - Incentives for stakeholders and support for future legislation
    - Road traffic improvements
    - Public transport improvements
    - Training and information

This review found that air pollution related to ports is a problem that is acknowledged and being addressed worldwide. USA and Europe appear to be leading in the development and deployment of measures; however, other parts of the world are also starting to address these issues. The measures found to be the most popular included:

- Providing shore-based power supply for ocean-going and other vessels at berth;
- Reducing the speed of vessels in proximity to the port by applying speed limits or Virtual Arrival;
- Using cleaner fuels like biodiesel, low sulphur diesel, ultra-low sulphur diesel, emulsified diesel or liquefied natural gas (LNG) for combustion engines of vessels and vehicles;
- Replacing, repairing, rebuilding or repowering vehicles or retrofitting them with emission control technologies;
- Improving the road traffic system surrounding the port and improving gate procedures for lorries approaching the port in order to reduce traffic queues;
- Offering incentives or tariffs based on environmental criteria to encourage specific practices that are desirable in the local situation.

Contents

1 Introduction

Suffolk Coastal District Council commissioned TRL to produce a review of air pollution mitigation options for ports being considered in the UK, Europe and worldwide. This review is one of the measures proposed in the Local Air Quality Management Action Plan for the Air Quality Management Area (AQMA) at Ferry Lane, Felixstowe, that was previously developed by TRL (Price & Turpin, 2012).

For this report a wide-ranging literature review was carried out comprising of information obtained from published reports, articles in journals and periodicals as well as presentations and web sites of ports and relevant organisations. Further information was gathered by an email enquiry of 10 ports in Europe, USA and Asia.

The report is structured as follows:

Section 2 gives background information on the sources of air pollution at ports and key pollutants, different political levels on which air pollution can be influenced and organisations and initiatives relevant to the topic.

Section 3 gives a comprehensive review of air pollution mitigation options. All options that were identified at different ports during this research were categorised into 27 different individual measures, which are presented in the form of a look up guide. Relevant references and resources for further information are given for each measure.

Section 4 provides a brief discussion and summary of air pollution mitigation measures found in this review to be most popular with some noteworthy innovations.

Appendix A lists additional sources for further information related to the topic.

2 Background

2.1 Air pollution at ports: Sources and key pollutants

There are various sources of emissions contributing to air pollution in and around ports. Broadly defined as being associated with shipping, portside handling activities and surface access to the port. More specifically sources can be grouped according to the following;

- Ocean going vessels (approaching or at berth)
- Harbour craft
- Cargo handling equipment
- Lorries
- Rail locomotives
- Construction equipment
- Traffic from port employees and visitors
- Power generation
- Fugitive emissions from handling and storage of raw material

The proportion of emissions from every of these sources depends heavily on the specific situation at every port and the pollution mitigation measures that have already been undertaken to manage emissions. Most of the vessels and vehicles in the above mentioned groups are conventionally powered by diesel engines. During the combustion process, diesel engines emit the greenhouse gas carbon dioxide (CO_2) and the following harmful gases as by-products:

- Nitrogen oxides (NO_x, i.e. NO and NO_2)
- Sulphur oxides (SO_x, i.e. SO_2, SO_3 and SO_4)
- Hydrocarbons (HC)
- Carbon monoxide (CO)
- Particulate matter, a mixture of solid particles and liquid droplets (PM, i.e. PM_{10}, $PM_{2.5}$ and black carbon)

The amount of SO_x emitted during combustion is directly related to the sulphur content of the burned fuel. Because sulphur is not a necessary component for the combustion process, different qualities or types of diesel fuel are available that contain different amounts of sulphur (e.g. heavy fuel oil with high sulphur content in contrast to low sulphur diesel, ultra-low sulphur diesel). The level of emissions of other pollutants (harmful gases and PM) is related to the physics and chemistry of the diesel combustion process. The reduction of PM and NO_x emitted by diesel engines is technically the most challenging (Starcrest Consulting Group, 2012).

The severity of air quality problems in port areas depends not only on the emitting sources but also on the climatic conditions of the port region, which can alleviate or exacerbate the problem considerably. The main objective of air quality programmes carried out by ports and maritime organisations throughout the world is to reduce levels of the air pollutants NO_x, SO_x and PM (Starcrest Consulting Group, 2012). In many of the

examples provided in this report, ports have been identified as a significant source of local emissions.

2.2 Influencing port- and shipping-related air pollution

The air pollution related to ports and shipping is being addressed on different political levels. On the international level, emissions from ocean shipping are regulated by the International Maritime Organisation (IMO), a sub-organisation of the United Nations (UN), in the MARPOL conventions. One of the measures related to air pollution, for example, is the progressive reduction of sulphur content of maritime fuel until 2020. Furthermore, on an international level, there are defined Emission Control Areas (ECAs) or Sulphur Emission Control Areas (SECAs) with specific restrictions, e.g. the North Sea, the Baltic Sea and the English Channel (since 2010) and the west and east coast of Canada and the USA (since 2012).

On the European level, the Clean Air for Europe (CAFE) programme, introduced in 2001, defined a strategy to reduce air pollution to protect public health and the environment. The strategy includes, amongst other things, further regulations to reduce overall PM concentrations and new emission standards for vehicles (EURO 5 and 6 for cars and light-duty vehicles, EURO V and VI for heavy-duty vehicles and busses). The central European legislation on air quality is contained in two directives. Since 2012, the European Ambient Air Quality Directive (2008/50/EC) defines emission limits for key pollutants. The European NEC Directive (2001/81/EC) defines National Emission Ceilings for four pollutants. (German Nature and Biodiversity Conservation Unit (NABU), 2012)

On a national level, additional air quality regulations can be defined or national governments can set up incentive programmes or financial subsidies to promote desired practices, e.g. changes in the mode of transport used or replacement of high emission vehicles. In England, the following air quality regulations apply: The Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002. On a regional level in the UK, local authorities have statutory duties for managing local air quality under Part IV of the Environment Act 1995. They are required to designate an Air Quality Management Area (AQMA), carry out an assessment and develop an action plan where air quality objectives are not being achieved.

Under national law or regulation, port authorities administer and manage the port infrastructures and co-ordinate and control the activities of the different operators present in the port (ESPO, 2010). The level of influence of a port authority varies between countries. For example, they can offer incentives or environmental tariffs to promote desired behaviour, they can define rules for their area of influence, e.g. demand fuel switch of vessels at berth or demand certain emissions standards from vehicles entering the port. Multi-port approaches, like the San Pedro Bay Ports or the Port Authority of New York and New Jersey, can facilitate the introduction of such measures.

2.3 Organisations and initiatives

The following information provides a selection of organisations and initiatives that address air quality problems related to ports and shipping and are useful sources for further information.

The World Ports Climate Initiative[1] (WPCI) was founded in 2008 as part of the International Association of Ports and Harbors[2] (IAPH). It provides best practice in monitoring and reducing emissions of air pollutants in ports and offers guidance in form of the IAPH Tool Box for Port Clean Air Programs (International Association of Ports and Harbors (IAPH), 2010). This tool box from the year 2010 contains information on possible measures to reduce emissions and supports the creation of clean air programmes for individual ports. In 2012, an update of the tool box was carried out by order of the International Council on Clean Transportation (ICCT)[3] (Starcrest Consulting Group, 2012).

The Environmental Ship Index[4] (ESI) is a project of the WPCI that tries to identify low emission ships. It calculates a score for a ship based on the level of its NO_x, SO_x and CO_2 emissions. Ports can then reduce port charges or offer incentives based on the ESI score. Currently 23 ports worldwide are involved in this scheme. The port of Felixstowe is not affiliated.

The Clean Baltic Sea Shipping[5] (CLEANSHIP) programme works to reduce ship-borne air pollution both in the Baltic Sea and in ports and port cities of the Baltic Sea Region. The programme aims at a harmonisation of environmental differentiated port charges and the development of best practice cases and technical pilot solutions regarding infrastructure for shore-based power, gas and LNG supply and sewage reception in ports. CLEANSHIP is developing the Environmental Port Index to assess single ports based on environmental aspects (Clean Baltic Sea Shipping, 2013).

Most ports worldwide undertake efforts to reduce emissions, either individually or as part of multi-port co-operations. Two examples are particularly worth mentioning as a source for further information because of their high level of effort and documentation: (1) The cooperation between the ports of Los Angeles and Long Beach, the San Pedro Bay Ports[6], which introduced a joint Clean Air Action Plan in 2006 and (2) the port of Rotterdam[7], which introduced a Clean Air Action Program in 2006.

[1] http://wpci.iaphworldports.org/

[2] http://www.iaphworldports.org/

[3] http://www.theicct.org/

[4] http://esi.wpci.nl/Public/Home

[5] http://www.clean-baltic-sea-shipping.com/

[6] http://www.cleanairactionplan.org/

[7] http://www.portofrotterdam.com/en/Pages/default.aspx

3 Air pollution mitigation measures

3.1 Measures related to ocean going vessels and harbour craft

3.1.1 Shore-based power

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Shore-based power
Description: This measure is also referred to as *cold ironing* or *alternative marine power*. The purpose is to provide vessels of all types with land-based power, allowing them to operate auxiliary systems at dock while their engines are turned off (Environmental Protection Agency (EPA), 2013). The electricity is either taken from the grid or generated at the port, ideally using natural gas, wind, solar or water power. In 2012, an international standard for shore-based power was adopted.
Examples of deployment: The port of Gothenburg, Sweden, was the first to offer high voltage shore-based power for vessels in 2000. One in three ships visiting the port can today make use of this system. The aim of the port for 2015 is to supply shore-based power for all ships calling at ro-ro- and passenger terminals. (Port of Gothenburg, 2013) Today, shore-based power is installed and used by many ports in Europe and America: Antwerp, Hamburg, Gothenburg, Helsingborg, Stockholm, Piteå, Kemi, Oulu, Kotka, Lübeck, Zeebrugge, London, Los Angeles, Long Beach, San Francisco, San Diego, Seattle, Juneau, Pittsburgh, Oakland and Vancouver. The ports of Le Havre, Marseille and Civitavecchia are implementing shore-based power at the moment (World Ports Climate Initiative, 2013). The port of Hong Kong is considering installing shore-based power at a new cruise terminal (Hong Kong Environmental Protection Department, 2012). The port of Hamburg has offered shore-based power for some vessel types for many years. Where it is not feasible to install the required equipment on shore, the port is planning a programme for 2013 to supply vessels with power from liquefied natural gas (LNG) generators installed on mobile barges (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012). The port of Southampton previously investigated the installation of facilities for shore-based power but rejected it due to high costs and low electric efficiency (Southampton City Council, 2010).
Effectiveness: Shore-based power is estimated to lead to emissions reductions from ships at berth of up to 97 percent for NO_x, 96 percent for SO_2 and PM, 94 percent for VOC (World Ports Climate Initiative, 2013). The following air-pollution reductions have been reported (Environmental Protection Agency (EPA), 2013): • Port of Oakland (estimated annual reductions): CO 3,727 kg, CO_2 1,742,470 kg, NO_x 39,437 kg, PM 328 kg, SO_x 6,557 kg • Port of Long Beach: 95 percent reduction of PM, NO_x, SO_x per vessel • Port of Seattle: Princess Cruises reduced CO_2 by 2,735 tonnes in 2005, Holland America Line decreased CO_2 by 29 percent in 2006

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Shore-based power
References: (Port of Gothenburg, 2013) (World Ports Climate Initiative, 2013) (Hong Kong Environmental Protection Department, 2012) (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012) (Southampton City Council, 2010) (Environmental Protection Agency (EPA), 2013) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html World Ports Climate Initiative Onshore Power Supply http://www.onshorepowersupply.org/

