



2012 Air Quality Updating and Screening Assessment for South Lanarkshire Council

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

January 2013

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Executive Summary

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 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.

A review of new monitoring data has identified the following:

- Annual mean NO₂ concentrations in excess of the 40 µg.m⁻³ objective were measured at Whirlies Roundabout, East Kilbride and at Raith Interchange. Neither of these monitoring locations represents relevant exposure. Distance correction calculations predicted concentrations below the objective at the nearest residential properties, therefore no further action is required at this time.
- Annual mean NO₂ concentrations in excess of the 40 µg.m⁻³ objective were measured at the diffusion tube located at the Kingsway, East Kilbride- but this is located at some distance from nearby properties. Based on uncertainty associated with the distance correction method; and another diffusion tube which is located closer to the nearby residential properties reporting a relatively low annual mean NO₂ concentration of 17 µg.m⁻³; the recommendation is to continue monitoring at this location to continue to observe trends in NO₂ concentrations. This will allow SLC to assess whether there is a risk of the annual mean objective being exceeded at the nearby residences. It is unlikely that there are exceedances of the objective at the properties given the nearby measurements.
- At Brandon Street, Hamilton the NO₂ annual mean measured during 2011 was 43 µg.m⁻³. A distance correction calculation predicted an NO₂ annual mean of 40.6 µg.m⁻³ at the nearest location of relevant exposure. A Detailed Assessment of NO₂ will be conducted during spring 2013 at this location in Hamilton when sufficient automatic monitoring data will be available to inform the study.
- Annual mean PM₁₀ concentrations in excess of the objective were measured during 2011 in Rutherglen. South Lanarkshire Council is currently in the process of declaring an AQMA for PM₁₀ at this location; therefore no further action is required.
- No other actions are required.

The assessment of new sources has not identified any sources that require additional assessment at this time.

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1 Introduction

1.1 Description of Local Authority Area

South Lanarkshire is a diverse area containing both densely populated industrial towns and large expanses of rural landscapes. It stretches from the Glasgow suburbs south to the open moorlands of the Leadhills via the Clyde Valley. The South Lanarkshire district shares its borders with a number of authorities from Dumfries and Galloway and Scottish Borders in the south, to East Ayrshire, East Renfrewshire, City of Glasgow, North Lanarkshire and West Lothian to its North, East and West boundaries.

The Council District can be described in four distinct areas:

- Cambuslang and Rutherglen area;
- Clydesdale.
- East Kilbride area; and
- Hamilton area;

The Cambuslang and Rutherglen areas are situated at the north-western tip of South Lanarkshire, bordering Glasgow City. The towns are commonly considered part of greater-Glasgow which is made up of a mix of both densely populated area suburbs and areas of large scale former industrial land use. The Hamilton area includes Blantyre, Bothwell, Larkhall and Stonehouse as well as the county town of Hamilton and many surrounding villages.

The East Kilbride area takes in the new town of East Kilbride and its surrounding villages as well as the small town of Strathaven. East Kilbride is a large new-town with high-technology industrial and extensive commercial activity, whilst Strathaven and the surrounding area is largely rural and agricultural.

The Clydesdale area forms the largest region in South Lanarkshire, and incorporates the southern and eastern areas of the district. The areas are largely rural and agricultural, dotted with several market towns, including Carluke, Lanark, Lesmahagow and Biggar as well as numerous villages.

There are a number of industrial sites located within South Lanarkshire, however most manufacture higher technology products and do not generate significant emissions to the air. The South Lanarkshire Council area is well served by an extensive road and rail network, including the M74 motorway, passing north to south through the council area.

1.2 Purpose of 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 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.

The objective of this Updating and Screening Assessment is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need

for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre, $\mu\text{g.m}^{-3}$ (milligrammes per cubic metre, mg.m^{-3} for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

Table 1.1: Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Scotland

Pollutant	Concentration	Measured as	Date to be achieved by
Benzene	16.25 $\mu\text{g.m}^{-3}$	Running annual mean	31.12.2003
	3.25 $\mu\text{g.m}^{-3}$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g.m}^{-3}$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg.m^{-3}	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g.m}^{-3}$	Annual mean	31.12.2004
	0.25 $\mu\text{g.m}^{-3}$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g.m}^{-3}$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g.m}^{-3}$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu\text{g.m}^{-3}$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	50 $\mu\text{g.m}^{-3}$, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	40 $\mu\text{g.m}^{-3}$	Annual mean	31.12.2004
	18 $\mu\text{g.m}^{-3}$	Annual mean	31.12.2010
Sulphur dioxide	350 $\mu\text{g.m}^{-3}$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g.m}^{-3}$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g.m}^{-3}$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

Since the commencement of the second round of the review and assessment process, South Lanarkshire Council has completed a number of LAQM Review and Assessment reports. A brief summary of all previous reviews and assessments of local air quality in South Lanarkshire are presented in Table 1.1 and described further in the following texts.

Table 1.1: Summary of previous reviews and assessments

Review/Assessment	Year	Outcome
Updating and screening assessment	2003	AQS objectives were likely to be met for all pollutants except for particulate matter (PM ₁₀). Potential exceedances of the 2010 PM ₁₀ objective were identified at some busy roads and junctions.
Detailed Assessment of PM ₁₀ concentrations at Whirlies roundabout, East Kilbride	2005	Concluded that neither the annual mean objective nor the 24-hour objectives were likely to be exceeded in 2010.
Progress Report	2006	Reported monitoring data and local developments relevant to LAQM
Updating and screening assessment	2007	Concluded that the measured PM ₁₀ annual mean at Whirlies roundabout was in excess of the 2010 objective. Annual mean NO ₂ diffusion tube measured close by was also in excess of the NO ₂ objective. A detailed assessment of PM ₁₀ and NO ₂ was recommended at Whirlies Roundabout.
Detailed assessment	2007	PM ₁₀ annual mean objective likely to be exceeded close to Whirlies Roundabout and that declaration of an AQMA be considered. NO ₂ annual mean was not likely to be exceeded in the study area
AQMA declaration at Whirlies Roundabout, East Kilbride	2008	Based on the conclusions of the 2007 detailed assessment an AQMA for PM ₁₀ was declared at Whirlies roundabout effective from the 28 th November 2008
Progress Report	2008	Measured annual mean NO ₂ was in excess of the 40 µg.m ⁻³ objective at three locations; further monitoring was recommended at these locations. The annual mean PM ₁₀ measured at Whirlies Roundabout was in excess of the 2010 objective of 18 µg.m ⁻³
Updating and screening assessment	2009	Based on the measured PM ₁₀ and NO ₂ concentrations and a review of roads within South Lanarkshire the report recommended: <ul style="list-style-type: none"> • A further assessment of PM₁₀ in the Whirlies AQMA; • A detailed assessment of PM₁₀ and NO₂ at Rutherglen; • A detailed assessment of PM₁₀ and NO₂ at Hamilton town centre; • A detailed assessment of NO₂ in Lanark town centre; • A detailed assessment of NO₂ at Main Street, Uddingston.
Progress Report	2010	Measured annual mean NO ₂ was in excess of the 40 µg.m ⁻³ objective at three locations; further monitoring was recommended at these locations which has already been highlighted in 2009's U&SA. The annual mean PM ₁₀ measured at Main Street Rutherglen was in excess of the 2010 objective of 18 µg.m ⁻³
Detailed Assessment at Rutherglen	2010	Annual mean PM ₁₀ concentrations in excess of the 2010 objective were predicted at multiple locations of relevant human exposure across the study area. Based on the modelling predictions it was considered necessary to declare an Air Quality Management Area (AQMA) within this area of Rutherglen for PM ₁₀ .
Further Assessment at Whirlies Roundabout	2010	Modelling predictions of PM ₁₀ concentrations confirmed that the declaration of the AQMA was valid and that the boundary should be maintained. Annual mean PM ₁₀ concentrations were predicted to exceed the 2010 objective at many locations of relevant human exposure which

		close to the roads assessed. Source apportionment indicated that volume sources i.e. local background, are the most significant source of PM ₁₀ concentrations at this location.
Progress Report	2011	Measured annual mean NO ₂ concentrations increased across the monitoring network when compared to the previous year, it was noted that this could be attributable to the meteorological conditions during 2010. The 2010 NO ₂ monitoring data confirmed the conclusions of the 2009 Updating and Screening Assessment and 2010 Progress Report which recommended proceeding with Detailed Assessments of NO ₂ concentrations at Bannatyne Street, Lanark and at Brandon Street, Hamilton. Both Detailed Assessments were planned for completion in 2011.
Detailed assessment at Lanark	2012	The dispersion modelling study indicated that annual mean NO ₂ concentrations in excess of the 40 µg.m ⁻³ objective may be occurring at locations of relevant exposure. The predicted exceedance area encompassed stretches of Bloomgate, Wellgate, High Street and Bannatyne Street. The detailed assessment concluded that South Lanarkshire Council should declare an Air Quality Management area encompassing all areas of exceedance of the NO ₂ annual mean objective predicted in the study.

Updating and Screening Assessment (2003)

South Lanarkshire's Updating and Screening Assessment (U&SA) concluded that the AQS objectives were likely to be met for all pollutants except for particulate matter (PM₁₀). Potential exceedances of the 2010 PM₁₀ objective were identified at some busy roads and junctions. The assessment specified that potential PM₁₀ concentrations in excess of the 18 µg.m⁻³ annual mean objective may occur at the junction of the A730 and the B768 in Rutherglen; the junction of the A726 and the B761 in East Kilbride; the Hamilton and Bothwell motorway junctions where the M74 meets the A723 and the A725 respectively; and at the Whirlies roundabout in East Kilbride.

Detailed Assessment (2005)

A Detailed Assessment of PM₁₀ concentrations at Whirlies roundabout, East Kilbride was undertaken in 2005. The Detailed Assessment concluded that neither the annual average objective nor the 24-hour objectives were likely to be exceeded around the Whirlies roundabout in 2010. The predicted concentrations close to the roundabout were however close to the objective.

Progress Report (2006)

A Progress Report was produced in 2006. This reported trends in diffusion tube monitoring data and listed developments with the potential to impact upon air quality in the local authority area.

Updating and Screening Assessment (2007)

The 2007 U&SA concluded that the measured annual average PM₁₀ concentrations at the Whirlies roundabout were in excess of the 2010 PM₁₀ annual mean objective. The Whirlies junction was considered representative of other "busy junctions" in South Lanarkshire; it was therefore decided to undertake further Detailed Assessment of PM₁₀ at the following junctions:

- Whirlies roundabout, East Kilbride
- A730/B768, Rutherglen;
- A726/B764, East Kilbride;
- A726/B761, East Kilbride;
- M74/A723, Hamilton and

- M74/A725, Bothwell.

Measured NO₂ concentrations at monitoring location “East Kilbride 5N” were in excess of the annual mean objective, this location was considered to be one of relevant public exposure; the U&SA therefore concluded that a detailed assessment of NO₂ at this location should be conducted.

Detailed Assessment (2007)

The Detailed Assessment completed in 2007 concluded:

- The 2010 PM₁₀ annual average objective is likely to be exceeded in the area around the Whirlies roundabout. It was recommended that air quality at this location was kept under review by South Lanarkshire Council and that the declaration of an AQMA be considered.
- Predicted NO₂ annual mean concentrations were not in excess of the objective at, and in the vicinity of the “East Kilbride 5N” monitoring location at locations of relevant public exposure.

The Detailed Assessment also recommended that the Council reviewed their monitoring systems and considered additional PM₁₀ monitoring at the following locations: A730/B768, Rutherglen; A726/B764, East Kilbride; and A726/B761, East Kilbride.

Based on the conclusions of the Detailed Assessment, an AQMA for PM₁₀ was declared at Whirlies roundabout effective from the 28th November 2008. A map showing the location of the AQMA is presented in Figure 1.1.

Progress Report (2008)

The 2008 progress report concluded that measured annual mean NO₂ concentrations were in excess of the 2005 objective at three diffusion tube locations:

- East Kilbride 1N, a roadside monitoring location;
- East Kilbride 5N, a roadside monitoring location; and
- Lanark 1N, a roadside location within a narrow, congested, street canyon.

Further monitoring was recommended at other locations of relevant public exposure near each site. Automatic monitoring of PM₁₀ concentrations conducted from February to May 2007 at Whirlies roundabout were adjusted to determine an estimated annual mean PM₁₀ concentrations using an adjustment factor derived with PM₁₀ measurement data from two Scottish AURN urban background sites. The estimated annual mean PM₁₀ concentration of 23.1 µg.m⁻³ was determined to be in excess of the 2010 objective.

Automatic monitoring of PM₁₀ was undertaken at Glespin between February and May 2007 in response to a complaint received regarding an opencast mine in the area. The results of the two months monitoring were adjusted to an estimated annual mean using factors derived from the Scottish AURN sites. The resulting annual mean PM₁₀ concentration of 7.44 µg.m⁻³ at Glespin was significantly below the 2010 objective and no further action was recommended.

Updating and Screening Assessment (2009)

Measured annual mean NO₂ concentration from eleven months of automatic measurements at Whirlies Roundabout were very close to exceeding the NAQS annual mean objective and exceeded the objective at Main Street, Rutherglen. Data capture at Rutherglen (59.8%) was low, and insufficient to derive firm conclusions for the site. The short-term NO₂ objective was not exceeded at either of the monitoring locations.

Annual mean NO₂ concentrations measured in 2008 increased at many of the diffusion tube sites when compared to the previous two years and were in excess of the NAQS objective at Glen Esk, East

Kilbride 3N; and at Cadzow Street, Hamilton 1N. Measured annual mean NO₂ concentrations at Bannatyne Street, Lanark exceeded the annual mean objective level for the third year in a row, thus it was considered likely that the objective is being exceeded within that narrow street canyon.

Annual mean PM₁₀ concentrations measured at Whirlies Roundabout, East Kilbride and Main Street, Rutherglen were less than the 2004 annual mean PM₁₀ objective. Predicted annual mean PM₁₀ concentrations at both sites were, however, in excess of the 2010 annual mean objective of 18 µg.m⁻³. Both sites were however noted to be at roadside locations and not considered representative of relevant long-term exposure, although residential properties are located close to each monitoring station. The 24-hour mean PM₁₀ objective was also exceeded at both sites.

A review of roads within the South Lanarkshire Council area identified two narrow congested streets that require Detailed Assessment at:

- Main Street, Rutherglen (including both Farmeloan and Glasgow Road junctions); and
- The section of Main Street, Uddingston, between the junctions with Church St/Spindlerow Road and the junction with Bellshill Road.

A review of all other roads identified that annual mean PM₁₀ concentrations at two road junctions in Hamilton town centre, the Almada Street / Bothwell Road junction, and Quarry Street / Duke Street junction may exceed the annual mean PM₁₀ objective. The report also noted that one road with a predicted traffic flows greater than 10,000 AADT is currently under construction within South Lanarkshire; the M74 extension project. The report recommended that a Detailed Assessment of road traffic emissions from the new road is conducted for the section of the road passing through Rutherglen.

The U&SA recommendations were:

- A Further Assessment of PM₁₀ concentrations within the Whirlies AQMA in East Kilbride is required as part of the Action planning process. The Further Assessment should take cognisance of the measured exceedances of the 24-hour mean PM₁₀ objective and review the extent of the AQMA accordingly.
- A Detailed Assessment of both NO₂ and PM₁₀ concentrations in Rutherglen should be undertaken, extending beyond the junction previously considered to include the Farmeloan Road junction. The Detailed Assessment should include for the effect of the opening of the M74 extension.
- A Detailed Assessment of both NO₂ and PM₁₀ concentrations in Hamilton town centre should be undertaken, accounting for the effect of street canyons and exposure at receptor locations above ground level.
- A Detailed Assessment of NO₂ concentrations in Lanark town centre should be undertaken, accounting for the influence of the narrow streets and queuing traffic.
- A Detailed Assessment of NO₂ concentrations at Main Street, Uddingston should be undertaken, between the junctions with Church St/Spindlerow Road and the junction with Bellshill Road.

It also recommended that the Council review the NO₂ diffusion tube monitoring network in light of the findings of this assessment and target additional monitoring at locations of public exposure.

Progress Report (2010)

The 2010 progress report concluded that measured annual mean NO₂ concentrations at Main Street Rutherglen had decreased since 2008 but were still in excess of the NAQS objective of 40 µg.m⁻³. Annual mean NO₂ concentrations measured at Whirlies Roundabout in 2009 decreased slightly when compared with 2008 and were below the 40 µg.m⁻³ NAQS objective.

No clear trend in annual mean NO₂ concentration across the diffusion tube network was apparent from the 2009 results. Annual mean concentrations increased at five locations and decreased at five locations when compared with the 2008 measurements.

The measured NO₂ annual mean concentration at Bannatyne Street, Lanark was in excess of the 40 µg.m⁻³ objective and had increased since 2008. The monitoring data reinforced the recommendation of the 2009 U&SA to conduct a Detailed Assessment of NO₂ in Lanark town centre.

The first year of diffusion tube monitoring at Brandon Street, Hamilton reported an annual mean NO₂ concentration in excess of the 40 µg.m⁻³ objective. This reinforced the recommendation of the 2009 U&SA to conduct a Detailed Assessment of NO₂ within the Hamilton town centre.

South Lanarkshire Council was awarded additional funding from the Scottish Government to install automatic monitoring stations at a location close to Bannatyne Street, Lanark and Brandon Street, Hamilton. The 2009 NO₂ monitoring data confirmed the conclusions of the 2009 Updating and Screening Assessment which recommended proceeding with Detailed Assessments of NO₂ concentrations at Bannatyne Street, Lanark and at Brandon Street, Hamilton.

Detailed assessment at Rutherglen (2010)

Based on the results of PM₁₀ and NO₂ monitoring conducted over 2008 and 2009; and the apparent under-prediction of PM₁₀ concentrations in a dispersion modelling assessment conducted in 2007; a Detailed Assessment of NO₂ and PM₁₀ concentrations was conducted for the main roads and junctions in Rutherglen.

The dispersion modelling assessment predicted pollutant concentrations at the Main Street automatic monitoring site and across a study area covering many locations of relevant human exposure. Comparison of modelled NO₂ predictions with local monitoring data indicated that the model was over-predicting NO₂ concentrations but not significantly enough to require adjustment of the predicted concentrations. Marginal exceedances of the annual mean NO₂ objective were predicted at several locations of relevant human exposure at residential properties close to the modelled roads and junction; these predictions were however noted to represent an over-estimation of actual annual mean NO₂ concentrations when compared with measured concentrations from one monitoring site.

The study also recognised that there were uncertainties relating to the modelled predictions based on the limitations of the available NO₂ monitoring data. The report concluded that NO₂ concentrations in excess of the annual mean objective could be occurring at locations of relevant human exposure where the predicted concentrations are close to the objective. The report recommended that additional NO₂ monitoring data is required to allow better verification of the model predictions across the overall study area.

Comparison of modelled annual mean PM₁₀ concentrations with local monitoring data indicated that the model was under-predicting PM₁₀ concentrations. The modelling predictions were, therefore, adjusted, in accordance with the method specified in the technical guidance to account for the under-prediction. Annual mean PM₁₀ concentrations in excess of the 2010 objective were subsequently predicted at multiple locations of relevant human exposure across the study area.

Based on the modelling predictions it was considered necessary to declare an Air Quality Management Area (AQMA) within this area of Rutherglen for PM₁₀. It was also recommended that the Council continue automatic monitoring at the Main Street location to provide twelve months of continuous monitoring data and that the Council give consideration to locating passive diffusion tubes at a number of representative receptor locations across the study area to provide further NO₂ monitoring data with which any future modelling results can be verified.

Further assessment at Whirlies Roundabout (2010)

Analysis of the 2009 monitoring data at Whirlies roundabout indicated an improvement in air quality when compared to previous years. The improvement was attributed to a reduction in traffic flows associated with the economic downturn. It was anticipated that this may be a short-lived improvement and that air quality may deteriorate again as traffic flows increase again as the economy recovers.

Due to the assumed temporary improvement in air quality levels the study considered air quality over a two-year period, i.e. analysed the average annual mean concentrations for the period 2008-09. The two-year average measured mean PM₁₀ concentrations was found to be above the 2010 objective level, however measured NO₂ concentrations were below objective levels.

To evaluate the validity of the approach to monitoring data, and to examine the spatial extent of any exceedance of NAQS objectives a dispersion modelling study of local emissions sources was undertaken. The dispersion modelling study utilised emissions data compiled in an inventory of local emissions sources.

The results of the dispersion modelling study indicated that it was likely that there would be no predicted exceedances of the NO₂ objectives at a location of relevant public exposure; therefore there is no requirement to declare an AQMA for NO₂.

Modelling predictions of PM₁₀ concentrations confirmed that the declaration of the AQMA was valid and that the boundary that has been set should be maintained. Annual mean PM₁₀ concentrations were predicted to exceed the 2010 objective of 18 µg.m⁻³ at locations within approximately 40-45m from the roads modelled, and at up to 70m from the Whirlies roundabout. This represents many locations of relevant human exposure which are close to the roads assessed.

The source apportionment study indicated that volume sources i.e. local background, are the most significant source of PM₁₀ concentrations. Road traffic is the dominant source of PM₁₀ concentrations at roadside locations while at background locations, volume sources are a more significant source of both PM₁₀ and NO₂ concentrations.

Analysis of the likely effect of Action Plan measures on traffic flows in and around the AQMA indicated that a modest reduction in traffic flows may occur. The reduction in traffic flows will result in a small improvement in PM₁₀ concentrations within the AQMA, however the improvements will not be sufficient to allow the 2010 annual mean objective level to be met by 2012.

Progress Report 2011

The review of new and changed emission sources identified no new sources that were likely to result in an exceedance of the NAQS objectives.

Analysis of the 2010 Nitrogen Dioxide (NO₂) and Particulate Matter (PM₁₀) monitoring data concluded the following:

- Measured annual mean NO₂ concentrations increased across the entire diffusion tube network in 2010 when compared to 2009. The measurements at Rutherglen reinforced the findings of the detailed assessment conducted at this location in 2010 and the need to declare an AQMA for PM₁₀.
- The measured annual mean NO₂ concentration at Whirlies Roundabout was in excess of the objective in 2010 and was noted to have increased year on year since 2008. The annual mean PM₁₀ concentration measured at Whirlies during 2010 has increased slightly since 2009 but was still significantly less than the concentration measured in 2008 which was found to be below the 18 µg.m⁻³ Scottish annual mean objective.
- Data capture at the automatic monitor at Bannatyne Street, Lanark was insufficient to provide a useful indication of annual mean NO₂ concentrations. The annual mean measured using a

diffusion tube at this location was in excess of the NAQS objective. The report noted that a detailed assessment for this location was proposed for completion later in 2011.

- The annual mean NO₂ concentration measured using a diffusion tube at Brandon Street, Hamilton increased significantly between 2009 and 2010 and was in excess of the NAQS annual mean objective and the 60 µg.m⁻³ threshold at which there may be a risk of the short term NO₂ objective being exceeded. A detailed assessment for this location was proposed for completion later in 2011.

Lanark Town Centre - Detailed Assessment 2012

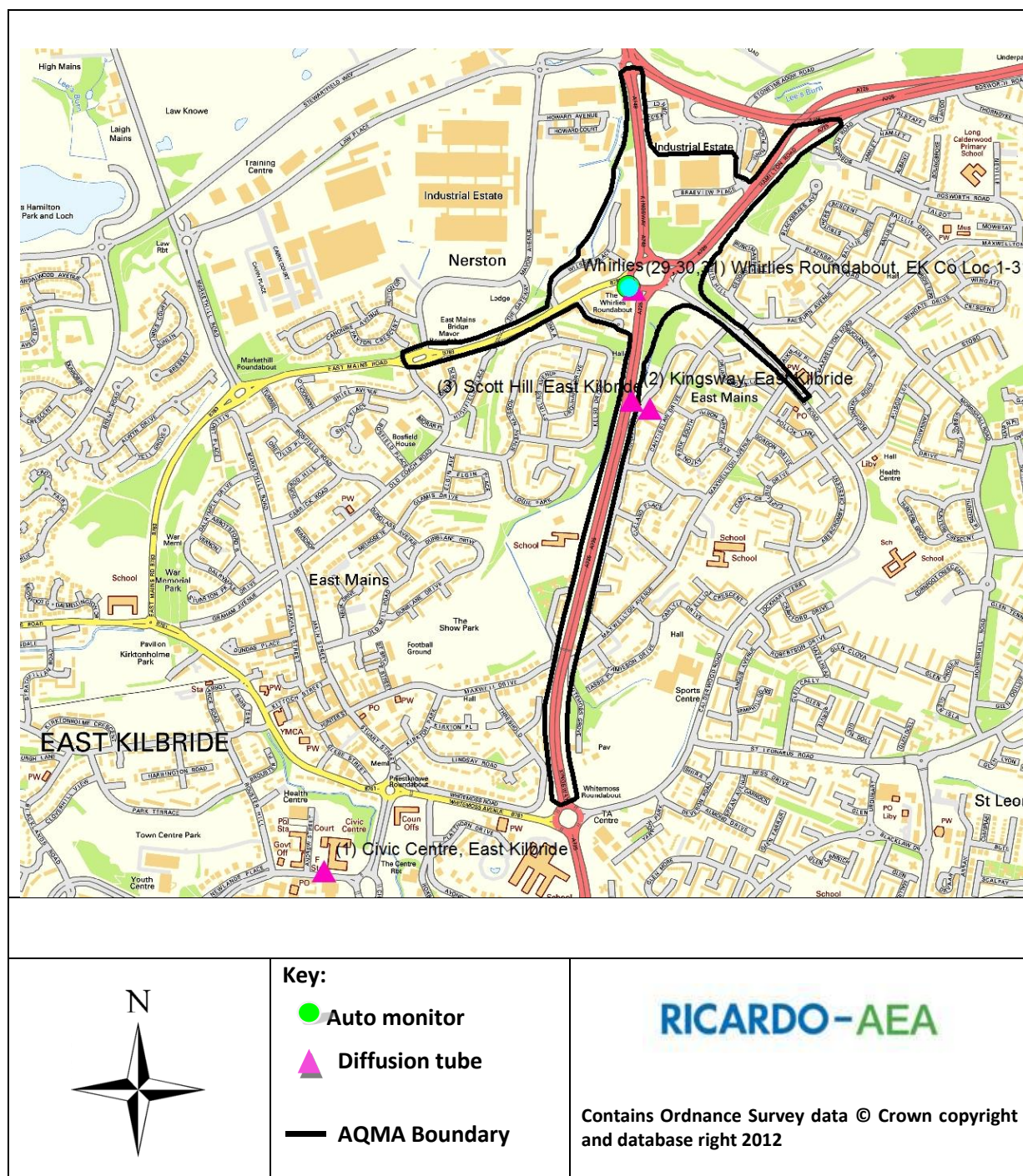
Due to annual mean NO₂ concentrations in excess of the objective being measured in Bannatyne Street, Lanark in both 2009 and 2010, a detailed assessment of NO₂ was conducted in Lanark town centre.

The study indicated that annual mean NO₂ concentrations in excess of the 40 µg.m⁻³ objective may be occurring at locations of relevant exposure. The predicted exceedance area encompassed stretches of Bloomgate, Wellgate, High Street and Bannatyne Street.

The detailed assessment concluded that, based on the available monitoring data, South Lanarkshire Council should declare an Air Quality Management area encompassing all areas of exceedance of the NO₂ annual mean objective predicted in the study. It also recommended that South Lanarkshire Council should expand their diffusion tube network so that more monitoring data is available for the Further Assessment.

South Lanarkshire Council subsequently concluded that more reliable, automatic monitoring data was required before declaring an AQMA. At the time of conducting the Detailed Assessment, data capture from the automatic monitoring site was too low to provide an annual mean NO₂ concentration that could be used to verify the modelling results. The council therefore concluded that the Detailed Assessment should be reviewed when more recent and robust monitoring data is available. A re-run of the detailed assessment, which will utilise both automatic and diffusion tube measurements with good data capture, is scheduled for early 2013.

Figure 1.1: Whirlies Roundabout AQMA, including nearby Automatic Monitoring and diffusion tube sites



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

During 2011, South Lanarkshire Council operated seven automatic continuous monitoring sites. Details of the automatic monitoring sites are presented in Table 2.1. The locations of the automatic monitoring sites are presented in Figure 2.1.

Monitoring commenced at the Hamilton and Uddingston sites during 2011. Due to problems with site calibrations during the initial period of operation, it has not been possible to ratify the data captured during 2011.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring technique	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Glespin	Roadside	280492	628150	PM ₁₀	FDMS	N	Y (10m)	5m	Y
Rutherglen	Roadside	261128	661703	NO ₂ , PM ₁₀	FDMS	N	Y (10m)	2-3m	Y
Whirlies	Roadside	264370	655670	NO ₂ , PM ₁₀	FDMS	Y	Y(10m)	1m	Y
Raith Interchange	Roadside	271125	658320	NO ₂ , PM ₁₀	FDMS	N	N(60m)	1-2m	Y
Lanark	Roadside	288426	643704	NO _x	Chemiluminescence	N	Y (2m)	1-2m	Y
Hamilton*	Roadside	272310	655276	NO _x	Chemiluminescence	N	Y(2m)	1-2m	Y
Uddingston*	Roadside	269663	660304	NO _x	Chemiluminescence	N	Y(2m)	2-3m	Y

**These sites were installed recently and any data produced is not validated and is only indicative*

2.1.2 Non-Automatic Monitoring

During 2011, diffusion tube monitoring of NO₂ was undertaken at 32 sites across the council area using passive diffusion tubes. 5 of these sites were discontinued in May 2011.

Diffusion tubes were deployed at 11 new sites between August and November 2011. For sites with insufficient data capture i.e. less than 3 months, the measured NO₂ concentrations have not been reported.

The new Sites (with insufficient data capture to report 2011 annual mean concentrations) were:

- Main St Rutherglen (Triplicate Co-location study tubes 1-3)
- Whirlies Roundabout, East Kilbride (Co-location study tubes 1-3)
- Main Street, Bothwell

The sites discontinued during 2011 were:

- Vancouver Drive, East Kilbride
- Glen Esk, East Kilbride
- Donaldson Rd, Larkhall
- Ridgemark Drive, Lanark
- Brousterhall, East Kilbride

Details of the diffusion tube monitoring locations at which measurement were conducted in 2011 are presented in Table 2.2. The locations include kerbside, intermediate and urban background sites.

Maps showing the locations of the diffusion tube monitoring sites are presented in Figures 2.1 and 2.2.

A national bias adjustment factor of 0.84 derived as the average of 8 co-location studies conducted during 2011 and analysed by Edinburgh Scientific Services during 2011 has been used to adjust the diffusion tube results¹. Full details of the diffusion tube QA/QC are presented in Appendix A.

¹ National Diffusion Tube Bias Adjustment Factor Spread sheet, version number 09/12.
<http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

Table 2.2 Details of Non- Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location?
(1) Civic Centre, East Kilbride	Roadside	263600	654194	NO ₂	No	No	4m	Yes
(2) Kingsway, East Kilbride	Roadside	264378	655383	NO ₂	Yes	No (20m)	8m	Yes
(3) Scott Hill, East Kilbride	Roadside	264424	655363	NO ₂	No	Yes (5m)	2m	No
(4) Stewartfield, East Kilbride	Roadside	262490	655726	NO ₂	No	Yes (11m)	2m	No
(5) Eaglesham Road, East Kilbride	Roadside	260882	654261	NO ₂	No	Yes (18m)	2m	Yes
(6) Townhead Street, Srathaven	Roadside	270081	644523	NO ₂	No	Yes (12m)	2m	No
(7) Strathaven Road, Hamilton	Roadside	271390	652685	NO ₂	No	No	2m	Yes
(8) Brandon Street, Hamilton	Roadside	272317	655297	NO ₂	No	Yes (5m)	3m	Yes
(9) Cadzow Street, Hamilton	Roadside	272461	655556	NO ₂	No	No	4m	Yes
(10) Orchard Street, Hamilton	Roadside	272014	655249	NO ₂	No	Yes (2m)	2m	No
(11) London Street, Larkhall	Kerbside	276090	651564	NO ₂	No	Yes (1m)	0.5m	Yes
(12) Canderside Toll, Stonehouse	Roadside	277134	648054	NO ₂	No	No	2m	Yes
(13) Kirkton Street, Carluke	Roadside	284550	650579	NO ₂	No	Yes (2m)	2m	Yes
(14) Hospitland Drive, Lanark	Background	289035	643842	NO ₂	No	Yes (5m)	2m	No
(15) Bannatyne Street, Lanark	Roadside	288475	643675	NO ₂	No	Yes (façade)	1m	Yes
(16) Wellgate, Lanark	Roadside	288173	643651	NO ₂	No	Yes (5m)	2m	Yes
(17) Main Street, Bothwell	Roadside	270574	658508	NO ₂	No	Yes (2m)	2m	Yes
(18) Wordsworth Way, Bothwell	Background	270933	659115	NO ₂	No	Yes (5m)	2m	No
(19) North British Road, Uddingston	Background	270180	660753	NO ₂	No	Yes (5m)	3m	No
(20) Burnpark Avenue, Uddingston	Roadside	268948	661476	NO ₂	No	Yes (5m)	30-40m (M74)	Yes
(21) Newton Station Road, Halfway	Roadside	266401	660407	NO ₂	No	Yes (11m)	2m	No
(22) Clydeford Road, Cambuslang	Roadside	264482	661160	NO ₂	No	Yes (30m)	1m	Yes
(23) Cambuslang Road, Rutherglen	Roadside	263524	661835	NO ₂	No	No	2m	No
(24) Farmeloan Road, Rutherglen	Roadside	261643	661689	NO ₂	No	Yes (25m)	2m	Yes
(25) Stonelaw Road, Rutherglen	Roadside	261688	661174	NO ₂	No	Yes (21m)	2m	Yes
(26) Main Street, Rutherglen Co Loc 1	Roadside	261116	661699	NO ₂	No	Yes (10m)	2-3m	Yes

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Worst-case Location?
(27) Main Street, Rutherglen Co Loc 2	Roadside	261118	661699	NO ₂	No	Yes (10m)	2-3m	Yes
(28) Main Street, Rutherglen Co Loc 3	Roadside	261120	661699	NO ₂	No	Yes (10m)	2-3m	Yes
(29) Whirlies Roundabout, EK Co Loc 1	Roadside	264383	655663	NO ₂	Yes	Yes (10m)	1m	Yes
(30) Whirlies Roundabout, EK Co Loc 2	Roadside	264383	655665	NO ₂	Yes	Yes(10m)	1m	Yes
(31) Whirlies Roundabout, EK Co Loc 3	Roadside	264383	655667	NO ₂	Yes	Yes(10m)	1m	Yes
Sites discontinued during 2011								
<i>Closed Vancouver Drive, East Kilbride</i>	<i>Background</i>	<i>261700</i>	<i>654200</i>	<i>NO₂</i>	<i>No</i>	<i>Yes (5m)</i>	<i>2m</i>	<i>No</i>
<i>Closed Glen Esk, East Kilbride</i>	<i>Background</i>	<i>265500</i>	<i>654900</i>	<i>NO₂</i>	<i>No</i>	<i>Yes (5m)</i>	<i>2m</i>	<i>No</i>
<i>Closed Donaldson Road, Larkhall</i>	<i>Roadside</i>	<i>277366</i>	<i>650224</i>	<i>NO₂</i>	<i>No</i>	<i>Yes (7m)</i>	<i>60m (M74)</i>	<i>Yes</i>
<i>Closed Ridgemark Drive, Lanark</i>	<i>Background</i>	<i>287900</i>	<i>644200</i>	<i>NO₂</i>	<i>No</i>	<i>Yes (5m)</i>	<i>2m</i>	<i>No</i>
<i>Closed Brousterhill, East Kilbride</i>	<i>Roadside</i>	<i>264427</i>	<i>655362</i>	<i>NO₂</i>	<i>No</i>	<i>Yes (5m)</i>	<i>2m</i>	<i>No</i>