3.1.2 *Hybridisation of harbour craft*

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Hybridisation of harbour craft
Description: Diesel-electric hybrid harbour craft, e.g. tugboats, exclusively use electric motors in low load situations, cutting local emissions to zero during these periods. In higher load situations, the diesel engines are switched on. The electric batteries are charged by power from the shore and from the diesel engines.
Examples of deployment: In 2010, the port of Los Angeles first introduced a hybrid propulsion system in a harbour craft, a 40 passenger harbour tour boat. The ports of Long Beach and Los Angeles use a small number of hybrid tugboats developed by Foss Maritime as part of their Clean Air Action Plan. The vessels use a diesel-electric hybrid propulsion system with downsized diesel engines (The Ports of Long Beach and Los Angeles, 2013). The port of Antwerp is currently carrying out a feasibility study into the conversion of their fleet of tugboats to hybrid propulsion (van Espen, 2012).
Effectiveness: The emissions from hybrid boats compared to conventional tugboats are estimated to be 44 percent lower for NO_x and PM, 20-30 percent lower for SO_x and CO. Fuel savings are estimated to be 20-30 percent (Environmental Protection Agency (EPA), 2013).
References: (The Ports of Long Beach and Los Angeles, 2013) (van Espen, 2012) (Environmental Protection Agency (EPA), 2013) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html San Pedro Bay Ports Clean Air Action Plan http://www.cleanairactionplan.org/

3.1.3 Vessel speed reduction

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Vessel speed reduction
Description: Slower vessels have lower emissions per kilometre than faster moving vessels. Therefore, slowing down ocean going vessels when they are in the vicinity of ports will reduce emissions close to populated areas. The overall reductions in fuel consumption bring net reductions in NO_x, PM, SO_x and all other air pollutants.
Examples of deployment: The ports of Los Angeles and Long Beach were the first to introduce a vessel speed reduction programme in 2001 (the Green Flag Program). It requires ships to slow down to 12 knots (ca. 22 km/h) when they come within a 37 km radius of the port. This reduces NO_x emissions at these ports by 1.1 tonnes/day. The ports of San Diego, New York and New Jersey introduced vessel speed reduction in 2009 and 2010 respectively. Many other US ports already evaluated this measure. The port of Shenzhen, China has had little success in encouraging ship owners to reduce their speed to 12 knots (ca. 22 km/h) within 37 km of the terminal since 2008 (Galbraith, Curry, & Loh, 2008). The port of Hong Kong imposed speed limits of 8-15 knots (ca. 15-28 km/h) within and around the harbour areas (Hong Kong Environmental Protection Department, 2012). The port of Rotterdam will impose speed limitations on inland barges at some locations from 2014 (Prinssen, 2012). Some ferry companies operating in the area of the port of London limit the top speed of their vessels to 29 knots (ca. 54 km/h) (Transport for London, 2011).
Effectiveness: A study found that slowing container ships from their traditional cruising speeds of 40-47 km/h to about 23 km/h reduced CO_2 emissions by about 60 percent, NO_x emissions by 55 percent and soot emissions by almost 70 percent (Khan, Agrawal, Ranganathan, Welch, Miller, & Cocker, 2012).
References: (Galbraith, Curry, & Loh, 2008) (Hong Kong Environmental Protection Department, 2012) (Prinssen, 2012) (Transport for London, 2011) (Khan, Agrawal, Ranganathan, Welch, Miller, & Cocker, 2012) **Further reading:** US Environmental Protection Agency (EPA) http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html Green Flag Program http://www.polb.com/environment/air/vessels/green_flag.asp

3.1.4 Clean fuels

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Clean fuels
Description: Vessels are able to run on different fuels. Switching to cleaner fuels than the conventional diesel can reduce emissions of air pollutants. Ports can for example require the use of lower sulphur distillate fuels within their coastal waters. Possible alternative fuels are: biodiesel, low sulphur diesel, ultra-low sulphur diesel, emulsified diesel and LNG. The overall effects of LNG can be considered controversial because the effect of "methane slip" reduces the positive effect of greenhouse gas reduction.
Examples of deployment: Since 2008, ferries operating in the area of the port of London use ultra-low sulphur diesel (Transport for London, 2011). The general limits for the maximum sulphur content of maritime fuels in the EU will be reduced from 3.5 percent to 0.5 percent by 2020. For ECAs the limit will be 0.1 percent from 2015. The port of Hamburg uses sulphur-free fuel for its own port authority vessels and floating equipment (ESPO, 2012). Furthermore, a programme is planned to provide LNG at the port (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012). The ports of California, including the ports of Los Angeles and Long Beach adopted the Ocean Going Vessel Clean Fuel Regulation in 2009[8], requiring vessels to use cleaner fuels within 44 km from the shore. Even before that time clean fuel regulations were in place at these ports. The limits for sulphur content in marine gas oil and marine diesel oil are: 1.0 percent and 0.5 percent respectively (from 2012), 0.1 percent (from 2014). The EPA requirement for the North American Environmental Control Area[9] is to use fuel with a sulphur content of 0.1 percent from 2015 (Environmental Protection Agency (EPA), 2013). Hong Kong has capped the sulphur content of marine fuel at 3.5 percent since 2012 and considers to set up an environmental control area that requires ocean going vessels to use 1.0 percent sulphur fuel (0.1 percent from 2015) when operating in Pearl River Delta waters. Additionally, 17 operators joined a charter that commits them to using 0.5 percent sulphur diesel when berthing at the port of Hong Kong. The government fleet uses low sulphur diesel since 2008 (Hong Kong Environmental Protection Department, 2012). The ports of Guangdong, Shenzhen, Macao and Hong Kong are considering a collaboration to mandate a fuel switch for vessels at berth (Hong Kong Environmental Protection Department, 2012). Since 2011, the port of Gothenburg offers financial incentives for shipping lines to use low sulphur or alternative fuels like LNG. Shipping lines that choose a fuel containing a maximum of 0.1 percent sulphur can receive up to SEK 250,000 (ca. £25,500) in compensation for increased fuel costs (Port of Gothenburg, 2013). The port of Gothenburg and the port of Rotterdam formed an alliance in 2012 to speed

[8] http://www.arb.ca.gov/regact/2011/ogv11/ogv11attach1.pdf

[9] http://www.epa.gov/oms/regs/nonroad/marine/ci/420f10015.pdf

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Clean fuels
up the establishment of LNG as a maritime fuel. Both ports plan to have infrastructure available for LNG bunkering at the port in 2015 when stricter sulphur regulations come into effect in northern Europe (Port of Gothenburg, 2013). The port of Antwerp also plans to have bunkering facilities for LNG in place by 2015 (van Espen, 2012). The ports of Bremen and Bremerhaven, Germany plan to introduce LNG as marine fuel by 2015 in order to reduce emissions of CO_2, NO_x, SO_x and PM from vessels. The port authorities support companies that are planning to supply LNG at the port and also support the development of different kinds of LNG use and provision, e.g. power-barge-systems, mobile tank containers for flexible fuel support and bunker facilities.
Effectiveness: The port of Hong Kong estimates to achieve the following territory wide emissions reductions by requiring ocean going vessels to use 0.1 percent sulphur fuel while berthing (base year 2010): SO_2 14 percent, PM_{10} 6 percent, NO_x 0.2 percent (Hong Kong Environmental Protection Department, 2012). In general, using clean fuels in vessels can lead to the following estimated reductions in emissions (Starcrest Consulting Group, 2012): • Ultra-low sulphur diesel: PM 5-15 percent, SO_x 99 percent • Emulsified diesel fuel: NO_x 10-20 percent, PM 15-60 percent
References: (Transport for London, 2011) (ESPO, 2012) (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012) (Environmental Protection Agency (EPA), 2013) (Hong Kong Environmental Protection Department, 2012) (Port of Gothenburg, 2013) (van Espen, 2012) (Hong Kong Environmental Protection Department, 2012) (Starcrest Consulting Group, 2012) **Further reading:** US Environmental Protection Agency (EPA) http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html California Air Resources Board http://www.arb.ca.gov/homepage.htm Port of Gothenburg http://www.portofgothenburg.com/About-the-port/Sustainable-port/

3.1.5 *Automated mooring system*

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Automated mooring system
Description: Automated mooring systems are a measure to eliminate the need of the crew to tie up the boat for example by using vacuum pads holding the ship. This reduces the mooring time and leads to a speed reduction of ships approaching the port, resulting in fuel savings and emissions reductions (Environmental Protection Agency (EPA), 2013).
Examples of deployment: The technology has been adopted at the Port of Salalah (Oman), Searoad Shipping Australia, Port of Dover (UK), Toll New Zealand, and St. Lawrence Seaway (Environmental Protection Agency (EPA), 2013).
Effectiveness: no data available
References: (Environmental Protection Agency (EPA), 2013) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html

3.1.6 *Replace, repair, rebuild, repower*

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Replace, repair, rebuild, repower
Description: Vessels and in particular harbour craft can be replaced with modern equipment with new engines having lower emissions. Also repairing and properly maintaining the engines of vessels can reduce fuel consumption and overall emissions. To rebuild an engine involves disassembling, cleaning and adjusting the engine and replacing certain components with more modern ones. To repower a vessel means to exchange the engine with a more efficient one, thus reducing emissions (Environmental Protection Agency (EPA), 2013).
Examples of deployment: In 2006, the port of Rotterdam started the Clean Air Action Program and replaced three harbour craft and began repowering parts of its harbour craft fleet to comply with CCR Phase II emission standards. Furthermore, the port raises 10 percent higher port charges for inland barges that don't comply with CCR Phase II emission standards and plans to ban them entirely from 2025 (Prinssen, 2012). At present, Hong Kong is investigating whether to replace engines in the government fleet with newer ones meeting the IMO Tier II standard in order to reduce NO_x emissions (Hong Kong Environmental Protection Department, 2012). The HUD Group, Hong Kong's largest tugboat operator has set up a programme to become completely carbon neutral. The measures taken include, amongst other things, increased maintenance, monitoring and cleaning of the vessels' hulls and propellers (Galbraith, Curry, & Loh, 2008). A ferry company operating in the area of the port of London upgraded the engines of its vessels to modern standards in order to improve fuel efficiency and reduce emissions (Transport for London, 2011).
Effectiveness: Rebuilding an engine or repowering a vessel can, in general, lead to emissions reductions of up to 90 percent for NO_x and up to 90 percent for PM (Starcrest Consulting Group, 2012).
References: (Prinssen, 2012) (Hong Kong Environmental Protection Department, 2012) (Galbraith, Curry, & Loh, 2008) (Transport for London, 2011) (Starcrest Consulting Group, 2012) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html

3.1.7 Emission control technologies

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Emission control technologies
Description: Emission control technologies include exhaust gas after treatment systems that can be retrofitted to vessels and help reduce emissions of harmful gases. Examples of technologies available for vessels are diesel oxygen catalyst (DOC), selective catalytic reduction (SCR), selective catalytic reduction and trap (SCRT), exhaust gas recirculation (EGR) and volatile organic compounds (VOC) recovery system. Another available technology are scrubbing systems installed in vessels, also known as scrubber bonnets that use seawater to filter the engine's exhaust gases before releasing them to the air. The sludge of filtered harmful substances has to be disposed of in special facilities in ports (Environmental Protection Agency (EPA), 2013).
Examples of deployment: The port of Rotterdam has retrofitted five of its harbour craft vessels with SCR and soot filters since 2006 (Prinssen, 2012). The port of Antwerp has equipped its 21 tugboats with SCRT exhaust gas treatment systems. The port plans to equip other vessels of the ports own fleet with SCR, scrubbers and soot filters (van Espen, 2012). A ferry company operating in the area of the port of London retrofitted its vessels with particulate filters (Transport for London, 2011). Since 2011, the EPA requires ships within the North American Environmental Control Area to comply with the Tier II NO_x emission standards. From 2016 on, the installation of NO_x after treatment systems will be mandatory (Environmental Protection Agency (EPA), 2013). In 2011, the ports of Los Angeles and Long Beach retrofitted all previously repowered harbour craft with NO_x and/or PM emissions reduction technologies (San Pedro Bay Ports, 2013). The port of Long Beach is also funding and working with an interagency group that is testing emission control technologies for ocean going vessel main engines (Port of Long Beach, 2013).
Effectiveness: Using these emission control technologies in combustion engines of different types of vehicles can, in general, lead to the following, estimated emissions reductions (Starcrest Consulting Group, 2012): • Diesel oxygen catalyst: PM 20-30 percent, HC 50-90 percent, CO 70-90 percent • Diesel particulate filter: PM up to 90 percent, HC and CO 60-90 percent • Selective catalytic reduction: NO_x 70-95 percent • Exhaust gas recirculation: NO_x 40-50 percent, PM 70 percent (with DPF) In ferries used in the port of New York, SCRs led to a reduction of 25 percent for PM and 80 percent for NO_x (Environmental Protection Agency (EPA), 2013). A seawater scrubbing system for vessels produced by the company Krystallon is reported to reduce SO_x emissions by over 98 percent and PM emissions by 80 percent and also lead to small reductions in CO_2 and NO_x emissions (Environmental Protection Agency