Figure 2.1a: Automatic Monitoring and diffusion tube locations in East Kilbride

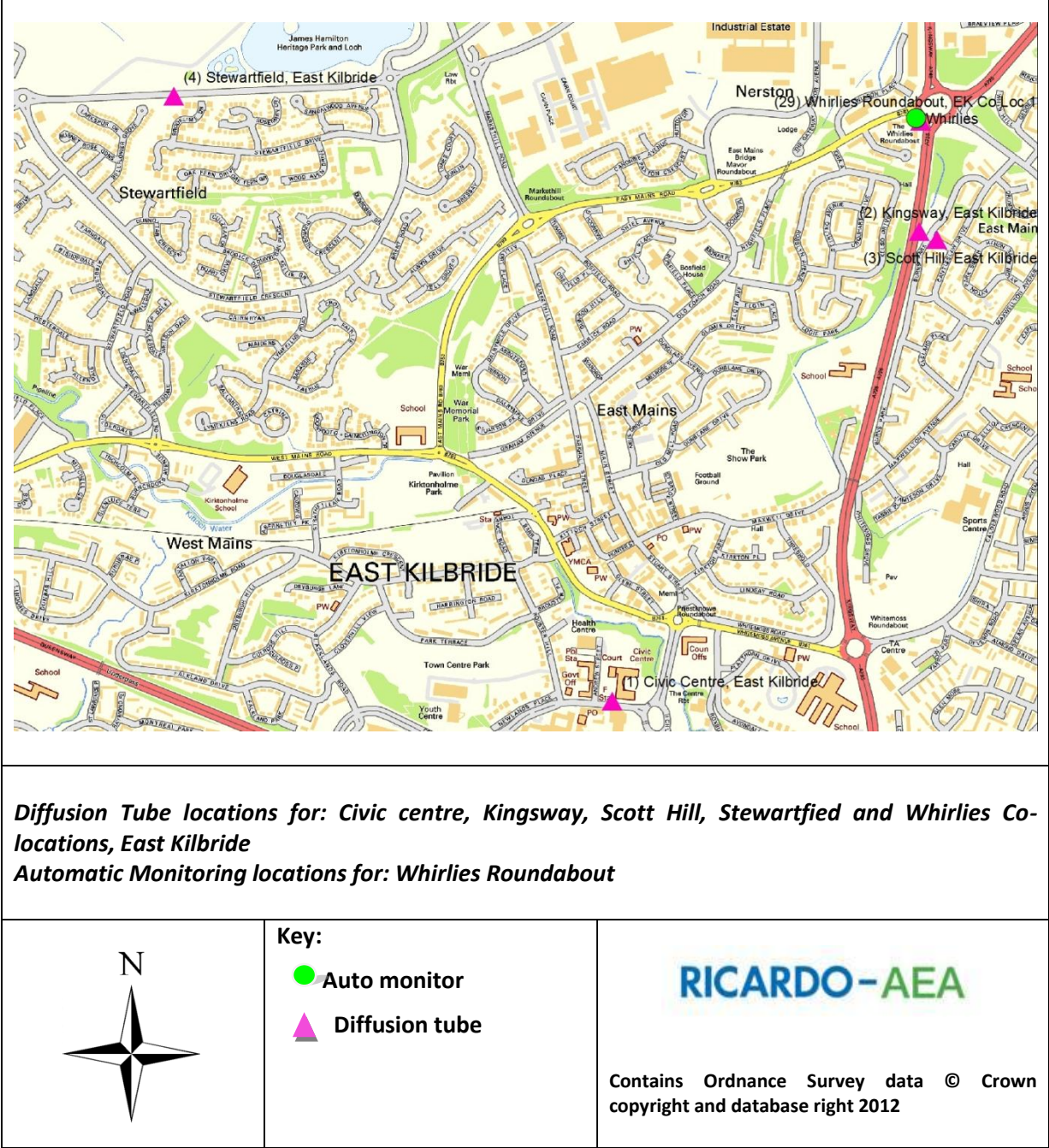


Figure 2.1b: Automatic Monitoring and diffusion tube locations in Strathaven

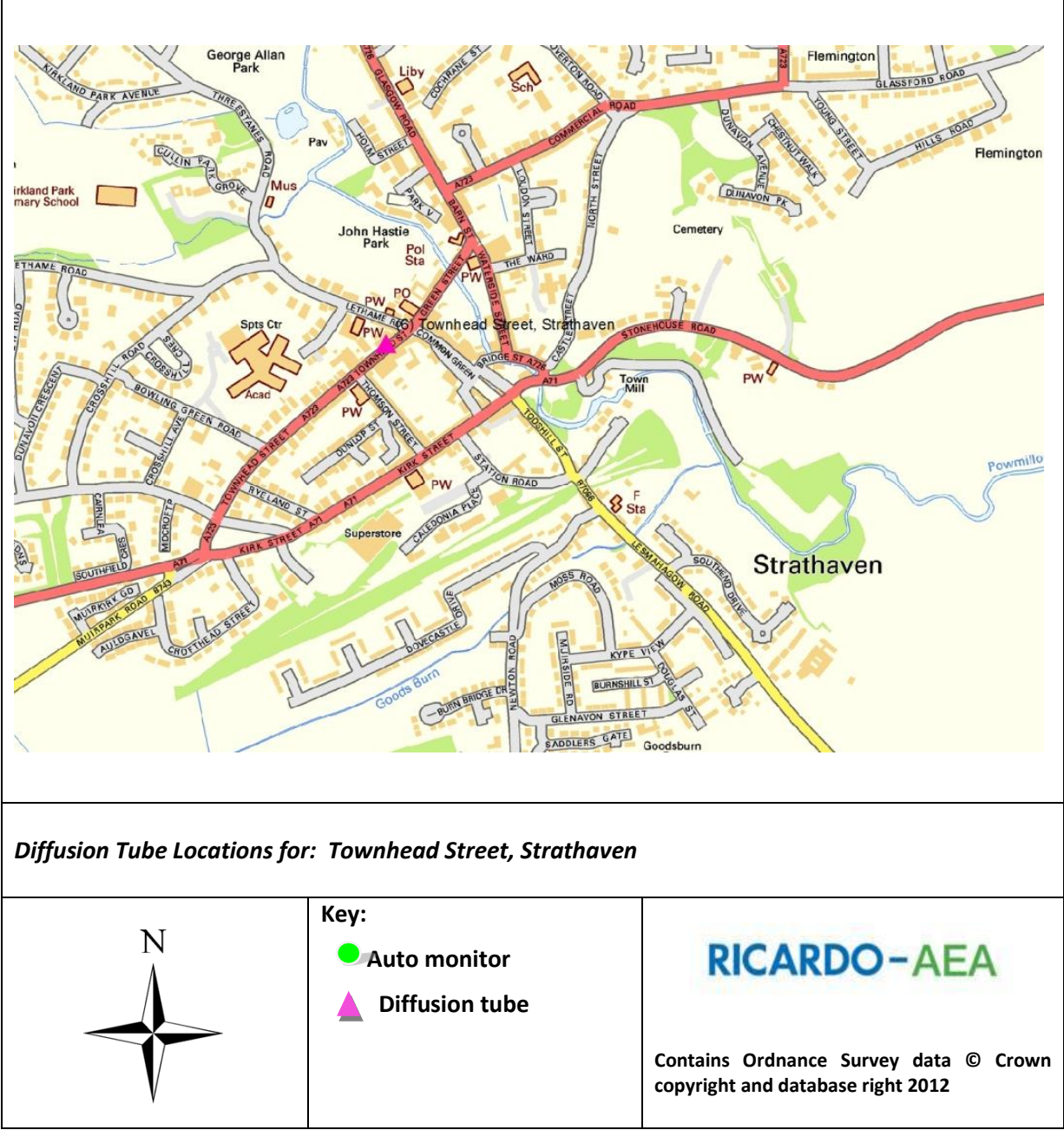


Figure 2.1c: Diffusion tube locations in Hamilton (1)

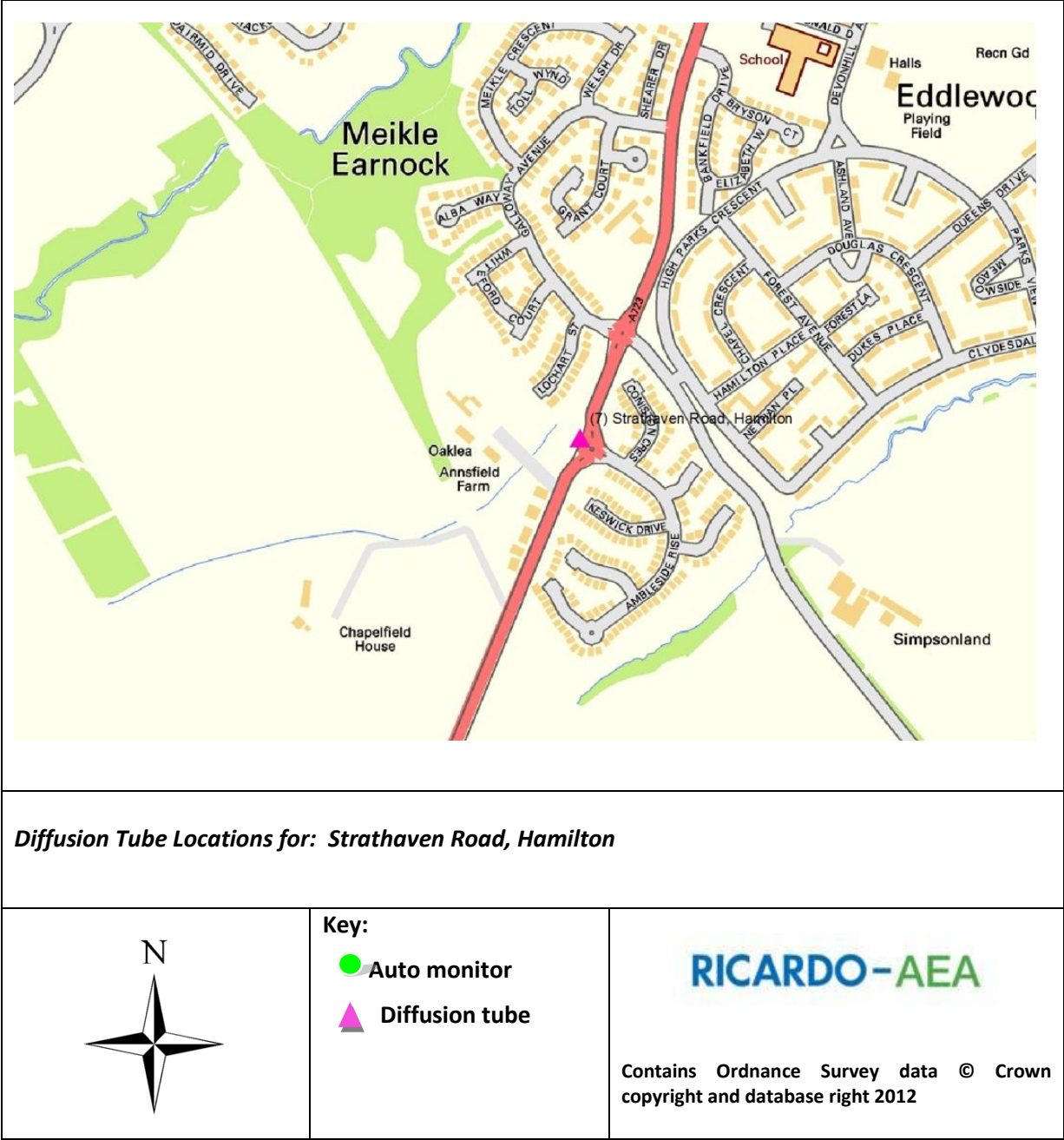


Figure 2.1d: Diffusion tube locations in Hamilton (2)