Air pollution mitigation options
Measures related to ocean going vessels and harbour craft
Measure: Emission control technologies
(EPA), 2013).
References: (Prinssen, 2012) (van Espen, 2012) (Transport for London, 2011) (Environmental Protection Agency (EPA), 2013) (San Pedro Bay Ports, 2013) (Port of Long Beach, 2013) (Starcrest Consulting Group, 2012) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html San Pedro Bay Ports Clean Air Action Plan http://www.cleanairactionplan.org/

3.2 Measures related to cargo handling equipment

3.2.1 Electrification and hybridisation

Air pollution mitigation options
Measures related to cargo handling equipment
Measure: Electrification and hybridisation
Description: Cargo handling equipment can be run as hybrid diesel-electric or purely electric vehicles. This reduces local emissions of harmful gases and fuel consumption. Examples of equipment suitable for electrification or hybridisation are rubber-tyred gantry cranes (RTGs), forklifts, straddle carriers and reach stackers.
Examples of deployment: Hybrid or electric forklifts are very common in many ports. In the USA, the following ports use additional electric or hybrid cargo handling equipment: the port of Los Angeles (cranes and yard hostlers, i.e. terminal tractors), the port of Portland (reach stackers), the port of Tacoma (straddle carriers) and the ports of Seattle, Virginia, Miami, Tacoma, Wilmington, Long Beach, Charleston, Houston, New York, New Jersey (cranes) (Environmental Protection Agency (EPA), 2013). The port of Felixstowe uses RTGs with diesel-electric hybrid drive systems at one of the terminals since 2010 (Port of Felixstowe, 2013). Since 2012, the port of Rotterdam uses automated guided vehicles powered by diesel-electric hybrid propulsion systems for container transport at one terminal. The port of Durban started using diesel-electric hybrid mobile harbour cranes in 2012 (Port Technology International, 2013). The port of Hong Kong is currently converting diesel powered RTGs to electric or hybrid ones. Most of the quay cranes in Hong Kong are already electric-driven (Hong Kong Environmental Protection Department, 2012). The Technology Advancement Program of the ports of Los Angeles and Long Beach is working since 2012 on a project to demonstrate the efficacy of deploying zero-emission hydrogen fuel cell-electric hybrid terminal tractors to move containerised cargo within the port's facilities (Port Technology International, 2013).
Effectiveness: The emissions reductions that were achieved by hybrid yard hostlers (i.e. terminal tractors) compared to diesel-only yard hostlers at the port of Long Beach were 93 percent for NO_x and PM. The crane manufacturer Vycon estimates reductions achieved by its hybrid cranes to be >25 percent for PM, 30 percent for NO_x and 35 percent for CO_2 (Environmental Protection Agency (EPA), 2013).
References: (Environmental Protection Agency (EPA), 2013) (Port of Felixstowe, 2013) (Port Technology International, 2013) (Hong Kong Environmental Protection Department, 2012) (Port Technology International, 2013) **Further reading:**

Air pollution mitigation options
Measures related to cargo handling equipment
Measure: Electrification and hybridisation
US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html Port Technology International http://www.porttechnology.org/

3.2.2 *Clean fuels*

Air pollution mitigation options
Measures related to cargo handling equipment
Measure: Clean fuels
Description: Cargo handling equipment in the port can be run on cleaner fuels with low sulphur content in order to reduce emissions of harmful gases. Possible alternative fuels are: biodiesel, low sulphur diesel, ultra-low sulphur diesel (ULSD), emulsified diesel, LNG and compressed natural gas (CNG). Forklifts can also be fuelled with liquefied petroleum gas (LPG), propane gas or natural gas, which is common since decades.
Examples of deployment: The port of Felixstowe already uses ultra-low sulphur diesel fuel in all its diesel engine-driven equipment (Port of Felixstowe, 2012). The port of Tacoma primarily supplies ULSD for its machinery. The port of Seattle offers a range of fuel options, including CNG, ULSD or a blend of this and biofuel (Comtoise & Slack, 2007) (see also Section 3.1.4).
Effectiveness: no data available
References: (Port of Felixstowe, 2012) (Comtoise & Slack, 2007) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html California Air Resources Board http://www.arb.ca.gov/homepage.htm

3.2.3 *Emission control technologies*

Air pollution mitigation options
Measures related to cargo handling equipment
Measure: Emission control technologies
Description: Emission control technologies include exhaust gas after treatment systems that are retrofitted to cargo handling equipment and help reduce emissions of harmful gases. Examples of available technologies are: selective catalytic reduction (SCR), diesel particulate filter (DPF), closed crankcase ventilation (CCV), exhaust gas recirculation (EGR) and diesel oxidation catalyst (DOC) (Environmental Protection Agency (EPA), 2013).
Examples of deployment: The port of Trelleborg, Sweden has equipped its terminal tractors with particulate filters since 2010. Newly bought tractors from 2012 are fitted with Ad Blue catalysts and particulate filters (ESPO, 2012). The port of Antwerp plans to retrofit DPFs to the cargo handling cranes as part of its action plan on PM and NO_x (van Espen, 2012). The port of Long Beach has retrofitted more than 600 pieces of cargo handling equipment with DOCs (Port of Long Beach, 2013). The port of Seattle has retrofitted all eligible cargo handling equipment with DOCs. The ports of Cleveland, Boston, Tacoma and Los Angeles also retrofitted emission control technologies to parts of their cargo handling equipment (Environmental Protection Agency (EPA), 2013).
Effectiveness: Using the aforementioned emission control technologies in combustion engines of different modes can, in general, lead to the following, estimated emissions reductions (Starcrest Consulting Group, 2012): • Diesel oxygen catalyst: PM 20-30 percent, HC 50-90 percent, CO 70-90 percent • Diesel particulate filter: PM up to 90 percent, HC and CO 60-90 percent • Selective catalytic reduction: NO_x 70-95 percent • Exhaust gas recirculation: NO_x 40-50 percent, PM 70 percent (with DPF) The port of Trelleborg expects the combination of Ad Blue catalysts and particulate filters in terminal tractors to reduce PM emissions by almost 100 percent (ESPO, 2012). The DOCs retrofitted to cargo handling equipment in the port of Seattle reduced PM emissions by 20 percent, HC emissions by 50 percent and CO emissions by 40 percent (Environmental Protection Agency (EPA), 2013).
References: (ESPO, 2012) (van Espen, 2012) (Port of Long Beach, 2013) (Environmental Protection Agency (EPA), 2013) (Starcrest Consulting Group, 2012)

Air pollution mitigation options
Measures related to cargo handling equipment
Measure: Emission control technologies
Further reading: US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html San Pedro Bay Ports Clean Air Action Plan http://www.cleanairactionplan.org/

3.2.4 *Replace, repair, rebuild, repower*

Air pollution mitigation options
Measures related to cargo handling equipment
Measure: Replace, repair, rebuild, repower
Description: Cargo handling equipment can be replaced with modern equipment with new engines having lower emissions. Similarly to replacing engines, repairing and properly maintaining the engines can reduce fuel consumption and overall emissions. To rebuild an engine means to disassemble, clean and adjust it and replace certain components with more modern ones. To repower a vehicle means to exchange the engine with a more efficient one, thus reducing emissions (Environmental Protection Agency (EPA), 2013).
Examples of deployment: The port of Long Beach repowered 3 yard hostlers (i.e. terminal tractors), the port of Virginia rebuilt several engines of RTGs and the port of Oakland repowered 70 heavy-duty vehicles (Environmental Protection Agency (EPA), 2013). At the ports of New York and New Jersey, the major container terminal operators are systematically replacing yard tractors at the end of their 5-10 year duty cycle with vehicles that come equipped with the cleanest available on-road engines (International Association of Ports and Harbors (IAPH), 2010). The port of Antwerp will replace 25 diesel powered forklifts with CNG powered types. Furthermore, it will convert 33 diesel powered straddle carriers to CNG powered types and will install hydrogen generators on 31 straddle carriers and 5 mobile cranes. Furthermore, it will install start-stop systems on 4 reach stackers and 65 forklifts (van Espen, 2012).
Effectiveness: The port of Antwerp estimates the following reductions of annual emissions due to low-emission cargo handling equipment (replacement, rebuilding and repowering) (van Espen, 2012): • PM_{10}: 4.73 tonnes/year • NO_x: 133.69 tonnes/year • SO_2: 1.04 tonnes/year • CO_2: 3,240.52 tonnes/year
References: (Environmental Protection Agency (EPA), 2013) (International Association of Ports and Harbors (IAPH), 2010) (van Espen, 2012) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html

3.3 Measures related to lorries, trains and construction equipment

3.3.1 Clean fuels

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: Clean fuels
Description: Lorries and trains can be run on different fuels in order to reduce emissions of harmful gases. These can be ultra-low sulphur diesel (ULSD) fuel, emulsified diesel fuels, oxygenated fuel (O_2 diesel fuel) and biodiesel. Additional clean fuel options for lorries include LNG and CNG.
Examples of deployment: Since 2009, the Environmental Protection Department of Hong Kong requires vehicles, including lorries, to use low sulphur Euro V diesel (Galbraith, Curry, & Loh, 2008). In 2008, the port of Long Beach has subsidised the test of LNG locomotives and the replacement of all Pacific Harbor Lines locomotives with cleaner units that use emulsified diesel. Furthermore, the port is requiring contractors to use ultra-low sulphur diesel or alternative fuels in construction equipment as part of its Clean Construction Program (Port of Long Beach, 2013) (see also Section 3.1.4).
Effectiveness: The potential emissions reductions that can be achieved by using clean fuels depend heavily on the specific base fuel. The general influences of the different fuels on air pollutants are (Environmental Protection Agency (EPA), 2013): • Ultra-low sulphur diesel: Reduction of SO_x and PM emissions. Enhances the effectiveness of retrofitted emission control technologies. • Emulsified diesel: Reduction of PM and NO_x emissions. • Biodiesel: Reduction of PM, CO and HC emissions. NO_x emissions increase with the concentration of biodiesel in the fuel. • LNG/CNG: When paired with catalysts or filters, LNG and CNG emissions are comparable to diesel emission from engines fitted with DPFs.
References: (Galbraith, Curry, & Loh, 2008) (Port of Long Beach, 2013) (Environmental Protection Agency (EPA), 2013) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html California Air Resources Board http://www.arb.ca.gov/homepage.htm

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: Clean fuels
Port of Long Beach http://www.polb.com

3.3.2 *Emission control technologies*

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: Emission control technologies
Description: Emission control technologies are exhaust gas after treatment systems that can be retrofitted to lorries and locomotives. These systems are DOC, SCR, LNC, EGR and CCV. Port authorities can consider only allowing lorries on their area that meet certain standards, for example being equipped with particulate filters and SCR or meeting EURO V requirements.
Examples of deployment: In 2008, the port of Los Angeles started a programme that successively banned older lorries from entering the port area. As of 2012, all trucks are banned that do not meet the 2007 Federal Clean Truck Emissions Standards (Port of Los Angeles , 2013). The port of Long Beach is requiring contractors to use electric powered dredges, and will require cleaner engines, oxidation catalysts and electric equipment wherever feasible as part of its Clean Construction Program (Port of Long Beach, 2013). As of 2011, the port of Seattle requires all lorries calling at its container terminals to meet the federal emission standards for engine year 1994. By the end of 2015, 80 percent of all lorries entering the port of Seattle must meet emission standards for engine year 2007 (100 percent by 2017). (Port of Seattle, 2013)
Effectiveness: Using the aforementioned emission control technologies in combustion engines of different modes can, in general, lead to the following, estimated emissions reductions (Starcrest Consulting Group, 2012): • Diesel oxygen catalyst: PM 20-30 percent, HC 50-90 percent, CO 70-90 percent • Diesel particulate filter: PM up to 90 percent, HC and CO 60-90 percent • Selective catalytic reduction: NO_x 70-95 percent • Exhaust gas recirculation: NO_x 40-50 percent, PM 70 percent (with DPF)
References: (Port of Los Angeles , 2013) (Port of Long Beach, 2013) (Port of Seattle, 2013) (Starcrest Consulting Group, 2012) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html San Pedro Bay Ports Clean Air Action Plan http://www.cleanairactionplan.org/

3.3.3 *Replace, repair, rebuild, repower*

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: Replace, repair, rebuild, repower
Description: Lorries, construction equipment and locomotives can be replaced with modern equipment with new engines having lower emissions. With respect to locomotives, a replacement of diesel powered locomotives with electric locomotives can be considered (i.e. if electrified rail can be mobilised). Also repairing and properly maintaining the engines of vehicles can reduce fuel consumption and overall emissions. To rebuild an engine means to disassemble, clean and adjust it and replace certain components with more modern ones. To repower a vehicle means to exchange the engine with a more efficient one, thus reducing emissions (Environmental Protection Agency (EPA), 2013).
Examples of deployment: The ports of Los Angeles and Long Beach encourage the replacement of older lorries following their Clean Air Action Plan: From 2008, pre-1989 lorries were banned at the ports. From 2012, all lorries not meeting 2007 emissions standards are banned. The ports also require class I locomotives to meet EPA Tier II engine standards and Tier III locomotives when they become more available (The Ports of Long Beach and Los Angeles, 2013). In 2008, the port of Long Beach subsidised the replacement of all Pacific Harbor Lines locomotives with cleaner units (Port of Long Beach, 2013). In Hong Kong, a government programme was introduced to try and encourage the replacement of older commercial vehicles, e.g. lorries, with modern, lower emission versions. The programme lasted from 2007 to 2008 and offered subsidies for the vehicle owners (Galbraith, Curry, & Loh, 2008). Since 2007, the German government has generally encouraged the acquisition of lower emission heavy duty vehicles meeting the EEV or Euro VI standard by offering direct financial subsidies, tax reductions and low-interest loans (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012). The UK previously provided support for operators of commercial vehicles to convert to run on liquid petroleum gas (LPG) or fit emission reduction technologies by obtaining grants from the Energy Saving Trust. Now that these technologies are more widely available, this assistance is no longer provided.
Effectiveness: no data available
References: (The Ports of Long Beach and Los Angeles, 2013) (Port of Long Beach, 2013) (Galbraith, Curry, & Loh, 2008) (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: Replace, repair, rebuild, repower
http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html San Pedro Bay Ports Clean Air Action Plan http://www.cleanairactionplan.org/

3.3.4 On-dock or near-dock rail

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: On-dock or near-dock rail
Description: Building and improving on-dock or near-dock rail facilities, in particular electrified rail, reduces the number of lorries necessary in the port area and the local and overall emissions of harmful gases because of the lower tonne-kilometre emissions of rail transport.
Examples of deployment: Railport Scandinavia has operated rail shuttles to and from the port of Gothenburg since 2002. These shuttles connect the port with 24 towns and cities throughout Sweden and Norway. At present, around half of all the containers that are transported to and from the port each year are handled by the rail shuttles. Work is in progress to also increase the number of trailers moved by rail (ESPO, 2012). 30 percent of all cargo (70 percent of long haul container cargo) is transported by rail to and from the port of Hamburg. The Hamburg Port Authority is planning to further increase the share of rail in the near future (Port of Hamburg, 2010). At the port of Felixstowe, 56 trains operate per day to 17 inland destinations. Future rail enhancements are planned to allow up to 40 freight trains per day to run in each direction by the year 2020, replacing 500,000 lorry movements per year. (Port of Felixstowe, 2013). The port of Shenzhen has started an initiative to promote rail transportation from the port on its dedicated rail-line (Galbraith, Curry, & Loh, 2008). Since 2010, the port of Portland has undertaken rail improvement projects that will provide benefits at several of their terminals. Off-site rail yard improvements aim to decrease congestion in the area and allow for more efficient assembly of unit trains servicing bulk commodity facilities located at the port (International Institute for Sustainable Seaports, 2010). The port of Vancouver also carried out a rail improvement project that provides benefits throughout their seaport facilities (International Institute for Sustainable Seaports, 2010).
Effectiveness: The rail shuttles at the port of Gothenburg replace more than 700 lorries per day and reduce the transport energy use by 70 percent, thus reducing CO_2 emissions by 50,000 tonnes per year (ESPO, 2012). The biggest train operator at the port of Hamburg, DB Schenker Rail, operates 625 trains per week to and from the port and in 2009 saved 500,000 tonnes of CO_2 emissions compared to using lorries (Port of Hamburg, 2010).
References: (ESPO, 2012) (Port of Hamburg, 2010) (Port of Felixstowe, 2013) (Galbraith, Curry, & Loh, 2008)

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: On-dock or near-dock rail
(International Institute for Sustainable Seaports, 2010) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html Port of Gothenburg http://www.portofgothenburg.com/About-the-port/Sustainable-port/

3.3.5 *Operational improvements*

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: Operational improvements
Description: This measure aims to encourage the more efficient use of vehicles. This can be implemented by offering additional incentives for efficient use or voluntary programmes. For trains, ports can consider an increased use of on-dock and near-dock rail, address rail bottlenecks in and around ports and consider using radio frequency identification (RFID) and optical character recognition (OCR) at rail yards, increasing the efficiency of how trains are stacked/queued or using longer trains for overall fuel efficiency. This can be achieved by setting operational agreements with relevant stakeholders.
Examples of deployment: The port of Felixstowe has introduced vehicle booking systems and has thereby reduced congestion around the port by reducing peak traffic and reducing the number of empty vehicle visits (Port of Felixstowe, 2012).
Effectiveness: no data available
References: (Port of Felixstowe, 2012) **Further reading:** International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html

3.3.6 *Idle-reduction technologies*

Air pollution mitigation options
Measures related to lorries, trains and construction equipment
Measure: Idle-reduction technologies
Description: This measure aims to reduce emissions from lorries and trains whilst their engines are idling. There are stationary technologies like shore power plug in, which provide power for stationary vehicles in certain areas, and mobile technologies like automatic start-stop systems and battery power. For trains, idle control technologies are available that allow the main engine to be shut down when not in use, and a smaller, more efficient diesel engine to operate instead.
Examples of deployment: In 2008, the port of Long Beach has subsidised the replacement of all Pacific Harbor Lines locomotives with cleaner units, which are equipped with idling controls (Port of Long Beach, 2013).
Effectiveness: no data available
References: (Port of Long Beach, 2013) **Further reading:** International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html

3.4 Management measures

3.4.1 Air quality monitoring

Air pollution mitigation options
Management measures
Measure: Air quality monitoring
Description: Air quality monitoring systems rely on monitoring stations in the port area, measuring the concentration of harmful gases in the air and meteorological conditions. Monitoring can either be used for reporting purposes to identify if there are any locations with concentrations above a given target and to recommend suitable management. Or, real-time monitoring can be employed whereby if predefined targets (thresholds) are exceeded, management measures are undertaken to reduce emissions temporarily, e.g. ceasing certain operations emitting the specific pollutant.
Examples of deployment: The port of Tallinn, Estonia operates an air quality monitoring system that is able to determine the most likely source locations of specific pollutants by modelling the dispersion under given meteorological conditions. Log files about the operations in the locations are then used to improve measures for future situations (ESPO, 2012). The port of Coruña operates an air quality monitoring system that also incorporates oceanographic data. The system is used to provide an automatic recommendation of operative procedures and to control the environmental effects of operations and services performed in the port (ESPO, 2012). The port of Long Beach operates two air monitoring stations to sample and report via their web site on air quality, including concentrations of key pollutants (Port of Long Beach, 2013). The port of Felixstowe monitors the NO_2 concentration for reporting purposes. Air quality monitoring systems are also used in the ports of Helsinki, Valencia and Turku, Finland (ESPO, 2012).
Effectiveness: no data available
References: (ESPO, 2012) (Port of Long Beach, 2013) **Further reading:** International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html Port of Long Beach http://www.polb.com European Sea Ports Organisation http://www.espo.be/index.php

3.4.2 *Gate procedure improvements*

Air pollution mitigation options
Management measures
Measure: Gate procedure improvements
Description: Gate opening hours can be extended on evenings, nights and weekends in order to ease congestion and reduce idling emissions during daytime hours. Alternatively, automated gate systems that recognise lorries (e.g. by the registration plate or tags) can be employed to allow them to pass automatically, to control the traffic flow and prevent congestion.
Examples of deployment: Many ports across the USA implement gate procedure related measures. The ports of Seattle and Tacoma, for example, increased the hours during which lorries have access and implemented an online reservation system to decrease waiting and idling times (Galbraith, Curry, & Loh, 2008). Furthermore, the port of Seattle uses RFID for lorries (Environmental Protection Agency (EPA), 2013). The ports of Los Angeles and Long Beach use electronic gates that identify approaching lorries via RFID tags since 2009. Both ports also extended their gate opening hours as part of their emissions reduction strategy (Port of Los Angeles , 2013). The Port Authority of New York and New Jersey tenants have installed automated gate equipment, relocated gates and extended gate hours to reduce delays and congestion (International Institute for Sustainable Seaports, 2010).
Effectiveness: no data available
References: (Galbraith, Curry, & Loh, 2008) (Environmental Protection Agency (EPA), 2013) (Port of Los Angeles , 2013) (International Institute for Sustainable Seaports, 2010) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html

3.4.3 *Container, freight and cargo management and handling*

Air pollution mitigation options
Management measures
Measure: Container, freight and cargo management and handling
Description: Container and freight management can be made more efficient by using the support of appropriate software systems. This can help reduce empty container movements, container dwell time and lorry wait times. When handling certain types of bulk cargo, measures can also be taken to prevent the release of particulate emissions (Environmental Protection Agency (EPA), 2013).
Examples of deployment: Examples of ports in the USA using specific software tools to improve their container and freight management as parts of emissions reduction programmes are the ports of Oakland, Los Angeles, Long Beach, New York, New Jersey and Virginia (Environmental Protection Agency (EPA), 2013). The port of Felixstowe uses innovative equipment scheduling and planning systems to reduce the amount of empty running and unproductive moves by port equipment (Port of Felixstowe, 2013). To reduce the effects of air pollution from cargo handling on people, the port of Valencia has restrictions in place that require discharging operations to stop if wind speeds exceed a certain value. In 2009, the port of Rauma, Finland installed a new unloading funnel and changed encasings of conveyor belt systems to reduce particulate emissions during unloading operations of bulk kaolin (ESPO, 2012). The port of Antwerp promotes specific technical and operational measures related to dry bulk handling in order to reduce dust emissions. These measures include, for example, leaving crane grabs as deep as possible before opening, to use semi-closed crane grabs, to use belt conveyors instead of bulldozers, to keep storage heaps wet and to put dusting goods into closed storage halls (van Espen, 2012).
Effectiveness: The innovative equipment scheduling and planning systems outlined above used at the port of Felixstowe resulted in reductions of fuel consumption of 18 percent (Port of Felixstowe, 2013).
References: (Environmental Protection Agency (EPA), 2013) (Port of Felixstowe, 2013) (van Espen, 2012) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html