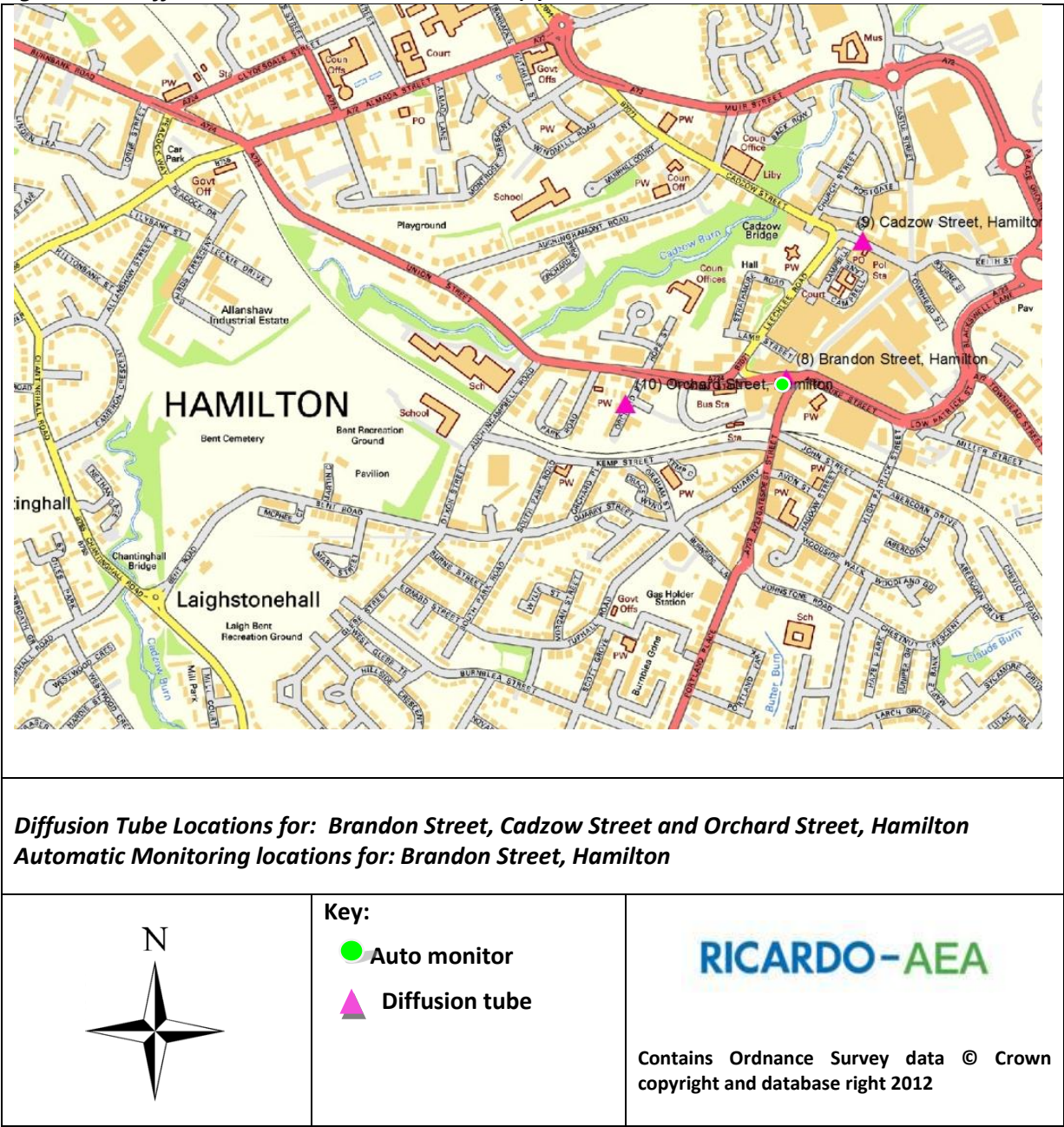


Figure 2.1e: Diffusion tube locations in Larkhall

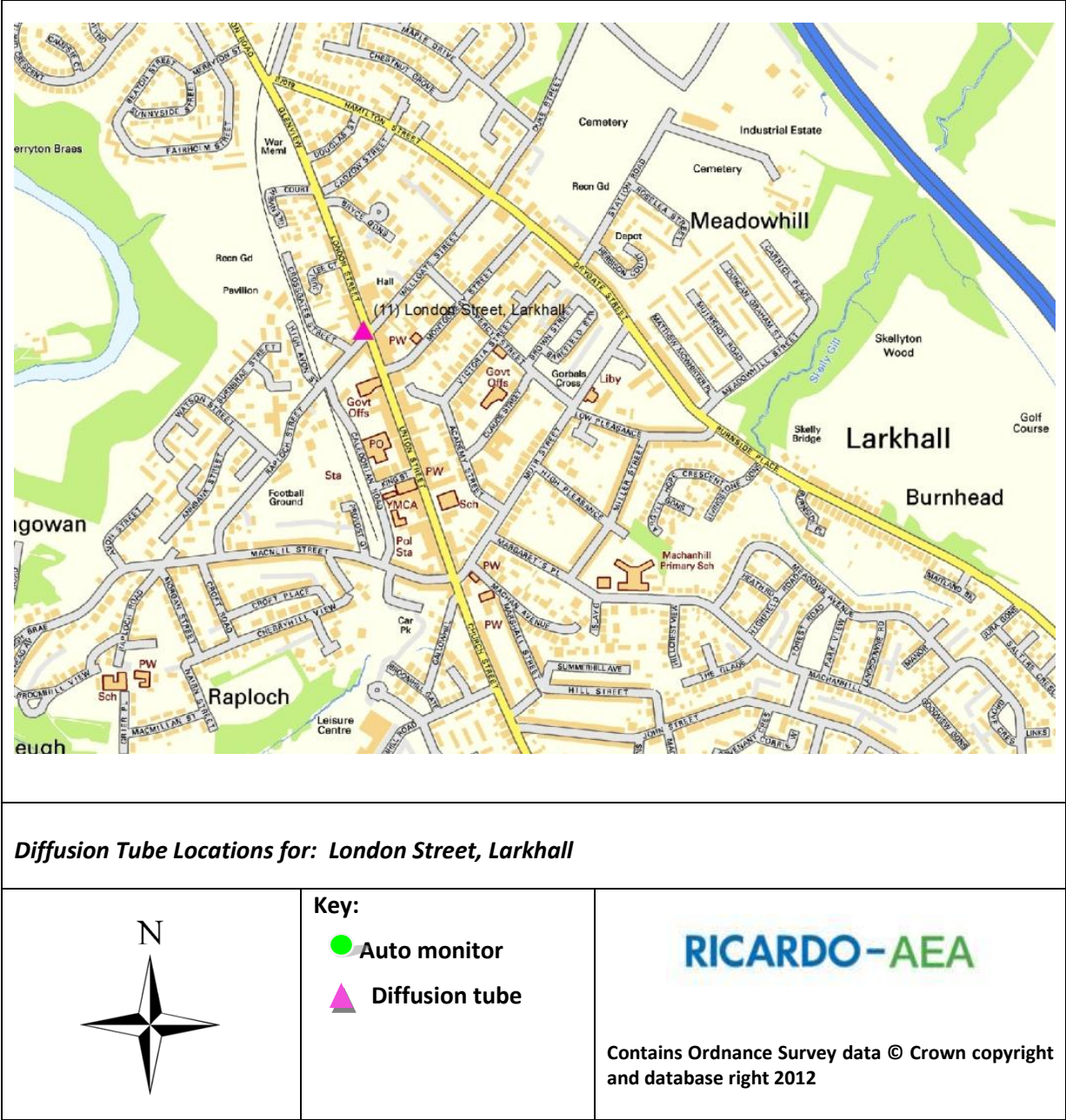


Figure 2.1f: Diffusion tube locations in Stonehouse

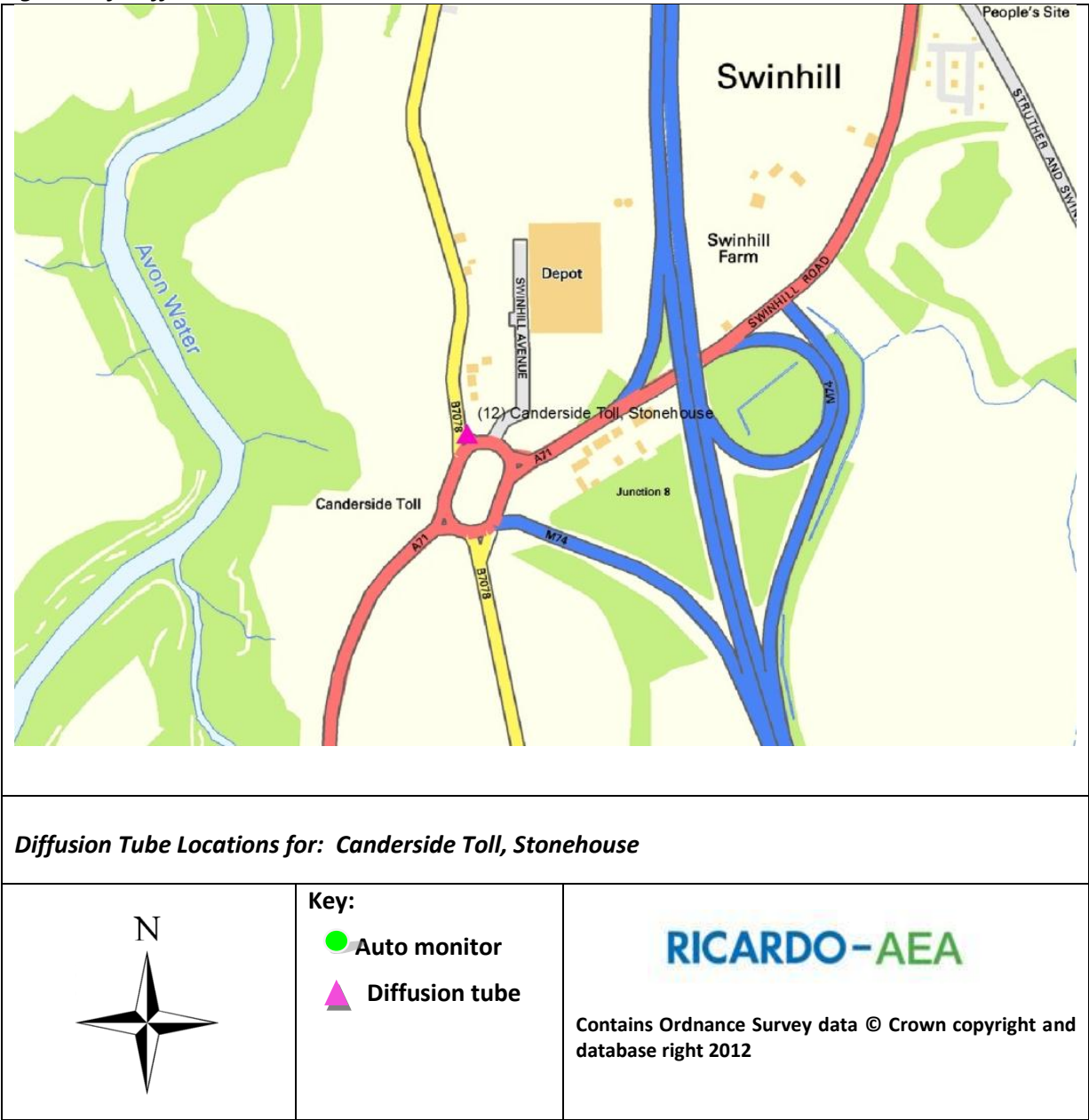


Figure 2.1g: Diffusion tube locations in Carluke

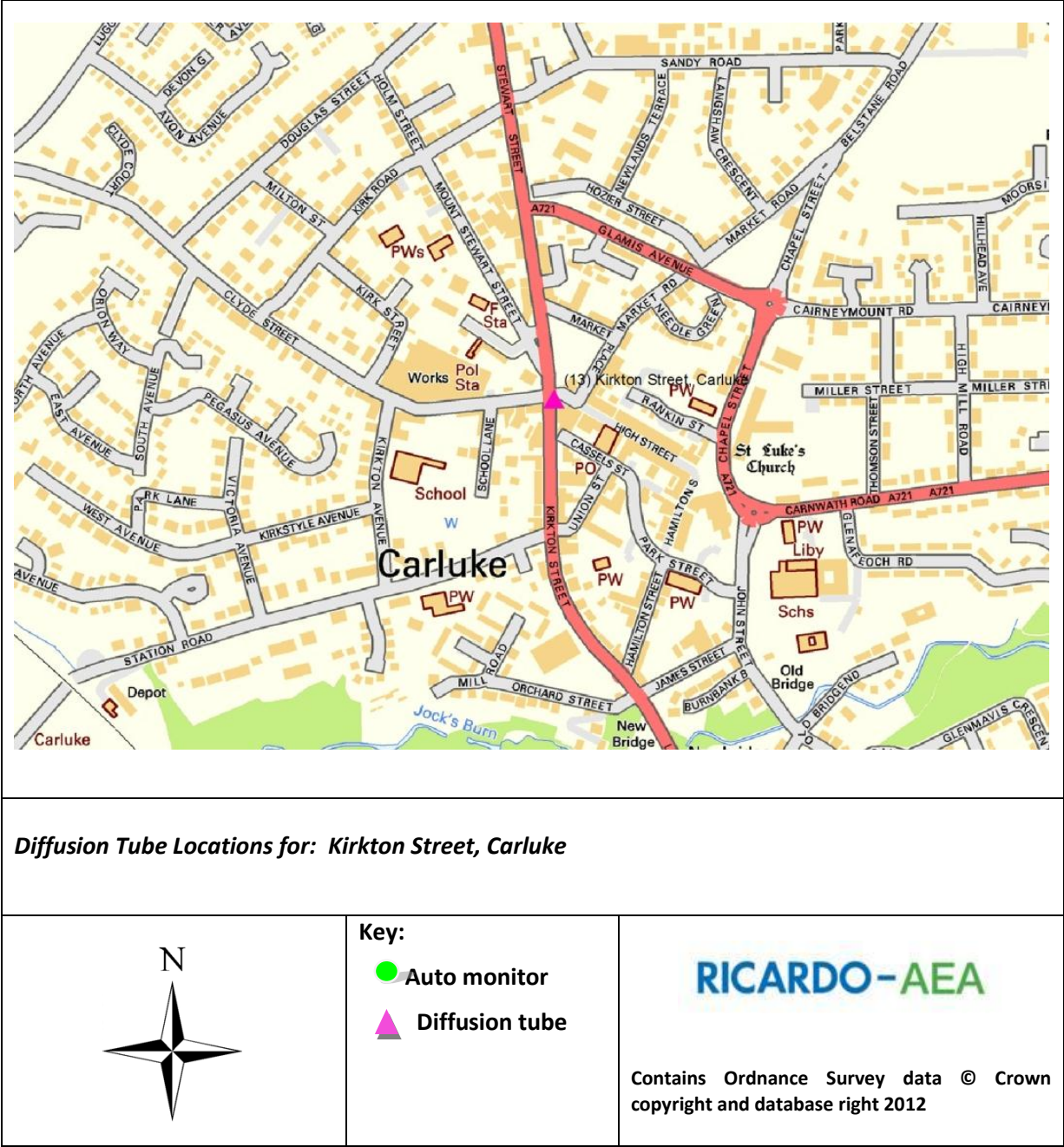


Figure 2.1h: Automatic Monitoring and Diffusion tube locations in Lanark

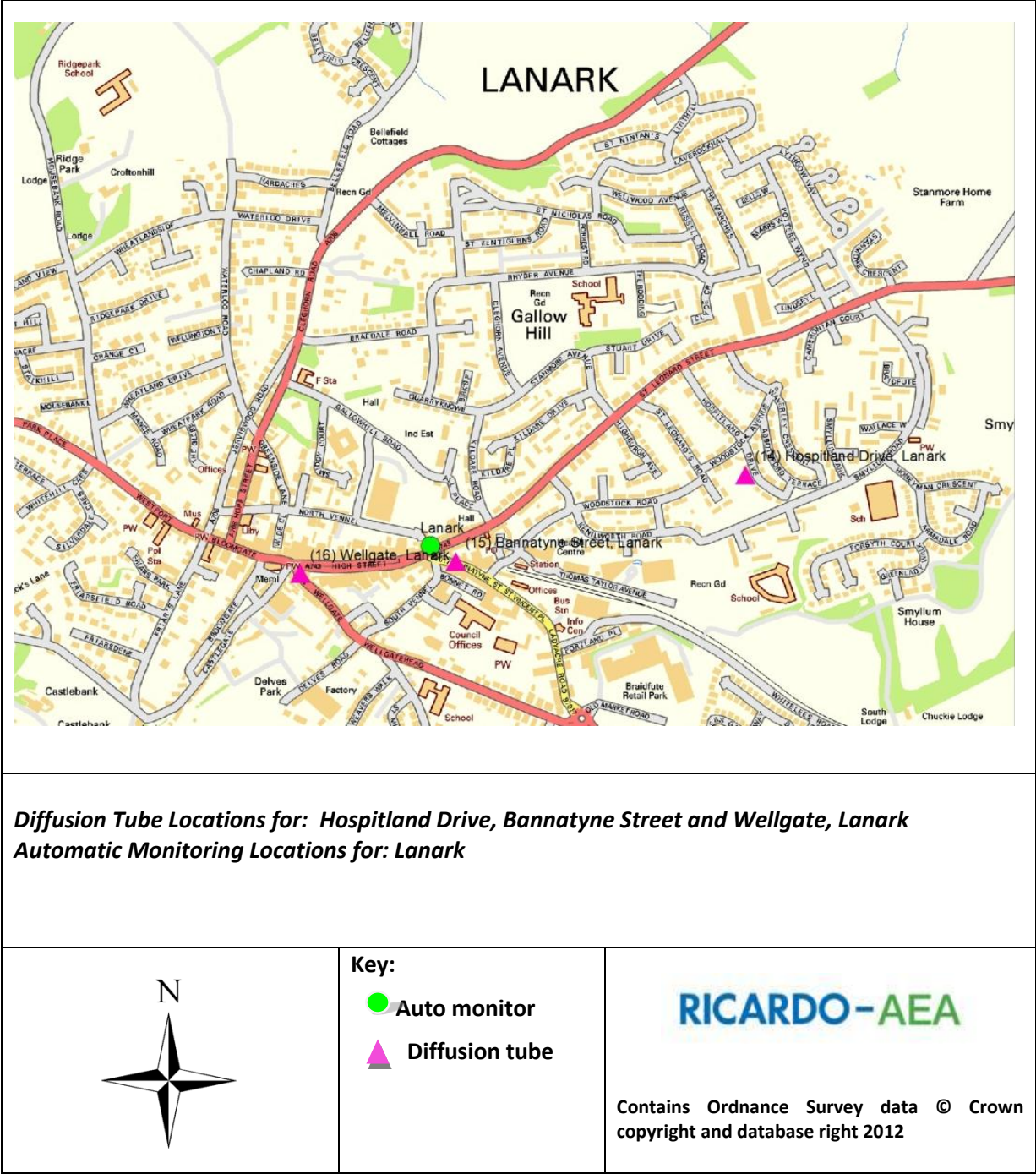


Figure 2.1i: Automatic Monitoring and Diffusion tube locations in Bothwell

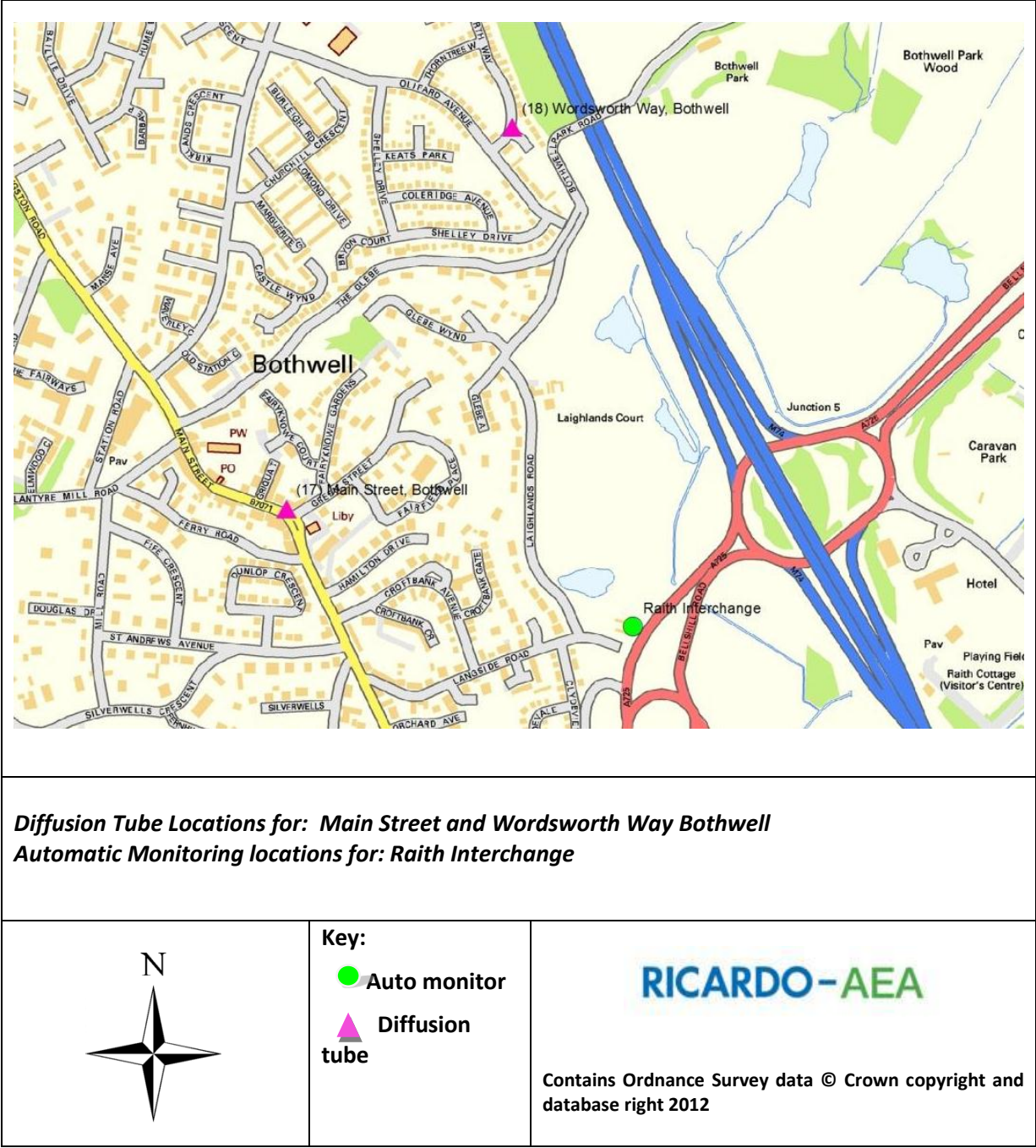


Figure 2.1j: Diffusion tube locations in Uddingston

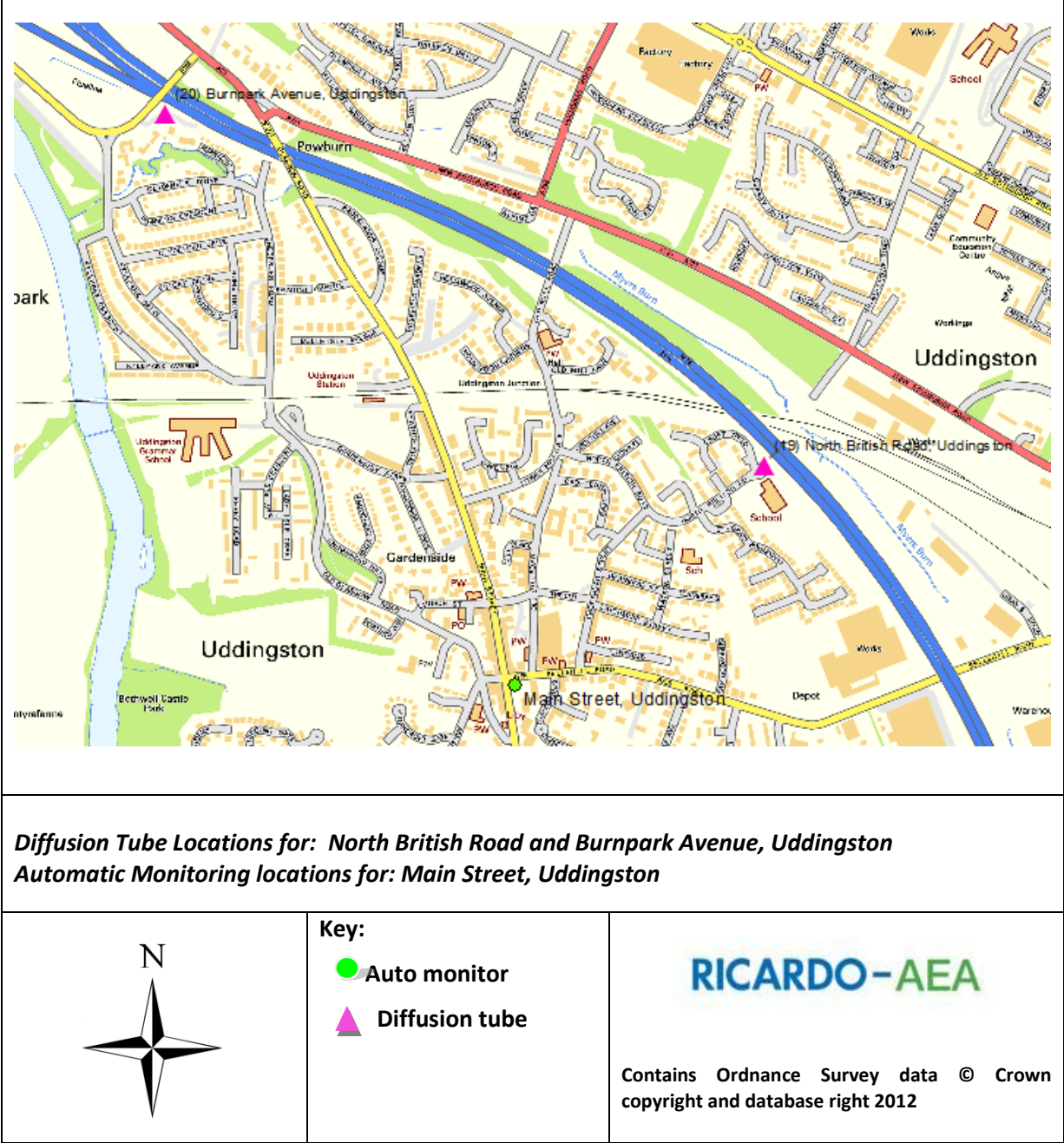


Figure 2.1k: Diffusion tube locations in Cambuslang and Halfway

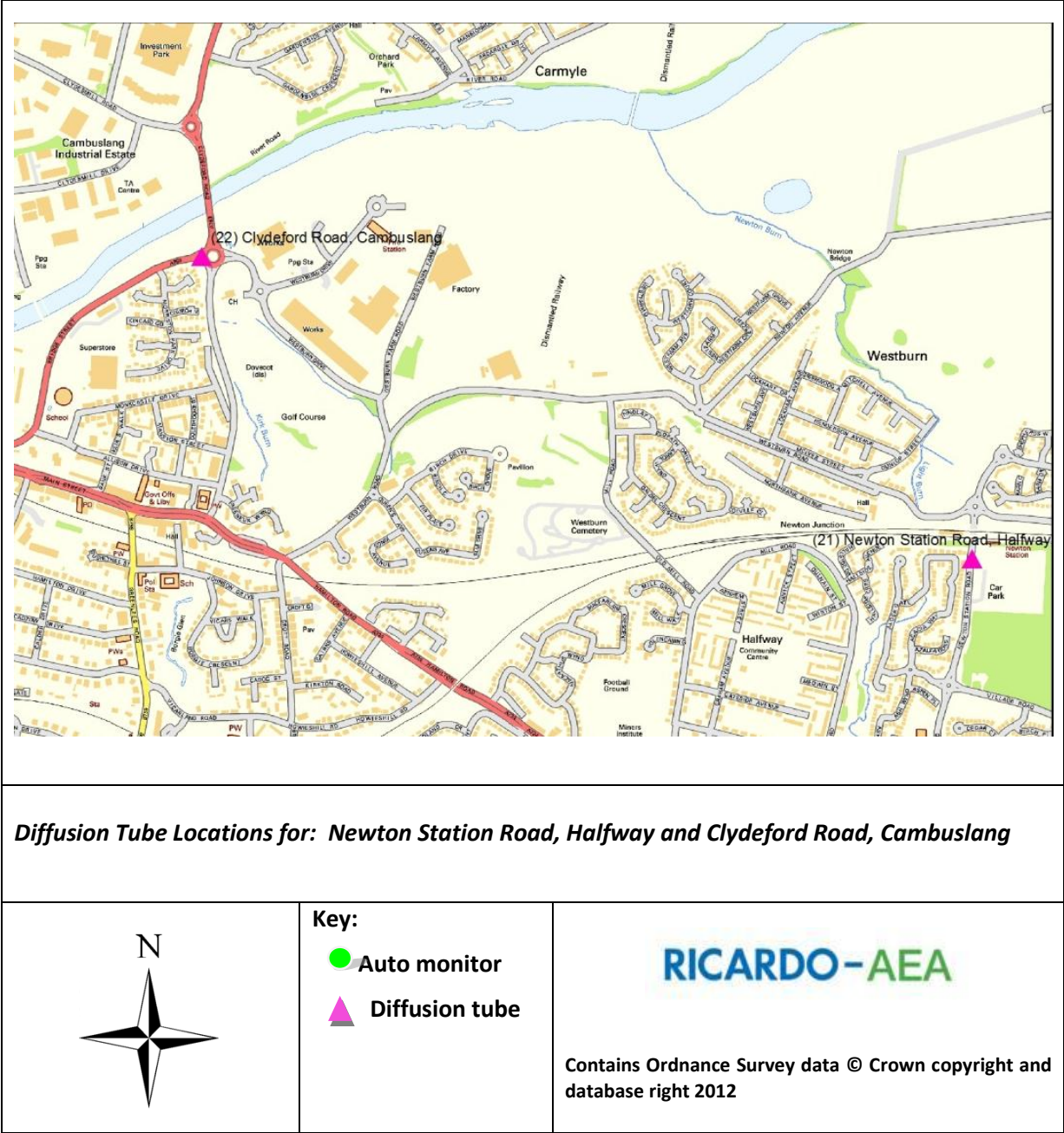


Figure 2.1l: Diffusion tube locations in Rutherglen (1)