3.4.4 *Idle-time restrictions*

Air pollution mitigation options
Management measures
Measure: Idle-time restrictions
Description: Ports can set restrictions on the maximum time, lorries are allowed to leave their engines idling in the port area. Anti-idling signs can explain these rules and help educate visiting lorry drivers and port employees. Port and terminal managers can enforce limits and provide alternatives to idling like driver waiting rooms and shore power for lorries (see also section 0).
Examples of deployment: The State of Massachusetts has a law that restricts idling to a maximum of five minutes and displays appropriate signs at its facilities (International Institute for Sustainable Seaports, 2010). The ports of Seattle and Tacoma also use signage in terminal areas to encourage lorry drivers to respect the rules (Environmental Protection Agency (EPA), 2013).
Effectiveness: no data available
References: (International Institute for Sustainable Seaports, 2010) (Environmental Protection Agency (EPA), 2013) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html

3.4.5 *Environmental management system*

Air pollution mitigation options
Management measures
Measure: Environmental management system
Description: An environmental management system is a comprehensive approach to identifying and managing all environmental aspects of an operation. The Plan-Do-Check-Act discipline built into an environmental management system can be set up to flag opportunities to make changes cost-effectively, such as upgrading equipment when due for service or replacement (Environmental Protection Agency (EPA), 2013).
Examples of deployment: Examples of ports with environmental management systems covering all or some of their facilities are: London, Seattle, Portland, Boston, Los Angeles, Vancouver, Houston, Beaumont/Port Arthur, Virginia, New York, New Jersey, Long Beach, Cleveland, Port of Everglades, Everett, Freeport, New Orleans, Baltimore, Jacksonville and Valencia (Environmental Protection Agency (EPA), 2013), (ESPO, 2012) (Port of London, 2013).
Effectiveness: no data available
References: (Environmental Protection Agency (EPA), 2013) (ESPO, 2012) (Port of London, 2013) **Further reading:** US Environmental Protection Agency (EPA) Port Technologies and Management Strategies http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html

3.4.6 *Operational improvements for vessels*

Air pollution mitigation options
Management measures
Measure: Operational improvements for vessels
Description: Possible operational improvements include: reconfiguration of existing terminals, deepening of channels and berths, improvement of inland access by rail and barge, installation of infrastructure to support electric-regenerative cranes, enhancement of on-dock and regional rail capabilities, speeding up vessel loading and unloading time or Virtual Arrival for vessels. The concept of Virtual Arrival uses weather analysis and algorithms to calculate and agree a notional vessel arrival time so that the ship will arrive at the port just in time. This allows the vessels to book a slot in advance and therefore reduces waiting time and emissions in proximity of the port.
Examples of deployment: The concept of Virtual Arrival was officially launched in 2011 by the Oil Companies International Marine Forum (OCIMF) and the International Association of Independent Tanker Owners (INTERTANKO). The scheme is carried out on a voluntary basis (OCIMF, Intertanko, 2010).
Effectiveness: no data available
References: (OCIMF, Intertanko, 2010) **Further reading:** International Association of Ports and Harbors (IAPH) Toolbox http://wpci.iaphworldports.org/iaphtoolbox/index.html

3.5 Broader measures

3.5.1 Incentives for stakeholders and support for future legislation

Air pollution mitigation options
Broader measures
Measure: Incentives for stakeholders and support for future legislation
Description: Some of the above mentioned measures like *Repair, rebuild, repower* are outside of the power of port authorities or local authorities. To implement these measures, the port would need to act by directly influencing different stakeholders. Ways to achieve this include: • Giving incentives to encourage desirable practices, e.g. modal shift from lorries to trains • Using environmental tariffs, e.g. reduced port charges if vessels fulfil certain requirements • Lobbying for desirable future legislation and supporting it, e.g. European emission standards
Examples of deployment: The Environmental Ship Index (ESI) identifies seagoing ships that perform better in reducing air emissions (NO_x, SO_x) than required by the current emission standards of the International Maritime Organisation (IMO). Based on the ESI, many ports worldwide give different financial incentives, e.g. discounted port charges. The following ports are examples of participants: Amsterdam, Rotterdam, Oslo, Hamburg, Bremen, Bremerhaven, Wilhelmshaven, Antwerp, Kiel, Civitavecchia, Zeebrugge, Le Havre, Los Angeles, Melbourne, New York and Vancouver. In the USA, the Diesel Emissions Reduction Act, for example, funded voluntary emissions reduction projects at ports and in the movement of freight. The programme was aimed at port authorities and terminal operators concerned about extra costs involved in retrofitting functioning engines (Galbraith, Curry, & Loh, 2008). The port of Rotterdam has operated environmentally differentiated port charges for inland barges since 2012. It offers, for example, a 15 percent discount for inland vessels meeting the Green Award[10] criteria and a 30 percent discount if the emissions are 60 percent below the CCR Phase II emission standards (Prinssen, 2012). The port of Turku provides a reduction in port charges if the sulphur content of the fuel used is below 0.5 percent or if the nitrogen content is below 10 g/kWh. Since 2012, the port of Hong Kong offers a 50 percent reduction in port facilities and lower charges for ocean going vessels that switch to 0.5 percent sulphur fuel when berthing (Hong Kong Environmental Protection Department, 2012). The port of Gothenburg reduced the tax on electricity for vessels at berth by 98 percent in 2011 in order to make use of shore-based power more financially interesting for shipping companies. Furthermore, it offers financial incentives for shipping lines to use low sulphur or alternative fuels like LNG (Port of Gothenburg, 2013).

[10] www.greenaward.org/467-english.html

Air pollution mitigation options
Broader measures
Measure: Incentives for stakeholders and support for future legislation
The port of Antwerp subsidises terminal operators with up to 400,000 Euro per call when acquiring more environmentally friendly cargo-handling equipment like forklifts, straddle carriers, mobile cranes, reach stackers and ro-ro-trackers (ESPO, 2012).
Effectiveness: no data available
References: (Galbraith, Curry, & Loh, 2008) (Prinssen, 2012) (Hong Kong Environmental Protection Department, 2012) (Port of Gothenburg, 2013) (ESPO, 2012) **Further reading:** Environmental Ship Index http://www.wpci-esi.org/Public/Home

3.5.2 *Road traffic improvements*

Air pollution mitigation options
Broader measures
Measure: Road traffic improvements
Description: Possible measures to reduce air pollution by improving road traffic on roads surrounding ports and at ro-ro-terminals depend heavily on the specific situation at each port. Examples of measures are road improvements, buffer zones, out of port car parks, dynamic speed limits and low emission zones.
Examples of deployment: In 2010, the Hamburg Port Authority introduced the Road Traffic Master Plan for the port of Hamburg in order to reduce traffic congestion. It includes numerous measures for roads inside and outside the port area, e.g. building new roads and bridges, extending the capacity of existing roads, improvements in signage and active traffic management measures. The traffic management includes guidance and control measures such as dynamic traffic information for drivers on signs and via a smartphone app, parking space management, pre-gate parking for lorries in case of disturbances inside the port area and targeted entry permission after disturbances have been resolved (Hamburg Port Authority, 2012) (Hamburg Port Authority, 2010). In its air quality action plan, Southampton City Council considers the creation of new access routes to the port of Southampton and the development of lorry staging areas (Southampton City Council, 2009). The port of Dover is currently redesigning the ferry terminal to ease traffic congestion and thus reduce emissions from vehicles approaching the ro-ro-terminals. The redesign incorporates a buffer zone for 220 freight vehicles and is due to be completed in 2013 (ESPO, 2012). Lorries approaching the port of Ghent are forced to follow a specific route that avoids residential centres. The measures to enforce this route include: installing traffic signs, adapting the signposts to the companies, fixing agreements with GPS operators and directional police controls. To further support enforcement, in 2010, digital gates were installed on the entrance roads to villages. The gates register the time every lorry enters and leaves the village and thereby determine if it had local business or was just passing through (ESPO, 2012). The port of Seattle offers free overnight parking for up to 120 drayage trucks in close proximity to the port (Port of Seattle, 2013).
Effectiveness: no data available
References: (Hamburg Port Authority, 2012) (Hamburg Port Authority, 2010) (Southampton City Council, 2009) (Port of Seattle, 2013) (ESPO, 2012)

3.5.3 *Public transport improvements*

Air pollution mitigation options
Broader measures
Measure: Public transport improvements
Description: The purpose of this measure is to reduce emissions generated by people travelling to and from the port (employees, visitors, etc.) by improving or extending the public transport systems available to reach the port.
Examples of deployment: Since 2004, the city of Hamburg has undertaken programmes to improve the public transport systems. The measures included: increasing the operation frequency, extending the network, building public park and ride car parks for all road users and equipping buses with DPF or hybrid propulsion systems. As a measure specifically related to the port of Hamburg, the city finished the construction of a subway line to and from the port in 2012 (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012).
Effectiveness: no data available
References: (Behoerde fuer Stadtentwicklung und Umwelt Hamburg, 2012)

3.5.4 Training and information

Air pollution mitigation options
Broader measures
Measure: Training and information
Description: Emissions and efficiency of equipment vary from operator to operator. Therefore, targeted training programmes for equipment operators and field personnel and general information campaigns to raise awareness for certain problems can reduce emissions.
Examples of deployment: The port of Dover has committed itself generally in its environmental policy to train staff in environmental issues and awareness and control of impacts (Port of Dover, 2013). Some ferry companies operating in the area of the port of London offer the captains of their vessels a high speed craft type rating training every two years which includes maximising fuel efficiency of operation (Transport for London, 2011). The port of Milford Haven offers ENVIROPASS training days for its workforce. These are formal environmental training and awareness raising sessions (Port of Milford Haven, 2013). The port of Antwerp will have all drivers of cargo handling equipment trained by external coaches (Ecodriving training). Furthermore, the port is planning information campaigns on slow steaming, eco-sailing, etc. (van Espen, 2012). Since 2011, the IMO requires large vessels to have a "Ship Energy Efficiency Management Plan", a document describing the best practices for fuel-efficient operation of a specific ship.
Effectiveness: no data available
References: (Port of Dover, 2013) (Transport for London, 2011) (Port of Milford Haven, 2013) (van Espen, 2012)

4 Discussion

Air pollution related to ports is a problem that is acknowledged and being addressed worldwide. This literature review has found that USA and Europe appear to be leading in the development and deployment of measures; however, other parts of the world are also starting to address the issues. Air pollution mitigation measures were identified as part of this research and categorised into 27 different individual measures.

Based on the data and information available, it was not possible to determine which measures could offer the greatest emission reductions. However, the most popular of the measures reviewed and some noteworthy innovations are highlighted below.

Providing shore-based power for ocean going and other vessels, thus allowing them to switch off their engines while at berth, was initially realised in 2000 and is today used at numerous ports in the USA and Europe, however at most ports is not available for all types of vessels due to technical limitations concerning voltage and plugs. The adoption of this measure has proven to greatly reduce all types of air-polluting emissions from vessels at berth. An innovation worth mentioning is the programme at the port of Hamburg that aims to supply vessels with power, generated by mobile LNG-powered generators installed on barges. It was reported that reductions in NO_X and PM emissions from vessels at berth reach up to 95 percent. With regard to the port of Felixstowe, the port authority considered that shore-based power was not feasible due to insufficient power on the grid and specific concerns regarding practicalities of implementation (Price & Turpin, 2012).

Vessel speed reduction was first introduced in 2001 by the San Pedro Bay ports in the USA and is now common at many US ports and also deployed or considered at some Asian ports. This measure has a large potential of reducing emissions of air pollutants from ships (e.g. estimated to reduce NO_x emissions by up to 55 percent and soot emissions by up to 70 percent) and therefore, depending on the meteorological situation, improving air quality in the port area and surroundings. The adoption of this measure can help to reduce all air pollutants, especially NO_x, PM, SO_x, and additionally CO_2. At the port of Felixstowe, current speed limits are governed by safety considerations and the port authorities of Felixstowe and Harwich Haven considered further speed reductions as not feasible (Price & Turpin, 2012).

The concept of Virtual Arrival for vessels is another measure that is related to the speed of the vessels (see Section 0, Management measures – Operational improvements for vessels). Virtual Arrival allows vessels to negotiate and reserve a specific arrival slot with the port in advance of arrival depending on actual weather conditions etc. This enables them to slow down and arrive just in time, instead of approaching the port at full speed and then having to wait. The reduced vessel speeds and waiting times lead to reductions in emissions of all air pollutants. This measure is not currently mobilised at the port of Felixstowe.

Using cleaner fuels for combustion engines is a measure that can be applied to all types of vessels, cargo handling equipment, lorries, locomotives and construction equipment. With regard to ocean going vessels, this topic is mostly covered by general international regulations and specific regulations for ECAs or SECAs like the North Sea, the Baltic Sea and the English Channel (since 2010) and the west and east coast of Canada and the USA (since 2012). However, some ports also apply individual rules, in the USA since 2009 and in Hong Kong since 2012. Using cleaner fuels for harbour craft and cargo handling equipment is common practice in many US and European ports and some Asian

ports. Many port authorities appear to consider LNG as an important fuel for the future and are undertaking programmes to bunker it at the port and use it in harbour craft. Some ports in Europe, Gothenburg and Rotterdam, also have an agenda to support and speed up the use of LNG as maritime fuel. The port of Felixstowe uses ultra-low sulphur diesel fuel in all its diesel engine driven equipment. The port authority is considering converting some of the port's internal movement vehicles from diesel fuel to LNG (Price & Turpin, 2012).

Replacing, repairing, rebuilding or repowering vehicles or retrofitting them with emission control technologies has the potential to reduce emissions of all types of air pollutants and is, in one form or another, carried out at ports worldwide. The level of emissions reduction depends heavily on the age and status of existing equipment. In general all types of air pollutants can be reduced, depending on the technology used, however, for diesel engines the main reductions can be achieved for NO_x and PM. Vehicle owners can be encouraged to apply these measures by subsidies from local governments or incentives like reduced port charges based on the ESI (see Section 3.5.1). The port of Felixstowe is considering measures to implement certain emission control technologies to its internal movement vehicles (Price & Turpin, 2012).

The measures can also be enforced, for example, by restricting the access to the port area to vehicles that meet certain emissions criteria (for example in the ports of Los Angeles and Long Beach). The port of Felixstowe has conducted an automatic number plate recognition survey to gather information on the type and age of vehicles in and around the port area. However, the port authority regards that implementing a minimum emissions standard (EURO V) for heavy duty vehicles transferring containers to and from the port would be difficult and is not likely to take this forward. The port authority is considering implementation of a polluter-pays policy in the long term (Price & Turpin, 2012).

Improvements in gate procedures for lorries approaching the port, like extended opening hours or automatic identification via RFID, can reduce vehicle queues and related emissions. Several US ports have adopted measures relating to their gate procedures. The effectiveness of these measures, however, depends heavily on the base situation at a given port and no evaluation data on actual emissions reductions could be acquired. The port of Felixstowe currently operates a vehicle booking system, which has successfully improved the management of vehicle arrivals.

Another measure that aims at reducing traffic queues are improvements in the road traffic system surrounding the port (see Section 0). This measure also has the potential to reduce local emissions in populated areas if traffic is guided around these areas, for example at the port of Ghent. Another aspect of this measure is offering parking space for lorries, e.g. overnight parking such as at the port of Seattle or parking outside the port area acting as a buffer for high traffic volume times like at the ports of Dover and Hamburg. The effectiveness and feasibility largely depends on the local situation. With regard to the port of Felixstowe, major infrastructure changes around the port were considered to be outside of the local authority's and the port authority's control and the cost to be prohibitive (Price & Turpin, 2012).

Incentives or tariffs based on environmental criteria are used by numerous ports worldwide to take influence in different areas. This broad measure is particularly interesting for ports because it offers them a way to encourage specific practices that are desirable in the local situation. The ESI, for example, is a system that rates vessels

according to environmental criteria and is applied at numerous ports worldwide, including the port of Hong Kong, for variable port charges. The port of Felixstowe is considering a polluter-pays policy for road freight and shipping, possibly including entry tariffs. This could be implemented in the longer term (Price & Turpin, 2012).

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6 Glossary of terms

Term	Description
AQMA	Air Quality Management Area
CAFE	Clean Air for Europe programme
CCV	Closed crankcase ventilation, an engine technology that provides a cleaner engine environment by capturing and returning oil in blow-by gasses to the tank. VOCs are sent to the intake system for re-combustion rather than sent out as exhaust.
CO	Carbon monoxide, a harmful gas
CO_2	Carbon dioxide, a greenhouse gas
CLEANSHIP	Clean Baltic Sea Shipping program
CNG	Compressed natural gas
CRT	Continuously regenerating trap, an exhaust gas after treatment system to reduce soot particles, hydrocarbon and carbon monoxide emissions
DOC	Diesel oxygen catalyst, an exhaust gas after treatment system that oxidises pollutants in the exhaust stream
DPF	Diesel particulate filter, a mesh or honeycomb device placed within the exhaust stream to trap and oxidise PM
ECA	Emission Control Area
EEV	Enhanced environmentally friendly vehicle, a European emissions standard for heavy duty vehicles that lies between the levels of Euro V and Euro VI
EGR	Exhaust gas recirculation, an engine technology that recirculates a portion of exhaust back into the engine to cool peak combustion temperatures and reduce NO_x
EPA	Environmental Protection Agency of the United States of America
ESI	Environmental Ship Index, an initiative of the WPCI to promote low emission ship technology
ESPO	European Sea Ports Organisation
EU	European Union
HC	Hydrocarbon, a harmful gas
IAPH	International Association of Ports and Harbors
ICCT	International Council on Clean Transportation
IMO	International Maritime Organisation
INTERTANKO	Association of Independent Tanker Owners
LNC	Lean NO_x catalyst

Term	Description
LNG	Liquefied natural gas
Lo-lo-terminal	Lift-on/lift-off-terminal for vessels that use a crane to load and unload cargo
LPG	Liquefied petroleum gas
NO_x	Nitrogen oxide, NO and NO_2, a harmful gas
OCIMF	Oil Companies International Marine Forum
OCR	Optical character recognition
PM	Particulate matter, PM_{10}, $PM_{2.5}$ and black carbon, a mixture of solid particles and liquid droplets
Ro-ro-terminal	Roll-on/roll-off-terminal for ships designed to carry wheeled cargo such as automobiles, trucks or trailers that are driven on and off the ship on their own wheels
RFID	Radio frequency identification
RTG	Rubber-tyred gantry crane
SCR	Selective catalytic reduction, an exhaust gas after treatment system that injects urea or other form of ammonia into the exhaust stream to react this mixture over a catalyst, reducing NO_x emissions
SCRT	Selective catalytic reduction and trap, a combined exhaust gas after treatment system of SCR and CRT technology
SECA	Sulphur Emission Control Area
SO_X	Sulphur oxide, SO_2, SO_3 and SO_4, a harmful gas
ULSD	Ultra-low sulphur diesel
UN	United Nations
VOC	Volatile organic compounds
WPCI	World Ports Climate Initiative

Appendix A Information resources

In addition to the resources mentioned in the section *References*, the following web sites provide further information:

- British Ports Association
  http://www.britishports.org.uk/
- California Air Resources Board
  http://www.arb.ca.gov/homepage.htm
- Clean Air in London
  http://cleanairinlondon.org/sources/reducing-sulphur-emissions-from-shipping/
- Clean Baltic Sea Shipping
  http://www.clean-baltic-sea-shipping.com/
- Environmental Ship Index
  http://www.wpci-esi.org/Public/Home
- European Sea Ports Organisation
  http://www.espo.be/index.php
- German Nature and Biodiversity Conservation Unit (NABU)
  http://www.nabu.de/themen/verkehr/schifffahrt/saubereluft/index.html
- Greenaward
  http://www.greenaward.org/467-english.html
- Greenport
  http://www.greenport.com/
- International Association of Ports and Harbors (IAPH) Toolbox
  http://wpci.iaphworldports.org/iaphtoolbox/index.html
- Natural Resources Defense Council
  http://www.nrdc.org/air/pollution/ports/execsum.asp
- Port.com Seaport Info
  http://ports.com/
- Port of Antwerp
  http://www.portofantwerp.com/en/sustainability
- Ports of Bremen and Bremerhaven
  http://www.bremenports.de/en/greenports/daring-to-go-green
- Port of Dover
  http://www.doverport.co.uk/?page=PortEnvironment
- Port of Felixstowe
  http://www.portoffelixstowe.co.uk/portdevelopment/FSR/environment.aspx
- Port of Gothenburg
  http://www.portofgothenburg.com/About-the-port/Sustainable-port/
- Port of Hamburg
  http://www.hamburg.de/luftreinhaltung
- Port of London
  http://www.pla.co.uk/display_dynamic.cfm/id/4/site/environment

- Port of Long Beach
  http://www.polb.com
- Port of Los Angeles
  http://www.portoflosangeles.org
- Port of Milford Haven
  http://www.mhpa.co.uk/environmental/
- Port of Oakland
  http://www.portofoakland.com/environm/prog_04a.asp
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  http://www.southamptonvts.co.uk/
- Portstrategy
  http://www.portstrategy.com/
- Port Technology International
  http://www.porttechnology.org/
- San Pedro Bay Ports Clean Air Action Plan
  http://www.cleanairactionplan.org/
- The International Council on Clean Transportation
  http://theicct.org/marine
- United Kingdom Major Ports Group Limited (UKMPG)
  http://www.ukmajorports.org.uk/pages/home
- US Environmental Protection Agency (EPA) Ports & Marine
  http://www.epa.gov/cleandiesel/sector-programs/ports-overview.htm
- US Environmental Protection Agency (EPA) Port Technologies and Management Strategies
  http://www.epa.gov/region1/eco/diesel/port-techs-mgmt-strategies.html
- World Ports Climate Initiative
  http://ops.wpci.nl/
- World Ports Climate Initiative Onshore Power Supply
  http://www.onshorepowersupply.org/

Appendix K:

Port of Felixstowe response to the ‘Air Pollution Mitigation Options for Ports’ literature review.

Email received 11/09/13 with the below comments and table.

Regarding air quality in general, the trends we are seeing are significant and sustained improvement primarily through action implemented by the Port of Felixstowe.

We are planning to continue to implement measures which will continue to reduce the port's emissions. The below summary of the literature review of mitigation options includes a weighting factor derived from the source apportionment contribution to oxides of nitrogen (NOX) concentration at the Dooley Inn from the Local Air Quality Management Action Plan report by TRL for SCDC. This should help to focus resource towards areas most likely to have an impact on air quality at the monitoring site.