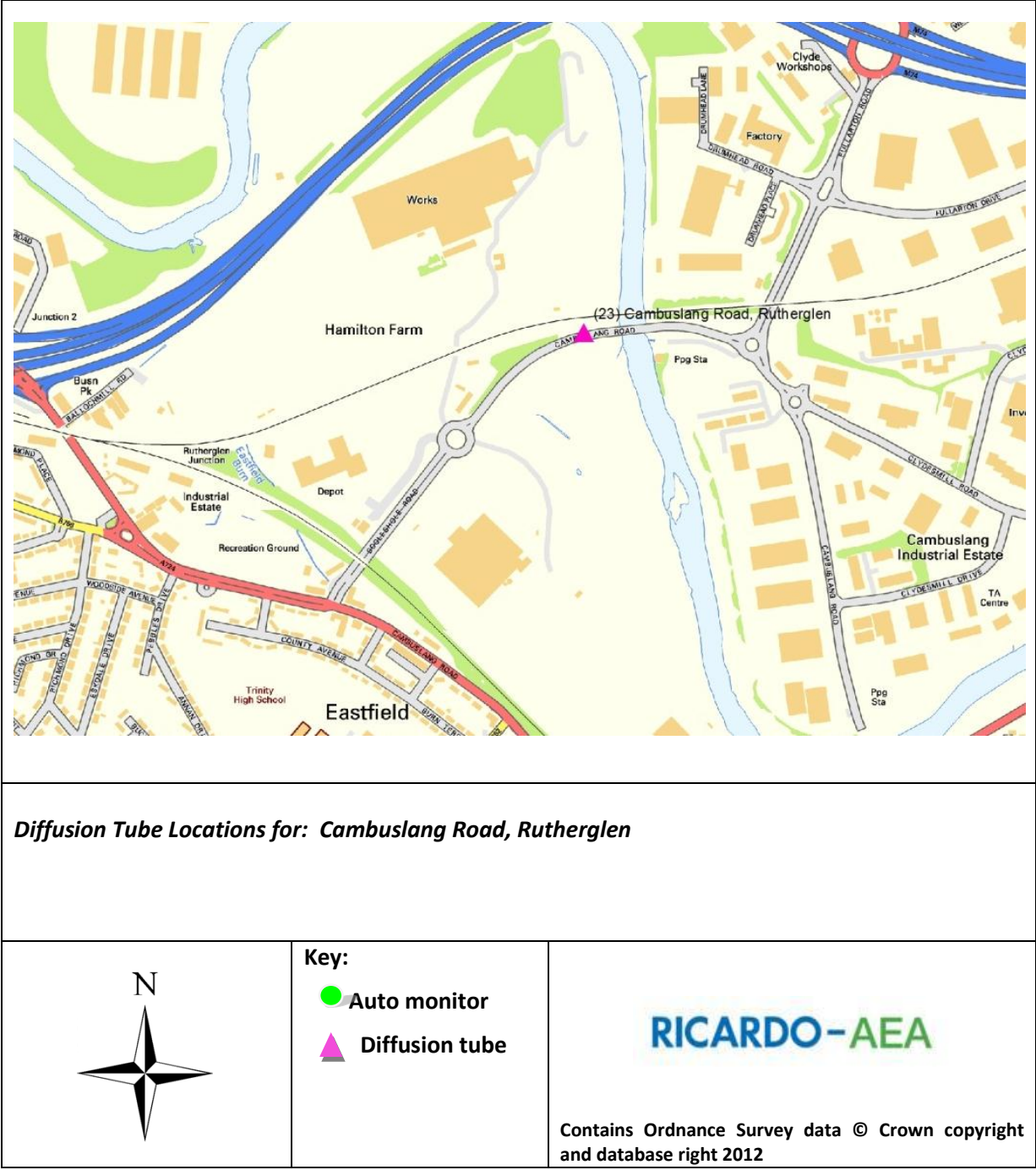


Figure 2.1m: Automatic Monitoring and Diffusion tube locations in Rutherglen (2)

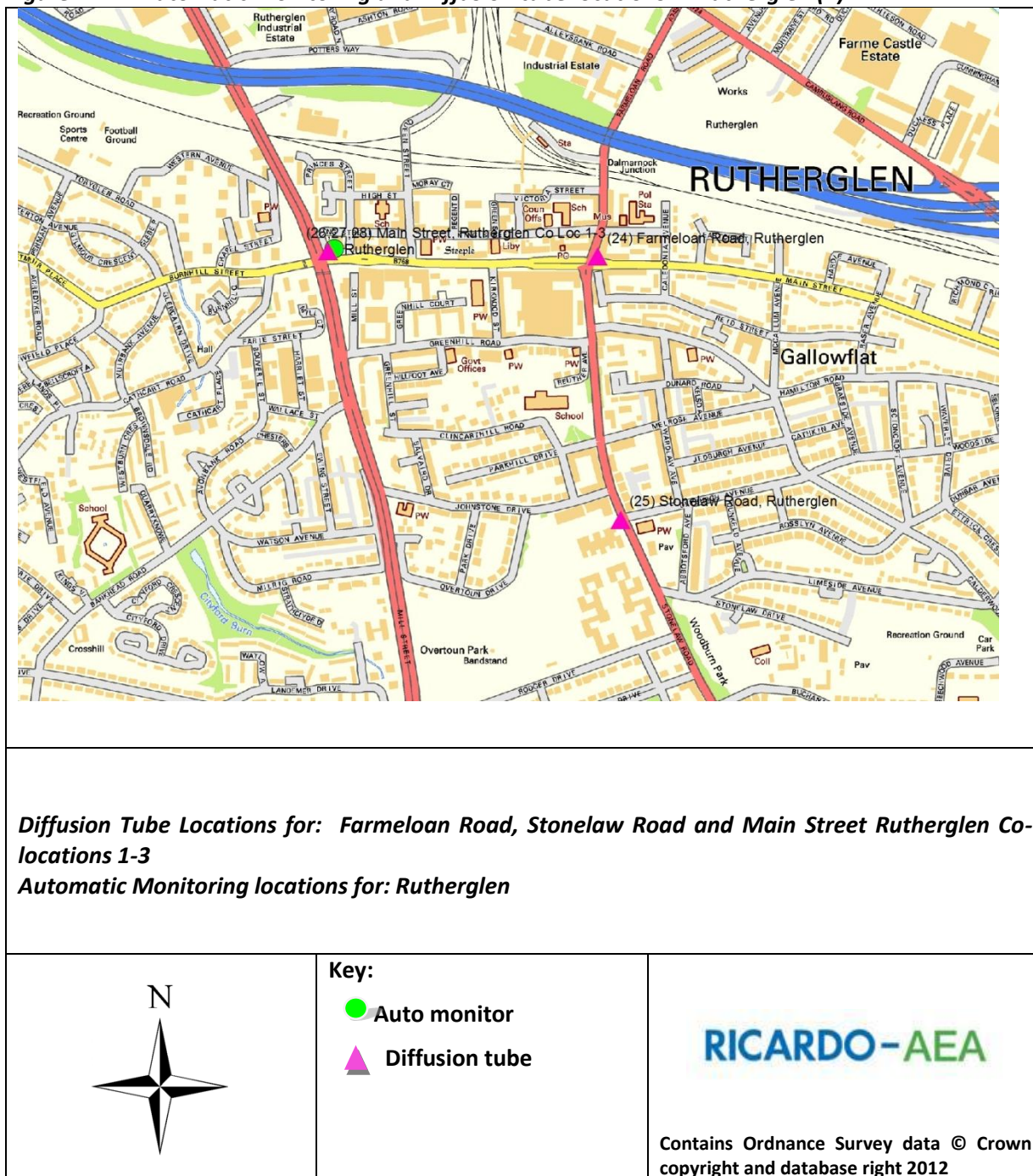
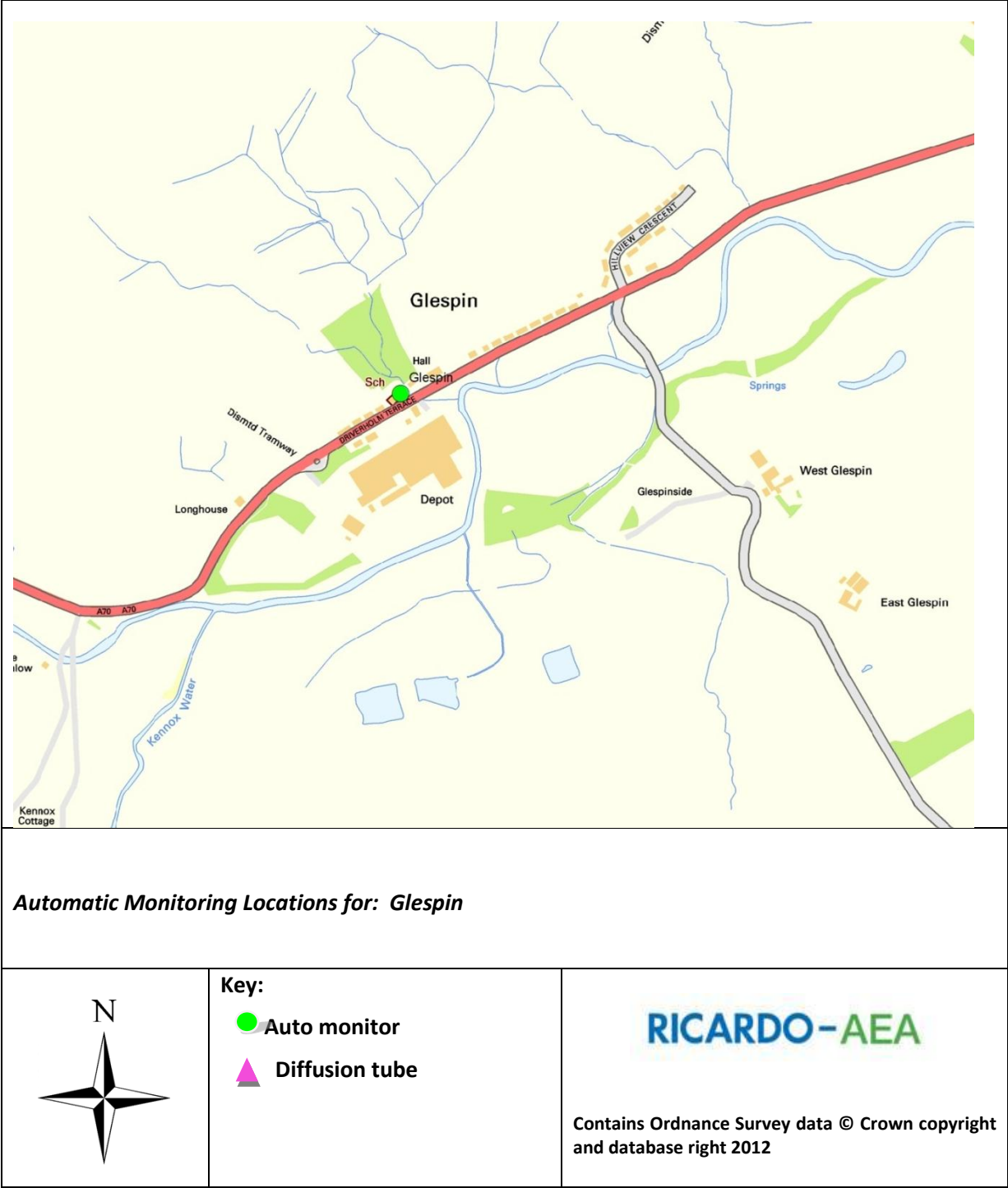


Figure 2.2: Automatic Monitoring location for Glespin



2.2 Comparison of Monitoring Results with AQ Objectives

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

The annual mean NO₂ concentrations measured at the four automatic monitoring locations in South Lanarkshire from 2007 to 2011 are presented in Table 2.3. Concentrations in excess of the 40 µg.m⁻³ objective are highlighted in bold.

Monitoring commenced at the Hamilton and Uddingston sites during 2011. Due to problems with site calibrations during the initial period of operation, it has not been possible to ratify the data captured during 2011. The Hamilton and Uddingston measurements have therefore been presented as provisional data and no short to long term adjustment has been applied.

Table 2.3 NO₂ Automatic monitoring results: Comparison with annual mean objective

Site name	Within AQMA?	Data Capture 2011 (%)	Annual mean concentrations (µg.m ⁻³)			
			2008	2009	2010	2011
Rutherglen	No	99.90%	53.3	40.3	24	37
Whirlies	Yes	98.90%	38.8	37.5	49	41
Raith Interchange	No	99.80%	-	-	61	56
Lanark	No	79.20%	-	-	17	30
Hamilton*	No	25.90%	-	-	-	41*
Uddingston*	No	69.70%	-	-	-	24*

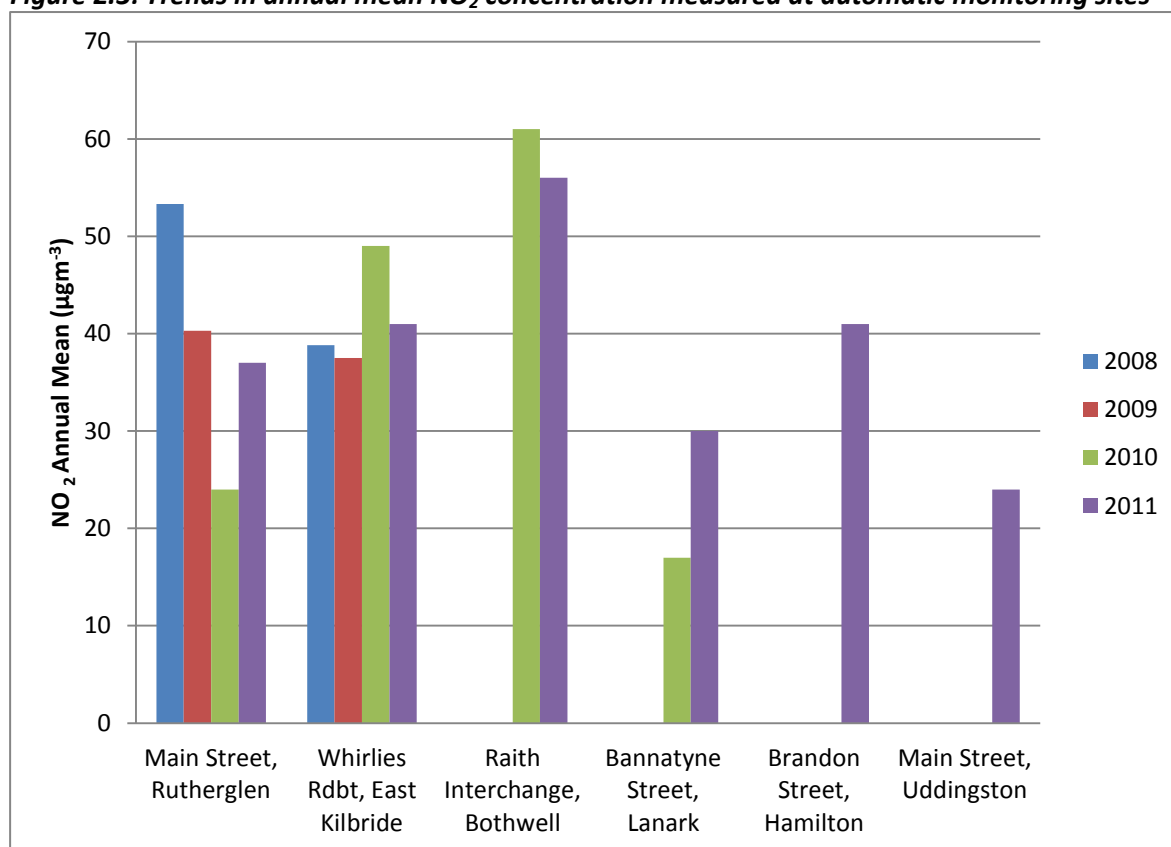
**Results presented are provisional and no short to long term adjustment has been applied*

Where the measured annual mean NO₂ concentration was in excess of the 40 µg.m⁻³ objective; a distance correction calculation has been conducted using the method described in Box 2.3 in Technical Guidance (TG(09)). This method provides a way of predicting the annual mean concentration at the nearest location of relevant exposure.

Distance corrections were calculated for both the Whirlies and Raith Interchange sites. Although the annual mean concentration measured at each site were 41 and 56 µg.m⁻³ respectively, the annual mean concentrations predicted at the nearest locations of relevant exposure were both below the objective of 40 µg.m⁻³. At the closest residential properties to the Whirlies Roundabout analyser, the predicted concentration was 32.1 µg.m⁻³; and at the closest residential properties to Raith Interchange, 33.7 µg.m⁻³.

As previously stated, data from the Hamilton and Uddingston sites are un-ratified and presented as provisional results only.

A bar chart showing the trends in annual mean NO₂ concentrations measured at the automatic sites over the last four years is presented in Figure 2.3. The chart shows annual mean NO₂ concentrations have decreased slightly at Whirlies Roundabout and Raith Interchange in 2011 compared to the previous year. Measured annual mean concentrations have increased at the Rutherglen and Lanark sites during 2011 when compared to 2010. Continued monitoring at these sites will help establish if this is an on-going trend.

Figure 2.3: Trends in annual mean NO₂ concentration measured at automatic monitoring sites

The number of measured 1-hour mean NO₂ concentrations in excess of the 200 µg.m⁻³ short-term objective at each of the automatic monitoring sites is presented in Table 2.4. Measured 1-hour mean concentrations in excess of the 200 µg.m⁻³ short-term objective were recorded twelve times at the Whirlies monitoring site; and zero were recorded at the Lanark site during 2011. Therefore neither site has exceeded the 1hr NO₂ objective.

At Lanark, the annual data capture was less than 90%. It is therefore appropriate to assess the 99.79th percentile of measured hourly mean NO₂ concentrations in relation to the 1-hour mean NO₂ objective. The 99.79th percentile of 1-hour mean concentrations measured at Lanark during 2011 was 120 µg.m⁻³, which is less than the 200 µg.m⁻³ NAQS objective.

Table 2.4 NO₂ automatic monitoring results 2011: Comparison with 1-hour mean objective

Site name	Within AQMA?	Data Capture 2011 (%)	Number of exceedences of hourly mean objective (200 µg.m ⁻³) For data capture < 90%, the 99.79th %ile of 1-hr means is shown in brackets (µg.m ⁻³)			
			2008	2009	2010	2011
Rutherglen	No	99.90%	4(169)	0 (74)	0 (101)	0
Whirlies	Yes	98.90%	9(179)	4	27(201)	12
Raith Interchange	No	99.80%	-	-	38(227)	0
Lanark	No	79.20%	-	-	0 (66)	0(120)
Hamilton*	No	25.90%	-	-	-	1(124)*
Uddingston*	No	69.70%	-	-	-	0(107)*
NB: For data capture < 90%, the 99.79 th %ile of 1-hr means is shown in brackets (µg.m ⁻³)						

* Results presented are provisional

Diffusion Tube Monitoring Data

Details of the annual mean NO₂ concentrations measured at diffusion tube sites during 2011 are presented in Table 2.5. The time series of results measured from 2007 to 2011 are presented in Table 2.6. Bar charts showing the trends in measured NO₂ annual mean concentrations are presented in Figures 2.4a and 2.4b. Note that Tables 2.5 and 2.6 differ from Table 2.2 due to insufficient data capture from the 7 new sites, listed in section 2.1.2.

Please note that the historical diffusion tube data from 2010 (presented in the 2011 Progress report) has now had an updated bias adjustment factor applied. This is due to additional co-location study data being available that had not been published on the national database of co-location studies at the time of writing the 2011 Progress Report. The updated bias adjustment factor is lower than that reported previously but is considered to more consistent with the correction factor applied to South Lanarkshire Council's diffusion in recent years.