From this weighting factor it can been seen that container handling is the largest contributing factor, however this still only represents around 1/3 of the total contributing sources. This area has seen the greatest investment and subsequent improvement in NO_2 emissions. Going forward the continued planned investments will see further improvements, but it should be noted that these will likely have a diminishing impact in terms of improvements at the AQMA site.

This source apportionment suggests that shipping contributes less than 10% to the NO_2 concentrations at the Dooley Inn. Again this is likely to have reduced with improvements in engine technologies and efficiencies. The opportunities for the port to influence this area are limited, and with such a low contributing factor any investment is likely to give a low return, e.g. the cost to supply vessels with shore power would be disproportionate to the environmental benefit.

The next largest contributor is external road (HDV) at 28.5%. Besides the contributions made to date by the port (i.e. modal shift to rail), and the management of traffic implemented through the ports Vehicle Booking System and subsequent traffic flow improvements, it is unclear what other measures are being made to tackle this area via the contribution of other actors.

In summary, the Port of Felixstowe's environmental management is significantly improving air quality in an area where there is low risk to public health from air quality and "*The Dooley Inn public house was the only relevant receptor where an exceedence of the annual mean NO_2 objective was predicted or measured*" (Transport Research Laboratory 2012). Many of the measures in the literature review are very high cost and are in the early stages of use, or proposed for ports within major urban conurbations with significant air quality issues, unlike Felixstowe. Any proposals should be proportionate to the environmental and/or public health risk and possible benefit here at Felixstowe.

We look forward to discussing the way forward.

Section Ref		Mitigation Measure	Description	Port of Felixstowe comment	Contributing factor to the AQMA at the Dooley Inn
3.1 Measures related to ocean going vessels and harbour craft	3.1.1	Shore-based power	Provides vessels of all types with land-based power, allowing them to operate auxiliary systems at dock while their engines are turned off.	It is unlikely that there is sufficient infrastructure within the electricity network to meet the potential demand. Svitzer tugs plug in to shore-based power supply whenever possible. They have power leads from the tug pontoon on Landguard and reduce all on-board power systems to a minimum. The demand on the grid would be high, especially for a vessel with a large number of reefers on board.	0.094
	3.1.2	Hybridisation of harbour craft	Diesel-electric hybrid harbour craft, e.g. tugboats, exclusively use electric motors in low load situations, cutting local emissions to zero during these periods.	This is an area which the tug operators could comment. Requires consistency across all UK/EU waters.	
	3.1.3	Vessel speed reduction	Slowing down ocean going vessels when they are in the vicinity of ports will reduce emissions close to populated areas.	Current speeds in the Harbour are slow and safety will be the predominant factor is vessel speed.	
	3.1.4	Clean fuels	Switching to cleaner fuels than the conventional diesel can reduce emissions of air pollutants. Ports can for example require the use of lower sulphur distillate fuels within their coastal waters. Possible alternative fuels are: biodiesel, low sulphur diesel, ultra-low sulphur diesel, emulsified diesel and LNG.	Agree with comments re "methane slip" also increased use of bio-diesel can increase NOx emissions. Also there are currently issue with the supply and quality of bio-diesel content. Bio-diesel can lead to increased Micro-Biological Contamination issues, resulting in fuel blockages and consequent engine failures and safety of navigation issues. LNG has very little take-up so far with shipping companies. Provision of LNG bunker barges is possible, but not in the short term. Public perception and safety issues would need to be addressed.	

	3.1.5	Automated mooring system	A measure to eliminate the need of the crew to tie up the boat for example by using vacuum pads holding the ship reducing the mooring time and leads to a speed reduction of ships approaching the port, resulting in fuel savings and emissions reductions	Not feasible for container berths as they reduce the flexibility of berth allocation and due to the varying designs and hull condition of visiting vessels would not be suitable for all vessels. Large amount of energy required to create vacuum. Will not in itself reduce ships speed.	
	3.1.6	Replace, repair, rebuild, repower	Vessels and in particular harbour craft can be replaced with modern equipment with new engines having lower emissions. Also repairing and properly maintaining the engines of vessels can reduce fuel consumption and overall emissions. To repower a vessel means to exchange the engine with a more efficient one	This is an area which the tug operators could comment.	
	3.1.7	Emission control technologies	Includes exhaust gas treatment systems that can be retrofitted to vessels, e.g diesel oxygen catalyst (DOC), selective catalytic reduction (SCR), selective catalytic reduction and trap (SCRT), exhaust gas recirculation (EGR) and volatile organic compounds (VOC) recovery system, and scrubber systems.	This is a measure for vessel operators; however scrubbers are expensive, use energy and create hazardous waste.	
3.2 Measures related to cargo handling equipment	3.2.1	Electrification and hybridisation	Hybrid diesel-electric or purely electric vehicles, RTGs, forklifts, straddle carriers and reach stackers	Over 50% of the RTG fleet now has some form of energy saving engine management system. Of a fleet of nearly 90RTGsThe Port now has 22 ecoRTGs, which use up to 40% less fuel and has retrofitted around 25 RTGs with a fuel saving system (improving performance by around 25%). Trials of the first four electric RTGs will take place in Q4 2013.	0.369*

	3.2.2	Clean fuels	Cargo handling equipment in the port can be run on cleaner fuels with low sulphur content in order to reduce emissions of harmful gases. Possible alternative fuels are: biodiesel, low sulphur diesel, ultra-low sulphur diesel (ULSD), emulsified diesel, LNG and compressed natural gas (CNG).	All port plant and vehicles use (ULSD), some forklifts use LPG. A trial of Hydrogen Forklift Trucks has been suspended by the project leads in Europe.	
	3.2.3	Emissions control technologies	Selective catalytic reduction (SCR), diesel particulate filter (DPF), closed crankcase ventilation (CCV), exhaust gas recirculation (EGR) and diesel oxidation catalyst (DOC)	AdBlue and SCR is beginning to be implemented and from 2014 all Internal Movement Vehicles purchased will be fitted with these systems.	
	3.2.4	Replace, repair, rebuild, repower	Replacing engines, repairing and properly maintaining the engines can reduce fuel consumption and overall emissions. To rebuild an engine means to disassemble, clean and adjust it and replace certain components with more modern ones. To repower a vehicle means to exchange the engine with a more efficient one, thus reducing emissions	The port employs over 200 engineers and has OEMs permanently on site. Equipment is serviced regularly to ensure plant is maintained to its optimum efficiency.	
3.3 Measures related to lorries, trains and construction equipment	3.3.1	Clean fuels	Lorries and trains can be run on different fuels in order to reduce emissions of harmful gases. These can be ultra-low sulphur diesel (ULSD) fuel, emulsified diesel fuels, oxygenated fuel (O2 diesel fuel) and biodiesel. Additional clean fuel options for lorries include LNG and CNG.	Most vehicles accessing the port use ULSD. Some logistics firms are now using LNG/CNG.	0.296**
	3.3.2	Emission control technologies	Exhaust gas treatment systems that can be retrofitted to lorries and locomotives. These systems are DOC, SCR, LNC, EGR and CCV. Port authorities can consider only allowing lorries on their area that meet certain standards, for example being equipped with particulate filters and SCR or meeting EURO V requirements.	This is a matter for the equipment operators. However, the port does intervene in cases of excessive emissions.	

	3.3.3	Replace, repair, rebuild, repower	Lorries, construction equipment and locomotives can be replaced with modern equipment with new engines having lower emissions. With respect to locomotives, a replacement of diesel powered locomotives with electric locomotives can be considered (i.e. if electrified rail can be mobilised).	This is a matter for the equipment operators. However, the port does intervene in cases of excessive emissions.	
	3.3.4	On-dock or near-dock rail	Building and improving on-dock or near-dock rail facilities, in particular electrified rail, reduces the number of lorries necessary in the port area and the local and overall emissions of harmful gases because of the lower tonne-kilometre emissions of rail transport.	All rail terminals at The Port of Felixstowe are with the operational areas of the port. The rail terminals are fully incorporated within the port operation.	
	3.3.5	Operational improvements	Encourages more efficient use of vehicles. This can be implemented by offering additional incentives for efficient use or voluntary programmes. For trains, ports can consider an increased use of on-dock and near-dock rail, address rail bottlenecks in and around ports and consider using radio frequency identification (RFID) and optical character recognition (OCR) at rail yards, increasing the efficiency of how trains are stacked/queued or using longer trains for overall fuel efficiency. This can be achieved by setting operational agreements with relevant stakeholders.	Implemented at Felixstowe with the Vehicle Booking System. This system has significantly reduced waiting times and queuing of vehicles in and around the port. There are also fewer empty vehicle movements and peak traffic has reduced with a change in the frequency distribution of vehicle throughput.	
	3.3.6	Idle-reduction technologies	Reduces emissions from lorries and trains whilst their engines are idling. There are stationary technologies like shore power plug in, which provide power for stationary vehicles in certain areas, and mobile technologies like automatic start-stop systems and battery power.	Hauliers do not as a rule leave vehicles idling. There are signs at the entrances to the port requesting engines to switch off while booking in.	

3.4 Management measures	3.4.1	Air quality monitoring	Monitoring stations in the port area, measuring the concentration of harmful gases in the air and meteorological conditions. Monitoring can either be used for reporting purposes or, real-time monitoring, whereby if predefined thresholds are exceeded, management measures are taken to reduce emissions temporarily, e.g. ceasing certain operations emitting the specific pollutant.	The port has monitored Nitrogen Dioxide around the port	0.369*
	3.4.2	Gate procedure improvements	Gate opening hours can be extended on evenings, nights and weekends in order to ease congestion and reduce idling emissions during daytime hours. Alternatively, automated gate systems that recognise lorries (e.g. by the registration plate or tags) can be employed to allow them to pass automatically, to control the traffic flow and prevent congestion.	The gates at Felixstowe are open 24hrs a day. Since the implementation of the new Vehicle Booking System the number of vehicles at peak hours has decreased and evening throughput has increased.	
	3.4.3	Container, freight and cargo management and handling	Container and freight management can be made more efficient with software systems. Helping to reduce empty container movements, container dwell time and lorry wait times. When handling certain types of bulk cargo, measures can also be taken to prevent the release of particulate emissions	The efficient movement of containers through the port is fundamental in the operation of the business. This continually being monitored and improved where possible. There are no bulk cargoes handled at Felixstowe which may emit particulates.	

	3.4.4	Idle-time restrictions	Ports set restrictions on the maximum time, lorries can leave engines idling in the port. Anti-idling signs explain the rules and help educate lorry drivers and port employees. Port and terminal managers can enforce limits and provide alternatives to idling like driver waiting rooms and shore power for lorries	Hauliers do not as a rule leave vehicles idling. There are signs at the entrances to the port requesting engines to switch off while booking in. Port internal movement vehicles and RTGs have timers fitted to reduce engine idling.	
	3.4.5	Environmental management system	An environmental management system is a comprehensive approach to identifying and managing all environmental aspects of an operation. The Plan-Do-Check-Act discipline built into an environmental management system can be set up to flag opportunities to make changes cost-effectively, such as upgrading equipment when due for service or replacement	An EMS has been in place for a number of years and has been certified to ISO 14001 since . In addition, the port has implemented and energy management plan in accordance with ISO 500001 to focus specifically on energy.	
	3.4.6	Operational improvements for vessels	Reconfiguration of existing terminals, deepening of channels and berths, improvement of inland access by rail and barge, installation of infrastructure to support electric-regenerative cranes, enhancement of on-dock and regional rail capabilities, speeding up vessel loading and unloading time or Virtual Arrival for vessels.	The terminals are where ever possible configured to maximise the fficiency of the operation. The port facilitates short sea shipping to	

3.5 Broader measures	3.5.1	Incentives for stakeholders and support for future legislation	Some of the above mentioned measures like Repair, rebuild, repower are outside of the power of port authorities or local authorities. To implement these measures, the port would need to act by directly influencing different stakeholders. Ways to achieve this include: Giving incentives to encourage desirable practices, e.g. modal shift from lorries to trains, Using environmental tariffs, e.g. reduced port charges if vessels fulfil certain requirements, Lobbying for desirable future legislation and supporting it, e.g. European emission standards.	The port facilitates short sea shipping around the coast of Britain and Ireland. There has been a significant increase in the utilisation of rail for container movement. Around 27% of all containers now leave by rail. There are 58 daily arrives or departures to locations throughout Britain.	0.129***
	3.5.2	Road traffic improvements	Possible measures to reduce air pollution by improving road traffic on roads surrounding ports and at ro-ro-terminals depend heavily on the specific situation at each port. Examples of measures are road improvements, buffer zones, out of port car parks, dynamic speed limits and low emission zones.	The port has funded major improvements to the A14/A12 to improve traffic flow. The ports Travel Plan has reduced it's Single Occupancy vehciles from 82% to 68% exceeding the target set by SCC of 75%	
	3.5.3	Public transport improvements	The purpose of this measure is to reduce emissions generated by people travelling to and from the port (employees, visitors, etc.) by improving or extending the public transport systems available to reach the port.	The Port of Felixstowe Travel Plan has Investigated the patronage of bus services with the view to introduce a sustainable serivce. It has been agreed in the Travel Plan steering group that without substantial funding each year, the service would be unsustainable .	
	3.5.4	Training and information	Emissions and efficiency of equipment vary from operator to operator. Therefore, targeted training programmes for equipment operators and field personnel and general information campaigns to raise awareness for certain problems can reduce emissions.		

Key:		*	This is the total contributing factor for container handling.		
		**	This is the combined contributing factor for external road (HDV) and Rail.		
		***	Local background contribution		

Glossary of Terms and Abbreviations

A

Air Quality Action Plan (AQAP) or Action Plan	Plan required by the Government to be drawn up for an Air Quality Management Area (AQMA) to provide information on what action will be taken to try and reduce pollutant levels to within the set objectives.
Air Quality Action Plan (AQAP) Progress Report	Once an Action Plan has been developed for an Air Quality Management Area (AQMA) the Government require that an annual report be produced to provide an update on progress.
Air Quality Management Area (AQMA)	Each local authority in the UK is required to undertake a review and assessment of air quality in their area. This involves measuring air pollution and trying to predict how it will change in the next few years. The aim of the review is to make sure that the national air quality objectives will be achieved throughout the UK by the relevant deadlines. These objectives have been put in place to protect people's health and the environment. If a local authority finds any places where the objectives are not likely to be achieved, it must declare an Air Quality Management Area there.
Air Quality Management Area (AQMA) Order	Air Quality Management Area Order – the official order which is made declaring an AQMA.
Air Quality Objectives	Policy targets generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences, within a specified timescale. The Objectives are set out in the UK Government's Air Quality Strategy for the key air pollutants.
Air Quality Standards	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The Standards are based on assessment of the effects of each pollutant on human health, including the effects on sensitive sub-groups.
Air Quality Strategy	The Air Quality Strategy for England, Scotland, Wales and Northern Ireland describes the plans drawn up by the Government and the Devolved Administrations to improve and protect ambient air quality in the UK in the medium-term. The Strategy sets Objectives for the main air pollutants to protect health. Performance against these Objectives is monitored where people regularly spend time and might be exposed to air pollution.
Analytical laboratory	Laboratory used to analyse air pollution samples collected.
Annualised mean	Calculation of an annual mean concentration using a period of less than a year to produce a calculation for the whole year.

Annual mean concentration	The average concentration of a pollutant measured over one year.
Automatic analyser	Equipment used to undertake accurate and reliable detailed monitoring of an air pollutant. Equipment records air pollution levels continuously and produces real-time measurements of pollutant concentrations.
B	
Bias	The overall tendency of (diffusion tube) readings to depart from the true value, i.e to over or under read when compared to the reference method (automatic analyser)
Bias adjustment/correction factor	Diffusion tubes used to monitor air pollutants (mainly nitrogen dioxide) are affected by several sources of interference which can cause substantial under or overestimation (often referred to as "bias") compared to an automatic analyser. This is a problem where diffusion tube results are to be compared with air quality objectives. As a result, local authorities using diffusion tubes are required to quantify the "bias" of their diffusion tube measurements and apply an appropriate bias adjustment factor to the annual mean if required.
Biomass combustion	Biomass is a renewable energy source - biological material from living, or recently living organisms, such as wood, waste, (hydrogen) gas, and alcohol fuels. Biomass is commonly plant matter grown to generate electricity or produce heat, usually by direct incineration. Biomass combustion is therefore a means of converting biomass to usable energy (both heat and electricity) by burning.
C	
Co-location study	Study in which the accuracy of diffusion tubes is quantified by exposure alongside an automatic analyser, and the results used to calculate a bias adjustment factor.
D	
Data Capture	Term given to the percentage of measurements for a given period that were validly measured.
Defra	Department for the Environment, Food and Rural Affairs – government body who deal with air quality matters.
Detailed Assessment	Where an Updating and Screening Assessment identifies a risk that an air quality objective may be exceeded at a location then a Detailed Assessment of the site is required. The aim of a Detailed Assessment is to identify with reasonable certainty whether or not an exceedance will occur.
Diffusion tube	Low-cost method for indicative monitoring of ambient air pollutant concentrations, mainly used for measuring nitrogen dioxide. Collect pollutants by molecular diffusion along an inert tube to an efficient chemical absorbent. After exposure

	for a known time, the absorbent material is chemically analysed and the concentration calculated.

E

Environment Act 1995 Part IV	The Parliamentary Act which sets out the requirements for Local Air Quality Management.
Environmental Impact Assessment	An assessment of the possible positive or negative impact that a proposed project may have on the environment, consisting of the natural, social and economic aspects. The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts when deciding whether to proceed with a project.
Environmental Permitting Regulations 2010	Regulations under which certain types of industry are required to have a permit to operate The industrial premises must show compliance with their permit conditions. Includes discharge consenting, groundwater authorisations and radioactive substances regulation.

F

Further Assessment	Where an Air Quality Management Area (AQMA) has been declared, a Further Assessment must be submitted to Defra within 12 months. This will supplement the information provided in the Detailed Assessment, confirm the objective exceedance, define what improvement in air quality and reduction in emissions is required to meet the objectives, and provide information on source contributions.

H

Haven Gateway	Area incorporating the five Haven ports of Felixstowe, Harwich International, Harwich Navyard, Ipswich and Mistley.
HDV – Heavy Duty Vehicle	A motor vehicle rated at more than 3,856 kg - includes trucks/lorries, buses and coaches.
HGV – Heavy Goods Vehicle	Goods motor vehicles (i.e. trucks / lorries) capable of carrying heavy loads over 3.5 tonnes maximum permissible gross vehicle weight and requiring a special license to drive.
Hourly mean concentration (1-hour mean)	The average over a one hour period of an air pollutant concentration.

I

IMVs	Internal Movement Vehicles, used on the Port of Felixstowe to move containers on the site.

L

Laboratory bias

There is considerable difference in the performance of diffusion tubes prepared by different laboratories, such that they may systematically over or under read when compared with an automatic analyser. The laboratory bias is the figure derived in order to correct the over/under read to the reference method – the automatic analyser results.

Local Air Quality Management (LAQM)

Each local authority in the UK is required to carry out a regular review and assessment of air quality in their area. This involves measuring air pollution and trying to predict how it will change in the next few years. The aim of the review is to make sure that national air quality objectives will be achieved throughout the UK by the relevant deadlines. These objectives have been put in place to protect people's health and the environment.

LAQM.PG(09)

Local Air Quality Management Policy Guidance February 2009. Policy guidance issued by Defra to assist local authorities when carrying out review and assessment of air quality within their district.

LAQM.TG (09)

Local Air Quality Management Technical Guidance February 2009. Technical guidance issued by Defra to assist local authorities in reviewing and assessing air quality on their district.

LDV – Light Duty Vehicle

A motor vehicle up to and including 3.5 tonnes Gross Vehicle Weight

LGV – Light Goods Vehicle

Goods vehicles, mainly vans (including car derived vans), not over 3.5 tonnes maximum permissible gross vehicle weight.

M

mg/m^3

Milligrams per cubic metre – unit for measurement of an air pollutant concentration. A measure of concentration in terms of mass per unit volume. A concentration of $1mg/m^3$ means that one cubic metre of air contains one milligram of pollutant.

$\mu g/m^3$

Micrograms per cubic metre – unit for measurement of an air pollutant concentration. A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g/m^3$ means that one cubic metre of air contains one microgram of pollutant.

N

NO_2

Nitrogen Dioxide - a gas produced by the reaction of nitrogen and oxygen in combustion processes in air. Nitrogen Oxide (NO) is formed initially and this is subsequently oxidised to form NO_2.

NOx	Oxides of nitrogen – NOx is a generic term for the nitrogen oxides NO and NO_2 (nitric oxide and nitrogen dioxide). They are produced from the reaction of nitrogen and oxygen gases in the air during combustion, especially at high temperatures.
O	
OS Grid Ref – Ordanance Survey Grid Reference	The British Grid Reference System which can be used to accurately pinpoint any location in Great Britain and it's outlying islands through the use of a unique Ordnance Survey map reference – a Grid Reference.
Outline Planning Application	An outline of the plans and other information that developers send to the local authority for decision on whether or not to grant planning permission. If outline planning permission is granted the developers are required to provide more information later, in advance of each works, to make sure that they are acceptable.
P	
Percentile	A value below which that percentage of data will either fall or equal. For instance the 98th percentile of values for a year is the value below which 98% of all the data in the year will fall or equal.
Progress Report	A report intended to maintain the continuity of the Local Air Quality Management process and fill in the gaps between the 3 yearly cycle of the review and assessment process. Required in all years when an Updating and Screening Assessment is not undertaken.
PM_{10}	Particulate Matter with a diameter of less than 10 microns – air pollutant of concern
Q	
QA:QC – Quality Assurance : Quality Control	Relates to the collection of air quality monitoring data - the systematic monitoring and evaluation of the various aspects to maximize the probability that the data collected is of good quality.
R	
Relevant exposure	Review and assessment of air quality must focus on locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the specific objective, this is termed relevant exposure.
RTGs	Rubber Tyred Gantry Cranes – specialised equipment for yard handling of containers.

Review and Assessment process	Procedure put in place by Defra to ensure that all local authorities review and assess air quality within their district on a regular basis and take action for any location where the air quality objectives are exceeded.
Running mean	This is a mean - or series of means - calculated for overlapping time periods, and is used in the calculation of several of the National Air Quality Standards. For example, an 8-hour running mean is calculated every hour, and averages the values for eight hours. There are, therefore, 24 possible 8-hour running means in a day (calculated from hourly data)
S	
SCC	Suffolk County Council
SCDC	Suffolk Coastal District Council
Section 106 planning agreements	Section 106 of the *Town and Country Planning Act 1990* (as amended) allows local planning authorities to negotiate arrangements whereby the developer makes some commitment if he obtains planning permission.
SO_2	Sulphur dioxide – air pollutant of concern.
Source apportionment	This exercise is undertaken if a Further Assessment is required for a site. All potential emission sources for the pollutant and site of concern are identified and investigations undertaken to determine how much of the problem is attributed to each emission source.
U	
USA – Updating and Screening Assessment	The first step of the review and assessment process which must be undertaken by all local authorities every 3 years. Based on a checklist to identify those matters which have changed since the previous round of review and assessment was completed.
W	
Worst case exposure	Location where air pollution from a specific source will be the highest.
15-minute mean	The average over a 15 minute period of an air pollutant concentration.
24-hour mean	The average over a 24 hour period of an air pollutant concentration.