Where measured annual mean concentrations were in excess of the objective value (i.e. 40 µg.m⁻³ or greater) a distance correction calculation has been conducted to predict the annual mean concentration at the nearest location of relevant exposure. The calculation is outlined in Box 2.3 of TG(09). These calculations were conducted for the Kingsway, East Kilbride and Brandon Street, Hamilton sites. The calculations returned values of 40.5 µg.m⁻³ and 40.6 µg.m⁻³ respectively, which are in excess of the objective.

At the Kingsway site where the diffusion tube is located within the declared AQMA for PM₁₀ at Whirlies roundabout, the distance correction calculation predicted an annual mean NO₂ concentration of 40.5 µg.m⁻³ at the nearest residential property which is in excess of the 40 µg.m⁻³ objective. There is however uncertainty associated with the concentration predicted using the distance correction method. Box 2.3 of TG(09) indicates that uncertainties may be present with this calculation method when the receptor is further from the kerb than the monitor, and when the distance exceeds 20m. As the calculation was performed at 20m, it is likely that the calculated value contains an element of uncertainty. In addition, the nearby Scott Hill diffusion tube, which is much closer to the nearby residential properties, had a relatively low annual mean NO₂ concentration of 17 µg.m⁻³.

Given the combination of these factors, prior to amending the existing PM₁₀ AQMA to also include NO₂, the recommendation is to continue monitoring at Kingsway to observe if measured NO₂ concentrations are increasing and there is a risk of the annual mean objective being exceeded at the nearby residences. Action plan measures are currently being implemented which are aiming to reduce road traffic emissions at this location.

At the Brandon Street site in Hamilton, the distance correction calculation predicted an NO₂ annual mean of 40.6 µg.m⁻³ at the nearest location of relevant exposure. A Detailed Assessment of NO₂ will be conducted during spring 2013 at this location in Hamilton when sufficient automatic monitoring data will be available to inform the study.

Recent trends in annual mean NO₂ concentrations measured using diffusion tubes are presented in Figure 2.4a. Examination of the trend in NO₂ annual means measured across the South Lanarkshire network indicates that NO₂ levels have dropped slightly across the majority of sites in 2011 when compared to previous years. The exception to this is the diffusion tube site at Kingsway, as described above.

Examination of the data for the new sites that have been opened in 2011 (Figure 2.4b) indicates that annual mean NO₂ concentration are below the 40µg m⁻³ objective. Therefore no action is required at these locations.

Table 2.5: Results of Nitrogen Dioxide Diffusion Tubes

Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (%)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration 2011 ($\mu\text{g.m}^{-3}$) (Bias Adj. factor = 0.84)
(1) Civic Centre, East Kilbride	Roadside	No	N	92	N	N	19
(2) Kingsway, East Kilbride	Roadside	Yes	N	83	N	N	49
(3) Scott Hill, East Kilbride	Roadside	No	N	92	N	N	17
(4) Stewartfield, East Kilbride	Roadside	No	N	42	Y	N	28
(5) Eaglesham Road, East Kilbride	Roadside	No	N	42	Y	N	21
(6) Townhead Street, Srathaven	Roadside	No	N	42	Y	N	23
(7) Strathaven Road, Hamilton	Roadside	No	N	92	N	N	12
(8) Brandon Street, Hamilton	Roadside	No	N	92	N	N	43
(9) Cadzow Street, Hamilton	Roadside	No	N	92	N	N	27
(10) Orchard Street, Hamilton	Roadside	No	N	42	Y	N	18
(11) London Street, Larkhall	Kerbside	No	N	42	Y	N	27
(12) Canderside Toll, Stonehouse	Roadside	No	N	42	Y	N	25
(13) Kirkton Street, Carluke	Roadside	No	N	42	N	N	36
(14) Hospitland Drive, Lanark	Background	No	N	92	N	N	16
(15) Bannatyne Street, Lanark	Roadside	No	N	92	N	N	39
(16) Wellgate, Lanark	Roadside	No	N	83	N	N	20
(18) Wordsworth Way, Bothwell	Background	No	N	92	N	N	20
(19) North British Road, Uddingston	Background	No	N	83	N	N	26
(20) Burnpark Avenue, Uddingston	Roadside	No	N	67	Y	N	25

Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (%)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration 2011 ($\mu\text{g.m}^{-3}$) (Bias Adj. factor = 0.84)
(21) Newton Station Road, Halfway	Roadside	No	N	33	Y	N	17
(22) Clydeford Road, Cambuslang	Roadside	No	N	42	Y	N	27
(23) Cambuslang Road, Rutherglen	Roadside	No	N	25	Y	N	21
(24) Farmeloa Road, Rutherglen	Roadside	No	N	25	Y	N	33
(25) Stonelaw Road, Rutherglen	Roadside	No	N	25	Y	N	21
Sites discontinued during 2011							
Closed Vancouver Drive, East Kilbride	Background	No	N	33	Y	N	14
Closed Glen Esk, East Kilbride	Background	No	N	42	Y	N	12
Closed Donaldson Road, Larkhall	Roadside	No	N	42	Y	N	20
Closed Ridgemark Drive, Lanark	Background	No	N	42	Y	N	10
Closed Brousterhill, East Kilbride	Roadside	No	N	42	Y	N	16

* Triplicate average at colocation study site.

Table 2.6: Results of Nitrogen Dioxide Diffusion Tubes (2007 to 2011)

Location	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2007 (Bias Adj. Factor = XX)	2008 (Bias Adj. Factor = 0.93)	2009 (Bias Adj. Factor = 0.98)	2010 (Bias Adj. Factor = 0.82)	2011 (Bias Adj. Factor = 0.84)
(1) Civic Centre, East Kilbride	Roadside	No	42.3	31.7	24.7	21.3	19.2
(2) Kingsway, East Kilbride	Roadside	Yes	50.8	45.8	53.8	43.1	48.6
(3) Scott Hill, East Kilbride	Roadside	No	-	-	13.9	21.1	17.3
(4) Stewartfield, East Kilbride	Roadside	No	-	-	-	-	27.8
(5) Eaglesham Road, East Kilbride	Roadside	No	-	-	-	-	21.3
(6) Townhead Street, Srathaven	Roadside	No	-	-	-	-	23.4
(7) Strathaven Road, Hamilton	Roadside	No	-	-	18.6	19.4	11.8
(8) Brandon Street, Hamilton	Roadside	No	-	-	49.4	47.0	42.8
(9) Cadzow Street, Hamilton	Roadside	No	31.0	37.7	32.9	39.4	27.5
(10) Orchard Street, Hamilton	Roadside	No	-	-	-	-	18.3
(11) London Street, Larkhall	Kerbside	No	-	-	-	-	27.2
(12) Canderside Toll, Stonehouse	Roadside	No	-	-	-	-	24.5
(13) Kirkton Street, Carluke	Roadside	No					35.7
(14) Hospitland Drive, Lanark	Background	No	12.0	23.8	19.4	18.2	16.3
(15) Bannatyne Street, Lanark	Roadside	No	51.0	37.1	47.2	40	38.7
(16) Wellgate, Lanark	Roadside	No	-	-	-		19.8
(18) Wordsworth Way, Bothwell	Background	No	19.7	21.8	24.6**	22.1	19.5
(19) North British Road, Uddingston	Background	No	24.5	27.2	31.4	33.4	25.5
(20) Burnpark Avenue, Uddingston	Roadside	No	28.5	30.9	31.9	32.5	25.4
(21) Newton Station Road, Halfway	Roadside	No	-	-	-	-	17.0

Location	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2007 (Bias Adj. Factor = XX)	2008 (Bias Adj. Factor = 0.93)	2009 (Bias Adj. Factor = 0.98)	2010 (Bias Adj. Factor = 0.82)	2011 (Bias Adj. Factor = 0.84)
(22) Clydeford Road, Cambuslang	Roadside	No	-	-	-	-	27.2
(23) Cambuslang Road, Rutherglen	Roadside	No	-	-	-	-	21.0
(24) Farmelohan Road, Rutherglen	Roadside	No	-	-	-	-	32.9
(25) Stonelaw Road, Rutherglen	Roadside	No	-	-	-	-	21.0
Sites discontinued in 2011							
Closed Vancouver Drive, East Kilbride	Background	No	18.2	17.9	20.5**	19.2	13.6
Closed Glen Esk, East Kilbride	Background	No	35.0	37.7	12.9	15.0	11.8
Closed Donaldson Road, Larkhall	Roadside	No	31.7	24.8	27.7	23.2	20.0
Closed Ridgemark Drive, Lanark	Background	No	11.5	20.7	13.1	13.3	10.0
Closed Brousterhill, East Kilbride	Roadside	No	-	-	19.3	19.7	15.6

* Triplicate average at colocation study site.

Figure 2.4a: Trends in NO₂ annual mean measured with diffusion tubes 2007 – 2011

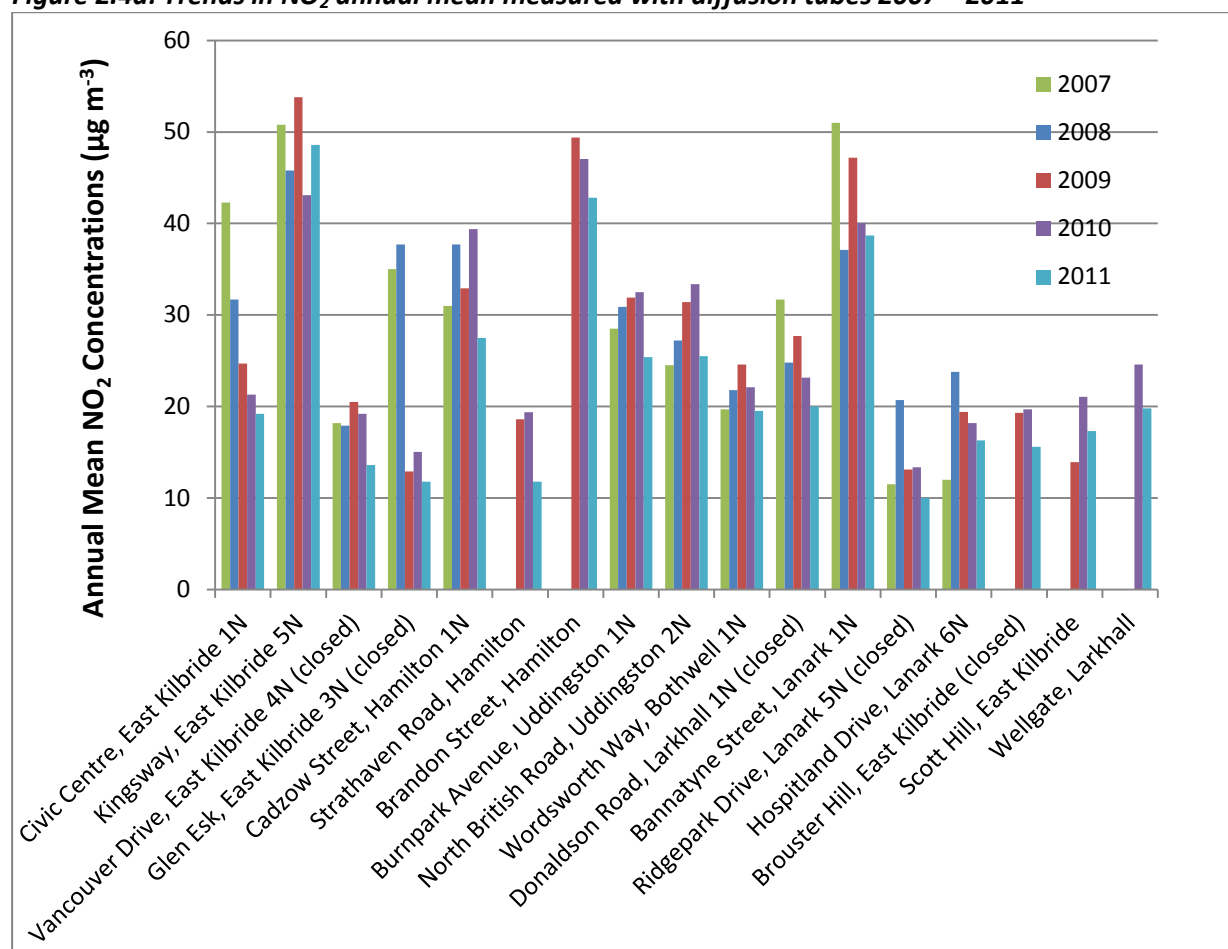
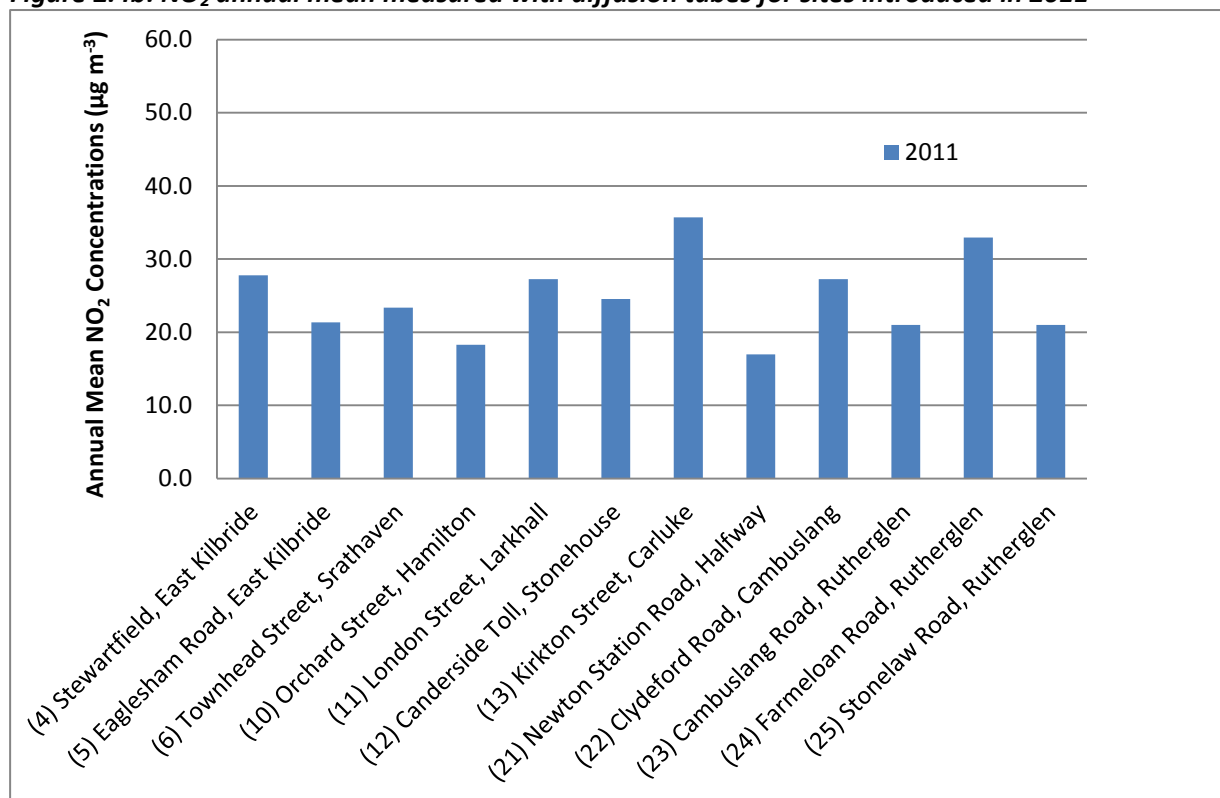


Figure 2.4b: NO₂ annual mean measured with diffusion tubes for sites introduced in 2011



2.2.2 PM₁₀

PM₁₀ concentrations measured at Whirlies and Glespin were below both the annual mean Scottish objective of 18µg m⁻³ and hourly objective of less than seven exceedances per year.

At the Rutherglen site, an annual mean PM₁₀ concentration of 21µg.m⁻³ was measured during 2011 and 21 24-hour mean concentrations in excess of the 50 µg.m⁻³ objective were recorded. South Lanarkshire Council is currently in the process of declaring an AQMA for PM₁₀ at this location.

At the Raith Interchange site an annual mean PM₁₀ concentration of 26 µg.m⁻³ was measured during 2011 with 13 exceedances of the 50 µg.m⁻³ short-term objective. At the Raith Interchange however, the nearest receptor is 60m from the source. Modelling a worst-case PM₁₀ scenario using DMRB, the prediction is a 2.7 µg.m⁻³ increase on the background levels at the receptor, i.e. an approximate concentration of 17.7 µg.m⁻³. This is below the 18 µg.m⁻³ objective, therefore no further action is recommended at this time, though if concentrations rise at the monitoring site action may be required. The details of the DMRB modelling inputs are presented in Appendix B

The annual mean PM₁₀ concentrations measured from 2008 to 2011 are presented in Table 2.7 and Figure 2.5. The number of 24-hour mean PM₁₀ concentrations in excess of the 50 µg.m⁻³ short-term objective; measured from 2008 to 2011 are presented in Table 2.8. Objective exceedances are highlighted in bold.

Figure 2.5: Trends in annual mean PM₁₀ concentrations measured from 2008 – 2011

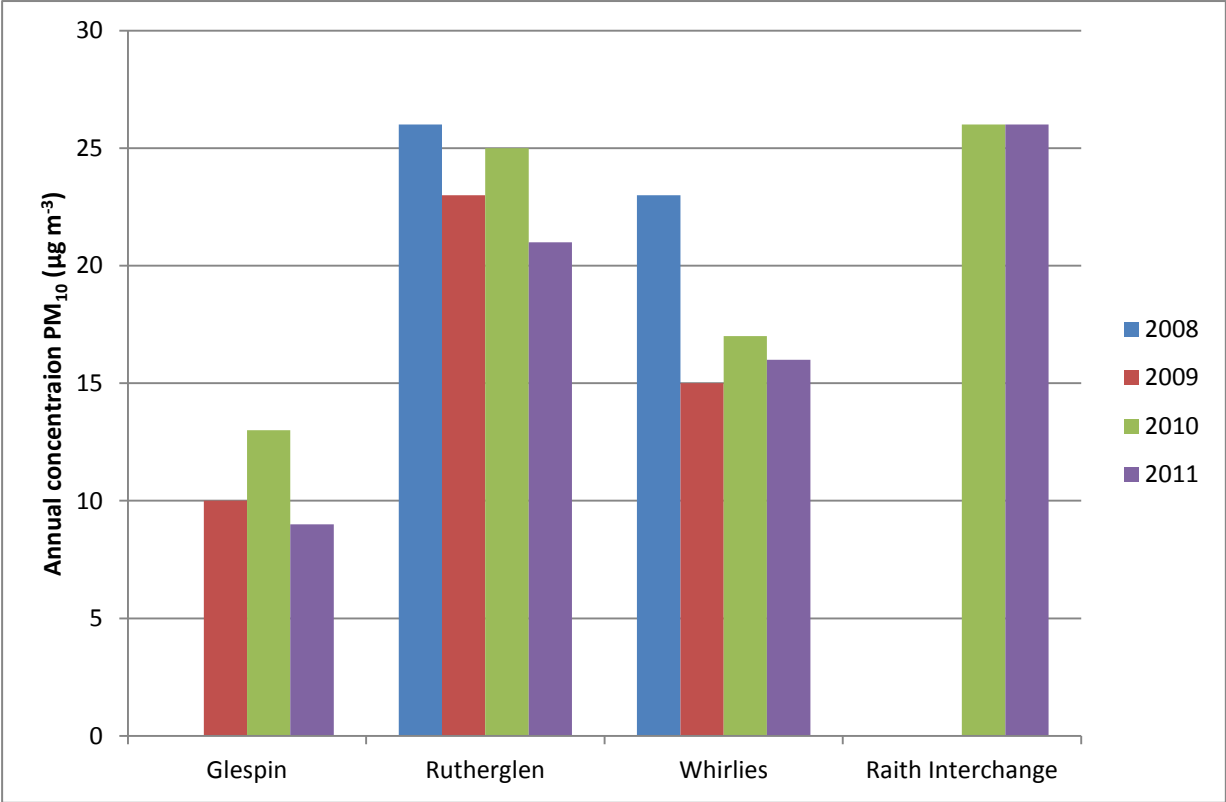


Table 2.7: Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective

Site name	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %	Valid Data Capture 2011 % ^b	Confirm Gravimetric Equivalent	Annual Mean Concentration ($\mu\text{g.m}^{-3}$)			
						2008	2009	2010	2011
Glespin	Roadside	N	90%	58.9%	Y	-	10	13	9
Rutherglen	Roadside	N	90%	82.4%	Y	26	23	25	21
Whirlies	Roadside	Y	90%	94.4%	Y	23	15	17	16
Raith Interchange	Roadside	N	90%	96.2%	Y	-	-	26	26

Table 2.8 Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

Site name	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %	Valid Data Capture 2011 %	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean ($50 \mu\text{g.m}^{-3}$)			
						2008	2009	2010	2011
Glespin	Roadside	N	90%	58.9%	Y	-	0	0	0
Rutherglen	Roadside	N	90%	96.2%	Y	-	-	5	13
Whirlies	Roadside	Y	90%	94.4%	Y	11 (59)	5	5(81)	2
Raith Interchange	Roadside	N	90%	82.4%	Y	9(54)	8 (56)	21	21

2.2.3 Sulphur Dioxide

South Lanarkshire council have not conducted monitoring of SO₂ in 2011.

2.2.4 Benzene

South Lanarkshire council have not conducted monitoring of benzene in 2011.

2.2.5 Other pollutants monitored

South Lanarkshire council have not conducted monitoring of any other pollutants in 2011.

2.2.6 Summary of Compliance with AQS Objectives

South Lanarkshire Council has examined the results from monitoring across the local authority area. Concentrations outside of the AQMAs are all below the objectives at relevant locations, therefore there is no need to proceed to a Detailed Assessment.

The locations where concentrations in excess of the objective have been measured are either within an existing AQMA, or at locations where a Detailed Assessment has been recommended in recent review and assessment reports.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

South Lanarkshire Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

South Lanarkshire Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

South Lanarkshire Council confirms that there are no new/newly identified roads with high flows of buses/HGVs.

3.4 Junctions

A roundabout layout in Hamilton has been changed since the previous updating and screening assessments. The roundabout change, forming a junction between Almada Street, Bothwell Street, Muir Street and The Furlongs in Hamilton, is of particular concern as there is university student accommodation located close to the roadside.

Using traffic flow data, the roundabout was modelled using the DMRB screening tool. The model inputs, outputs, traffic data and link definitions are presented in Appendix B.

The DMRB assessment predicted NO₂ concentrations of 32 µg.m⁻³ and PM₁₀ concentrations of 17.2 µg.m⁻³. As both these values are below their respective objectives, no further action is required due to this change in roundabout layout.

South Lanarkshire Council has assessed new/newly identified junctions meeting the criteria in Section A.4 of Box 5.3 in TG(09), and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

South Lanarkshire confirms that there are no new/proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

South Lanarkshire has identified a section of Almada Street, Hamilton as having a significantly changed traffic flow since the previous Updating and Screening Assessment. Almada Street was previously a one way street between Douglas Street and Burnbank Road. It has been updated such that Almada Street is now a four-lane street, with traffic flowing in both directions. Traffic lights have also been added to the area, which has the potential to increase vehicle idling and congestion. South Lanarkshire Council have recently deployed diffusion tubes in the area to measure NO₂ concentrations. However, due to insufficient data capture during 2011, none of this data has been included in this report.

As recommended in the guidance presented in TG(09), DMRB modelling was performed to screen the impact of road traffic emissions on local air quality. Two junctions, constituting worst-case locations, due to the road layout change and proximity to relevant exposure, were modelled separately in DMRB. These were the Almada Street/Douglas Street junction and the Almada Street/Union Street/Burnbank Road junction. Full details of the DMRB modelling inputs and parameters for each of these scenarios are presented in Appendix B2.

The DMRB model for the Almada Street/Douglas Street junction predicted annual mean NO₂ concentrations of 31.1 µg.m⁻³ and PM₁₀ concentrations of 16.8 µg.m⁻³. Similarly, the results for the Almada Street/Union Street/Burnbank Road junction were 28.5µg.m⁻³ for NO₂ and 15.2 µg.m⁻³ for PM₁₀. As these predictions are below their respective air quality objective values, no further action is required at this stage.

South Lanarkshire Council has assessed new/newly identified roads with significantly changed traffic flows, and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.7 Bus and Coach Stations

First Bus has opened a depot in Blantyre, consisting of a fleet of 200 – 230 buses at which there is a bus flow of 1000 vehicles per day. As this is less than the value of 2,500 vehicles per day set out in TG(09), no further action is currently required.

South Lanarkshire Council has assessed new/newly identified bus stations, and concluded that it will not be necessary to proceed to a Detailed Assessment

4 Other Transport Sources

4.1 Airports

South Lanarkshire Council confirms that there are no airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

4.2.1 Stationary Trains

South Lanarkshire Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

South Lanarkshire Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

South Lanarkshire Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

A proposal for a Waste Incineration Directive at the ScotGen Carlisle Road site at Dovesdale Farm was submitted in 2010. ScotGen has now however withdrawn its application and this is no longer relevant.

South Lanarkshire Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority that have not passed an Air Quality assessment.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

South Lanarkshire Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

South Lanarkshire Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

There are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

South Lanarkshire Council confirms that there are no petrol stations meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

A number of biomass installations have been identified for screening within the South Lanarkshire Council area. The method described TG(09), Box 5.8 has been used. Details of the biomass installations are presented in Table 6.1 below. The relevant nomograms were used to assess if the individual installations were exceeding the relevant pollutant emission rate for NO₂ and PM₁₀. The results are presented in Table 6.2. None of the Biomass sources assessed are exceeding the threshold values presented in TG(09).

South Lanarkshire Council has assessed the biomass sites, and concluded that it will not be necessary to proceed to a Detailed Assessment so long as the above proposals are considered.

Table 6.1 – Biomass Facilities and Relevant Surrounding

Name of Establishment	Power (kW)	Stack Height(m)	Diameter (mm)	Height of Buildings with 5x stack height (m)	Effective Stack Height (m)
St Marks PS, Kirkriggs Avenue, Rutherglen G73 4LY	120	9.0	250	-	14.9
St Peters PS, Highstonehall Road, Hamilton ML3 8LU	300	6.4	300	4.5	3.2
St Marks PS, Sherry Drive, Hamilton ML3 8XF	108	9.2	360	-	15.3
Coalburn PS, Coalburn ML11 0LH	150	10.0	250	7.5	4.2
Blackwood PS, Carlisle Road, Lanark ML11 9SB	165	12.2	300	10.0	3.7
Heathery Knowe PS, Whitehills Terrace EK G75 0NG	145	9.4	25	8.0	2.2
Mossneuk PS, Mossneuk Drive, EK G75 8XQ	140	9.4	250	7.4	3.4
Abercrombie House, EK	250	24.5	300	21.5	5.0

Table 6.2 –Screening Results for Biomass Sources

Name of Establishment	Background concentration		Emission rate		Adjusted emission rate		Exceeding Nomogram value?
	NO ₂ (µg.m ⁻³)	PM ₁₀ (µg.m ⁻³)	NO _x (g/s)	PM ₁₀ (g/s)	NO _x (g/s)	PM ₁₀ (g/s)	
St Marks PS, Kirkriggs Avenue, Rutherglen G73 4LY	18.2	12.3	0.0029	0.0034	0.000133	0.00017	No
St Peters PS, Highstonehall Road, Hamilton ML3 8LU	15.1	12.4	0.0295	0.01	0.001185	0.00051	No
St Marks PS, Sherry Drive, Hamilton ML3 8XF	14.2	12.1	0.0656	0.0138	0.002543	0.000693	No
Coalburn PS, Coalburn ML11 0LH	3.07	10.4	0.0241	0.0067	0.000653	0.000309	No
Blackwood PS, Carlisle Road, Lanark ML11 9SB	8.7	12.2	0.0028	0.0008	0.000088	0.000038	No
Heathery Knowe PS, Whitehills Terrace EK G75 0NG	18.8	12.6	0.0003	0.0001	0.000014	0.000005	No
Mossneuk PS, Mossneuk Drive, EK G75 8XQ	13.6	11.7	0.0195	-	0.000739	-	No
Abercrombie House, EK	14.4	12.2	0.0497	0.0197	0.001941	0.001026	No

6.2 Biomass Combustion – Combined Impacts

South Lanarkshire Council plans to commission a study to quantify and assess the combined impacts of biomass combustion upon receptors within South Lanarkshire. This is planned for completion in 2013. Therefore no further action is recommended at this time, pending the findings of the study.

South Lanarkshire Council has commissioned a Detailed Assessment on the combined impacts of Biomass Combustion, and therefore additional assessments are not required at this stage.

6.3 Domestic Solid-Fuel Burning

South Lanarkshire Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

South Lanarkshire have identified two fugitive sources within their council area – Glentaggart open cast mine and the Broken Cross North (East) mine extension.

Glentaggart Opencast mine

An air quality assessment for Glentaggart was carried out by AMEC on behalf of Scottish Coal. Primarily focusing on the dust and PM₁₀ effects on air quality, the study considered national, regional and local planning guidance, while considering PM₁₀ concentrations in relation to the European Directive, National Air Quality Directive and Local Air Quality Management.

The assessment did not predict exceedances of the PM₁₀ objectives. The report noted that there were no sensitive receptors within 200m of the site. The background annual mean PM₁₀ concentration at Glentaggart from the background maps is 9.1 µg.m⁻³.

The screening criteria for fugitive and uncontrolled sources of PM₁₀ in the TG (09) guidance recommend that, at a location with a background concentration < 16 µg.m⁻³, a detailed assessment of PM₁₀ is required if there is any relevant exposure within 200m of the source of emissions. In this case there is no relevant exposure within 200m so no further action is required.

Broken Cross North (East) mine extension

AMEC were commissioned to conduct an Air Quality assessment of the Broken Cross North (East) Extension. The assessment identified that the nearest relevant exposure is within 200m of the site boundary (Beechfield, 180m) but that it was unlikely that particulate emissions from the mine would lead to an exceedance of the Scottish PM₁₀ air quality objectives. A number of dust mitigation measures were proposed at the site to minimise the impact of dust emissions. The Council was satisfied with the conclusions of the air quality assessment and planning permission was granted for this extension in 2012.

The 2012 background PM₁₀ annual mean concentration at this location is estimated at 10.6 µg.m⁻³ on the Scottish background maps; therefore nearby relevant exposure is defined as within 200m in TG(09).

At the time of writing, South Lanarkshire Council have received 4 dust complaints during 2012, due to visible dust emissions from the Broken Cross site; all of which were from properties over 200m from the site boundary. Investigation of these complaints by the council found evidence of deposited dust on one occasion only. On all occasions when complaints were received, the quarry was visited and suitable dust suppression measures were being practiced on site.

The excavation of the Broken Cross North Extension is planned in phases over the next 7.5 years. Currently there are no on-site sources of PM₁₀ within 200m of the nearest residential property at Beechfield; and no complaints have been received to date from the residents at Beechfield. Based on the screening criteria in TG(09) for fugitive and uncontrolled sources of PM₁₀ it is not currently required to proceed to a Detailed Assessment at this location.

Future phases of the excavation may mean that there are potential sources of fugitive PM₁₀ emissions within 200m of the residential property at Beechfield. The phasing timetable for excavation in the section of the mine close to Beechfield is currently understood to be delayed due to other issues regarding overhead powerlines. It is not therefore currently known when this phase of the excavation will take place. It is recommended that activity at this location is monitored and

South Lanarkshire Council

records of dust complaints maintained for consideration in future rounds of air quality review and assessment.

South Lanarkshire Council has assessed fugitive and uncontrolled sources of PM₁₀, and concluded that it will not be necessary to proceed to a Detailed Assessment at this time.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

The majority of the monitoring data obtained by South Lanarkshire for NO₂ is in compliance with the Scottish Air Quality objectives.

Annual mean NO₂ concentrations in excess of the 40 µg.m⁻³ objective were measured at Whirlies Roundabout, East Kilbride and at Raith Interchange. Neither of these monitoring locations are at locations of relevant exposure. Distance correction calculations predicted concentrations below the objective at the nearest residential properties, therefore no further action is required at this time.

Annual mean NO₂ concentrations in excess of the 40 µg.m⁻³ objective were measured at the Kingsway, East Kilbride and Brandon Street, Hamilton diffusion tube sites.

At Kingsway, East Kilbride, a distance correction calculation predicted an annual mean NO₂ concentration of 40.5 µg.m⁻³ at the nearest residential property. This site is within the existing AQMA for PM₁₀. There is however uncertainty associated with the NO₂ concentration predicted using the distance correction method; and another diffusion tube which is located closer to the nearby residential properties, is reporting a relatively low annual mean NO₂ concentration of 17 µg.m⁻³. Given the combination of these factors, prior to amending the existing PM₁₀ AQMA to also include NO₂; the recommendation is to continue monitoring at this location to observe if measured NO₂ concentrations are increasing and there is a risk of the annual mean objective being exceeded at the nearby residences. Action plan measures are currently being implemented which aim to reduce road traffic emissions at this location.

At Brandon Street, Hamilton the NO₂ annual mean measured during 2011 was 43 µg.m⁻³. A distance correction calculation predicted an NO₂ annual mean of 40.6 µg.m⁻³ at the nearest location of relevant exposure. A Detailed Assessment of NO₂ will be conducted during spring 2013 at this location in Hamilton when sufficient automatic monitoring data will be available to inform the study.

Measured annual mean PM₁₀ concentrations exceeded the 18 µg.m⁻³ objective at Raith Interchange and Rutherglen during 2011. Neither of these sites are however at locations of relevant exposure.

Modelling a worst-case PM₁₀ scenario using DMRB at the nearest relevant exposure to the monitoring site at Raith Interchange, predicted an annual mean PM₁₀ below the objective, hence no further action is currently required.

At Rutherglen, although annual mean PM₁₀ concentrations in excess of the objective were measured during 2011, South Lanarkshire Council is currently in the process of declaring an AQMA for PM₁₀ at this location; therefore no action is required in addition to this.

8.2 Conclusions from Assessment of Sources

The assessment of previously unidentified sources included the following:

Bus Stations

A bus depot was recently opened in South Lanarkshire (First Bus), however the bus flow was substantially less than 2,500, therefore no detailed assessment is required.

Junctions and Roads with Significantly Changed Traffic Flows

Due to road layout changes around the Almada Street area of Hamilton, an assessment using the screening criteria for junctions and roads with significantly changed traffic flows was required. DMRB modelling predicted no exceedances of the NO₂ and PM₁₀ objective values.

Biomass Combustion – Individual Installations

Individual Biomass installations were screened using the method prescribed in LAQM TG (09). There was one source where a detailed assessment may be required, however this site is currently awaiting planning permission, so the recommended action is to specify that a taller stack is used rather than proceed to a detailed assessment.

Biomass Combustion – Combined Impacts

South Lanarkshire Council plans to commission a study to quantify and assess the combined impacts of biomass combustion upon receptors within South Lanarkshire. This is planned for completion in 2013.

Fugitive or Uncontrolled Sources

Two potential fugitive sources of PM₁₀ were identified (open cast mines) within the South Lanarkshire Council area. Assessment of both sources using the relevant screening criteria did not identify a requirement for a Detailed Assessment at this time.

8.3 Proposed Actions

The council are commissioning a study to quantify and assess the combined impacts of biomass combustion upon receptors within South Lanarkshire. This is planned for completion in 2013.

Additional NO₂ diffusion tubes have been deployed in the Almada street area in Hamilton where road changes have been identified.

9 Acknowledgements

AEA gratefully acknowledge the support received from Ann Crossar, Bronah Byrne and Andrew Smith of South Lanarkshire Council when completing this assessment.

10 References

Department for Environment, Food and Rural Affairs, (2009) Local Air Quality Management Technical Guidance LAQM.TG (09).

Department for Environment, Food and Rural Affairs, Air Quality Strategy for England, Scotland Wales and Northern Ireland, 2007.

Spreadsheet of Diffusion Tube Bias Adjustment Factors accessed at <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

Appendices

Appendix A: QA/QC Data

QA/QC of automatic monitoring

South Lanarkshire Council's automatic sites are part of the National Automatic Monitoring Calibration Club, whereby monitoring data are managed to the same procedures and standards as AURN sites by AEA Technology.

Diffusion Tube Bias Adjustment Factors

All passive diffusion tubes (PDT) for NO₂ measurement were prepared and analysed by Edinburgh Scientific Services. The PDTs were prepared using the 50% triethanolamine (TEA) in water method. Edinburgh Scientific Services is a UKAS accredited laboratory with documented Quality Assurance/Quality Control (QA/QC) procedures for diffusion tube analysis. Edinburgh Scientific Services participates in the WASP scheme that is managed by the Health & Safety Laboratory and a monthly inter-comparison exercise that is managed by AEA. The recent WASP round results for Edinburgh Scientific Services are presented as follows, which use the z-score system. The results are the percentage of satisfactory results i.e. those with a z-score of $< \pm 2$.

- Jan – Mar 2011: 100%
- Apr – Jun 2011: 100%
- Jul – Sep 2011: 100%
- Oct – Dec 2011: 0%

Table A.1 Details of the performance of Edinburgh Scientifics in the WASP scheme

	Performance on basis of RPI, OLD CRITERIA, best 4 out of the 5 rounds 105 -109	Performance on basis of RPI, NEW CRITERIA, best 4 out of the 5 rounds 105 - 109
Edinburgh scientific services	Good	Good

The tube precision for Edinburgh Scientific Services for eight co-location studies conducted during 2011 is shown in Table A.2. The results show good precision in the study. The most recently available bias adjustment factor for this laboratory based on the eight co-location studies, detailed in Table A.2 below, was 0.84.

Table A.2: Details of the 2009 bias correction factors for NO₂ diffusion tubes

Site Name	Study duration (months)	Tube precision	Bias correction factor
Marylebone Road Intercomparison	12	Good	0.97
West Lothian Council	11	Good	1.04
City of Edinburgh Council	11	Good	0.87
City of Edinburgh Council	11	Good	0.66
City of Edinburgh Council	12	Good	0.69
City of Edinburgh Council	12	Good	0.77
City of Edinburgh Council	11	Good	0.81
Stirling Council	11	Good	1.02
Overall factor (8 studies)			0.84

Short-term to Long-term Data adjustment

A short to long term data adjustment was applied to eighteen annual mean NO₂ diffusion tube measurements where the data capture was less than 75%. Six separate adjustment ratios were calculated; one for the diffusion tubes that were deployed in August 2011, namely:

- Stewartfield, East Kilbride
- Eaglesham Road, East Kilbride
- Townhead Street, Strathaven
- Orchard Street, Hamilton
- London Street, Larkhall
- Canderside Toll, Stonehouse
- Kirkton Street, Carluke
- Clydeford Road, Cambuslang

The details of the AURN sites used and the ratio calculations are presented in Table A.3.

Table A.3: Short to long term data adjustment derivation (August to December 2011)

Period #	Corresponding Data Capture Period	Relevant Diffusion Tube Sites	Period Mean (Pm)	Ratio (Am/Pm)
Glasgow Anderson	Urban Background	34.6	40.7	0.85
Edinburgh St Leonards	Urban Background	25.2	21.6	1.16
			Average ratio (Am/Pm)	1.01

The second ratio was calculated for the tubes that were deployed in September 2011.

- Newton Station Road, Halfway

The details of the AURN sites used and the ratio calculations are presented in Table A.4.

Table A.4: Short to long term data adjustment derivation (September to December 2011)

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Glasgow Anderson	Urban Background	34.6	45.9	0.75
Edinburgh St Leonards	Urban Background	25.2	21.5	1.17
			Average ratio (Am/Pm)	0.96

The third ratio was calculated for the tubes that were deployed in October 2011 .

- Cambuslang Road, Rutherglen
- Farmeloa Road, Rutherglen
- Stonelaw Road, Rutherglen

The details of the AURN sites used and the ratio calculations are presented in Table A.5.

Table A.5: Short to long term data adjustment derivation (October to December 2011)

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Glasgow Anderson	Urban Background	34.6	48.2	0.72
Edinburgh St Leonards	Urban Background	25.2	23.7	1.06
			Average ratio (Am/Pm)	0.89

The fourth ratio was calculated for the tubes that had no data capture between June and September 2001 (inclusive).

- Burnpark Avenue, Uddingston

The details of the AURN sites used and the ratio calculations are presented in Table A.6

Table A.6: Short to long term data adjustment derivation (Jan – Jun / Sept – Dec 2011)

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Glasgow Anderson	Urban Background	34.6	39.7	0.87
Edinburgh St Leonards	Urban Background	25.2	28.0	0.90
			Average ratio (Am/Pm)	0.89

The fifth ratio was calculated for the tubes that were discontinued after April 2011 .

- (Closed) Vancouver Drive, East Kilbride

The details of the AURN sites used and the ratio calculations are presented in Table A.7.

Table A.7: Short to Long Term data adjustment derivation (Tubes discontinued after April 2011)

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Glasgow Anderson	Urban Background	34.6	38.2	0.76
Edinburgh St Leonards	Urban Background	25.2	33.3	0.91
			Average ratio (Am/Pm)	0.83

The final ratio was calculated for the tubes that were discontinued after May 2011 .

- (Closed) Glen Esk, East Kilbride
- (Closed) Donaldson Road, Larkhall
- (Closed) Ridgepark Drive, Lanark
- (Closed) Brousterhill, East Kilbride

The details of the AURN sites used and the ratio calculations are presented in Table A.8.

Table A.8: Short to Long Term data adjustment derivation (Tubes discontinued after May 2011)

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Glasgow Anderson	Urban Background	34.6	34.6	1.00
Edinburgh St Leonards	Urban Background	25.2	30.6	0.82
			Average ratio (Am/Pm)	0.91

PM₁₀ Monitoring Adjustment

All of the South Lanarkshire Council PM₁₀ monitoring sites use TEOM FDMS analysers therefore no adjustment of the measured PM₁₀ concentrations was required.

Table A.2: NO₂ monthly mean concentrations measured at diffusion tubes sites 2011

Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	Data Capture	Requires annualised?	Bias adjusted annual mean (µg.m ⁻³) (0.84 adj factor)
(1) Civic Centre, East Kilbride	31	29	22	23	13	-	21	22	18	22	31	20	22.9	91.7	N	19.2
(2) Kingsway, East Kilbride	80	75	60	44		-	49	60	55	48	47	60	57.8	83.3	N	48.6
(3) Scott Hill, East Kilbride	31	32	27	18	10	-	16	19	18	16	17	22	20.5	91.7	N	17.3
(4) Stewartfield, East Kilbride	-	-	-	-	-	-	-	34	29	28	37	36	32.8	41.7	Y	27.8
(5) Eaglesham Road, East Kilbride	-	-	-	-	-	-	-	27	23	21	30	25	25.2	41.7	Y	21.3
(6) Townhead Street, Strathaven	-	-	-	-	-	-	-	30	26	26	30	26	27.6	41.7	Y	23.4
(7) Strathaven Road, Hamilton	19	24	12	13	18	-	-	13	12	14	10	10	14.0	91.7	N	11.8
(8) Brandon Street, Hamilton	63	63	51	37	40	-	-	51	50	47	57	54	50.9	91.7	N	42.8
(9) Cadzow Street, Hamilton	45	38	38	31	23	-	-	32	31	27	36	31	32.7	91.7	N	27.5
(10) Orchard Street, Hamilton	-	-	-	-	-	-	-	19	18	19	28	24	21.6	41.7	Y	18.3
(11) London Street, Larkhall	-	-	-	-	-	-	-	32	30	31	32	36	32.2	41.7	Y	27.2
(12) Canderside Toll, Stonehouse	-	-	-	-	-	-	-	33	28	29	35	20	29.0	41.7	Y	24.5
(13) Kirkton Street, Carluke	-	-	-	-	-	-	-	45	36	48	35	47	42.2	41.7	Y	35.7
(14) Hospitland Drive, Lanark	23	34	19	9	16	-	18	9	13	19	24	29	19.4	91.7	N	16.3
(15) Bannatyne Street, Lanark	52	67	39	56	36	-	50	50	39	32	47	39	46.1	91.7	N	38.7
(16) Wellgate, Lanark	26	38		21	15	-	24	22	21	20	26	23	23.6	83.3	N	19.8
(18) Wordsworth Way, Bothwell	25	40	23	23	14	-	22	20	16	22	29	22	23.3	91.7	N	19.5
(19) North British Road, Uddingston	32	55	28	33	17	-	32		21	24	33	29	30.4	83.3	N	25.5
(20) Burnpark Avenue, Uddingston	40	47	37	31	16	-	-	-	-	30	38	34	34.1	66.7	N	25.4
(21) Newton Station Road, Halfway	-	-	-	-	-	-	-	-	15	18	28	23	21.0	33.3	Y	17
(22) Clydeford Road, Cambuslang	-	-	-	-	-	-	-	-	46	28	23	32	32.2	41.7	Y	27.2

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Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	Data Capture	Requires annualised?	Bias adjusted annual mean ($\mu\text{g.m}^{-3}$) (0.84 adj factor)
(23) Cambuslang Road, Rutherglen	-	-	-	-	-	-	-	-	-	27	35	22	28.0	25.0	Y	21
(24) Farmelohan Road, Rutherglen	-	-	-	-	-	-	-	-	-	40	48	44	44.0	25.0	Y	32.9
(25) Stonelaw Road, Rutherglen	-	-	-	-	-	-	-	-	-	22	38	24	28.0	25.0	Y	21
Sites dis-continued during 2011																
Closed Vancouver Drive, East Kilbride	22	22	20	14	-	-	-	-	-	-	-	-	19.5	33.3	Y	13.6
Closed Glen Esk, East Kilbride	21	21	15	12	8	-	-	-	-	-	-	-	15.4	41.7	Y	11.8
Closed Donaldson Road, Larkhall	22	40	20	34	17	-	-	-	-	-	-	-	26.6	41.7	Y	20
Closed Ridgemark Drive, Lanark	15	21	12	8	7	-	-	-	-	-	-	-	12.6	41.7	Y	10
Closed Brousterhill, East Kilbride	28	29	19	16	10	-	-	-	-	-	-	-	20.4	41.7	Y	15.6

Appendix B: DMRB Calculations

The DMRB screening model was used to assess road traffic emissions at three locations:

- 1) PM₁₀ concentrations at the nearest-relevant exposure to the automatic monitoring site at Raith Interchange
- 2) NO₂ and PM₁₀ predicted concentrations due to road layout change at Almada Street, Hamilton.
- 3) NO₂ and PM₁₀ predicted concentrations due to roundabout layout change at the Almada Street/Bothwell Street junction in Hamilton.

B1 Raith Interchange

Annual mean PM₁₀ concentrations in excess of the 18 µg.m⁻³ objective were measured at Raith Interchange, to assess if there is a risk of the objective being exceeded at the nearest relevant exposure, the data presented in Table B.1 was input into the DMRB model to assess relevant exposure at the nearest receptor.

Traffic flow and fleet split data were accessed from the nearest Transport Scotland 2010 traffic count location in the area and was considered representative of a worst case traffic flow scenario.

Table B.1 Input Data

Location: Raith Interchange			Background PM ₁₀ : 15µg.m ⁻³				
Location/ Receptor	Link number	Distance from link centre to receptor (m)	Traffic flow & speed		Traffic composition		
			AADT (combined, veh/day)	Annual average speed (km/h)	Road type (A,B,C,D)	Total % LDV (<3.5t GVW)	Total % HDV (>3.5t GVW)
A (Receptor)	1	60	48000	55	A	90	10
	2	60	22000	55	A	90	10
B (Monitor)	1	2	48000	55	A	90	10
	2	20	22000	55	A	90	10

Verification

As there is monitoring data for the area, the DMRB model predictions can be verified:

$$\text{Verified Concentration (not including background)} = \frac{(\text{DMRB Predicted @ receptor} - \text{Background}) \times (\text{Measured Data @ Monitor} - \text{Background})}{(\text{DMRB Predicted @ Monitor} - \text{Background})}$$

Results

The results were as follows:

DMRB Prediction @ Receptor: $16.3\mu\text{gm}^{-3}$

DMRB Prediction @ Monitor: $19.4\mu\text{gm}^{-3}$

Measured Data @ Monitor: $26\mu\text{gm}^{-3}$

Verified Concentration (including Background): 17.7 (i.e. less than the objective)

In addition, the DMRB predicted no exceedences of the 24-hour mean PM_{10} objective at the receptor. Hence the DMRB model confirms there is no relevant exposure at the nearest receptor to Raith Interchange.

A map of the area is presented in Figure B1.

B2 Almada Street Road Layout Change

Due to a significant road layout change at a section of Almada Street, Hamilton, DMRB modelling was conducted to assess the potential impact of the road layout changes on local air quality. DMRB modelling was carried out for two separate locations within this area:

- 1) Almada Street / Douglas Street junction
- 2) Almada Street / Union Street / Burnbank Road junction

Details of the modeling inputs are presented in Table B.2. The background concentrations of PM_{10} were adjusted by subtracting the relevant sector contribution to avoid double counting of PM_{10} emissions from road vehicles. The results of the DMRB model are presented in Table B.3. A map of the location is presented in Figure B1.

No verification of the DMRB calculations was conducted, as there was no monitoring of NO_2 or PM_{10} at either of the locations assessed.

B3 Roundabout Layout Change: Almada Street, Hamilton

To account for the roundabout layout change at the Almada Street/ Bothwell Street/ Muir Street and The Furlongs in Hamilton where there is university student accommodation close to the roadside. The DMRB screening model was used to assess the potential impact of the road layout changes upon local air quality.

The details of the modeling inputs are presented in Table B.2. The background concentrations of PM_{10} were adjusted by subtracting the relevant sector contribution to avoid any double counting of PM_{10} emissions from road vehicles.. The results of the DMRB model are presented in Table B.3. A map of the location is presented in Figure B1.

No verification of the DMRB calculations was conducted, as there was no monitoring of NO_2 or PM_{10} at the location assessed.

Table B2: DMRB Modelling inputs, Junctions and Road Changes

Background (μgm^{-3})	PM ₁₀		NO ₂
	13.3		22.7

	Link number	Distance from link centre to receptor (m)	Traffic flow & speed		Traffic Composition		
			AADT (combined, veh/day)	Annual average speed (km/h)	Road type (A,B,C, D)	Vehicles <3.5t GVW (LDV)	Vehicles>3.5t GVW (HDV)
						Total % LDV	Total % HDV
Roundabout Layout Change	1	5	20250	24	A	95.3	4.7
	2	35	25945	24	A	96.2	3.8
	3	50	7000	24	B	98	2
Aimada St / Douglas St Junction	1	4	20250	25	A	95.3	4.7
	2	4	10000	25	B	98	2
Aimada St / Muir St / Burnpark Rd Junction	1	47	20250	25	A	95.3	4.7
	2	33	10925	25	A	89.4	10.6

Table B3: Results of DMRB Modelling, Junctions and Road Changes

Modelling Area	NO ₂	PM ₁₀	
	Annual Mean	Annual Mean	Days Exceeding 50µgm ⁻³
	(µgm ⁻³)	(µgm ⁻³)	
Roundabout Layout Change	32	17.2	1
Almada St/ Douglas St Junction	31.1	16.8	1
Almada St / Muir St / Burnpark Rd Junction	28.5	15.2	0

Figure B1a: Raith Interchange Roundabout

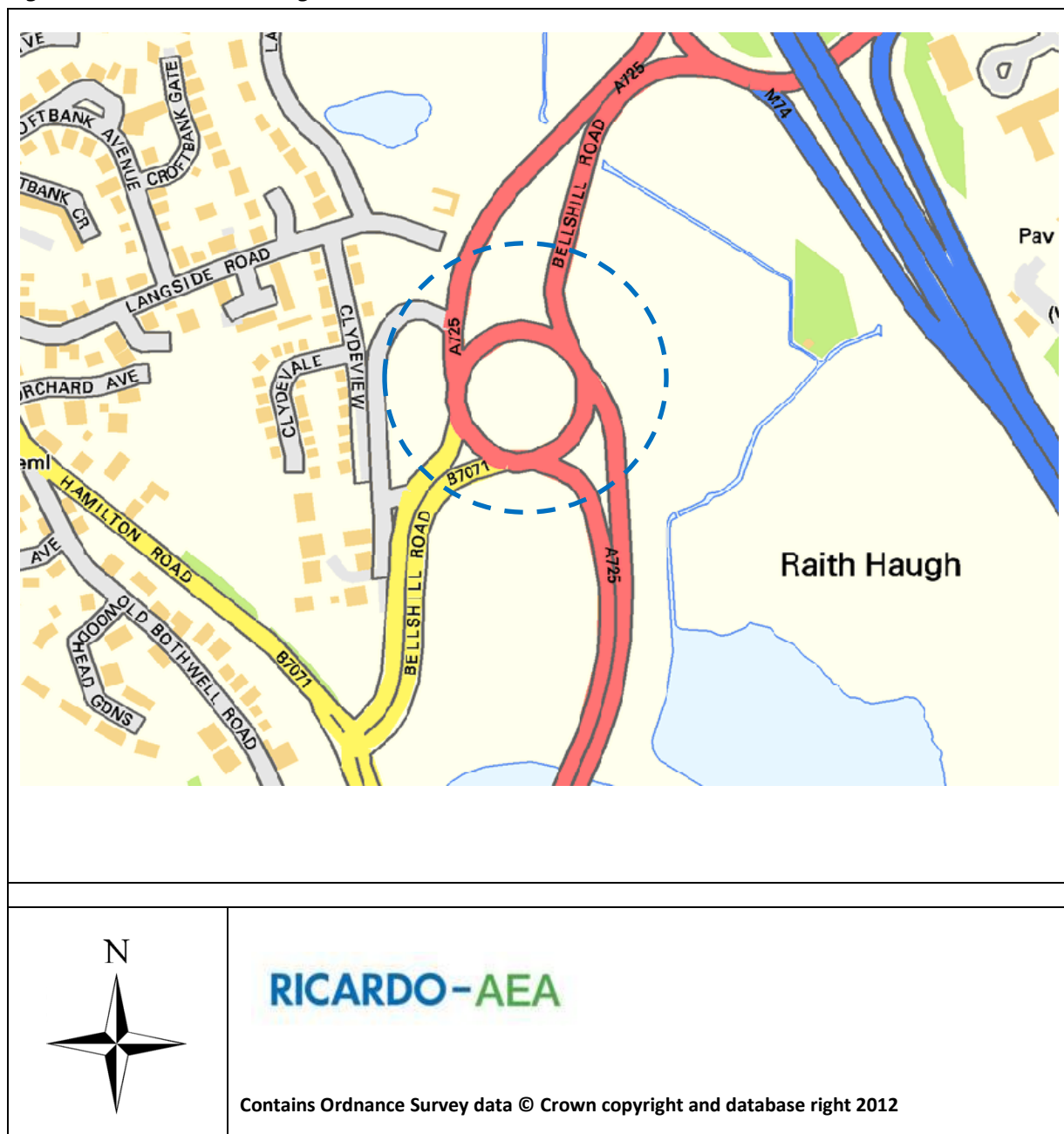


Figure B1b: Roundabout Layout Change, Hamilton

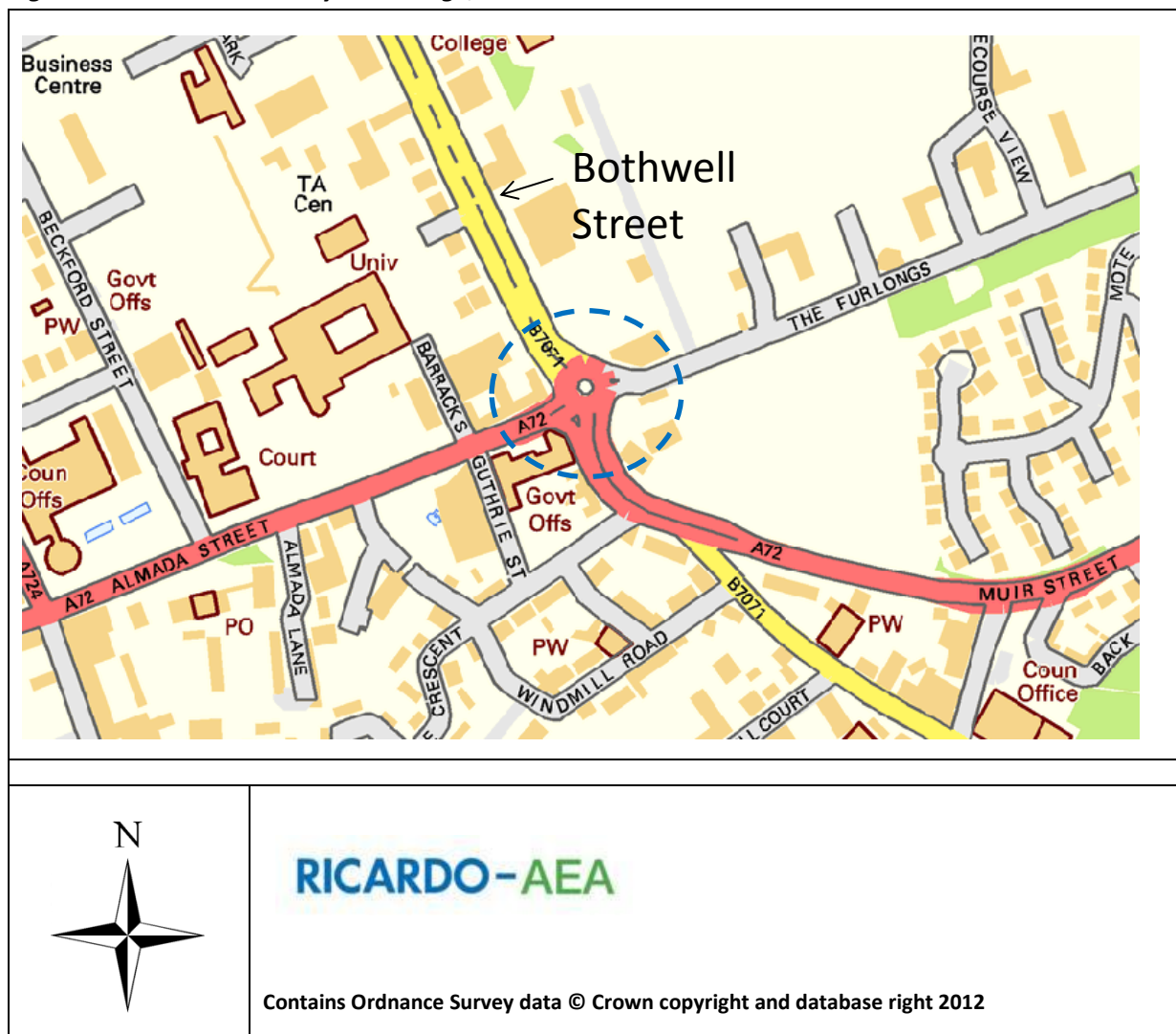


Figure B1c: Almada St / Douglas St Junction

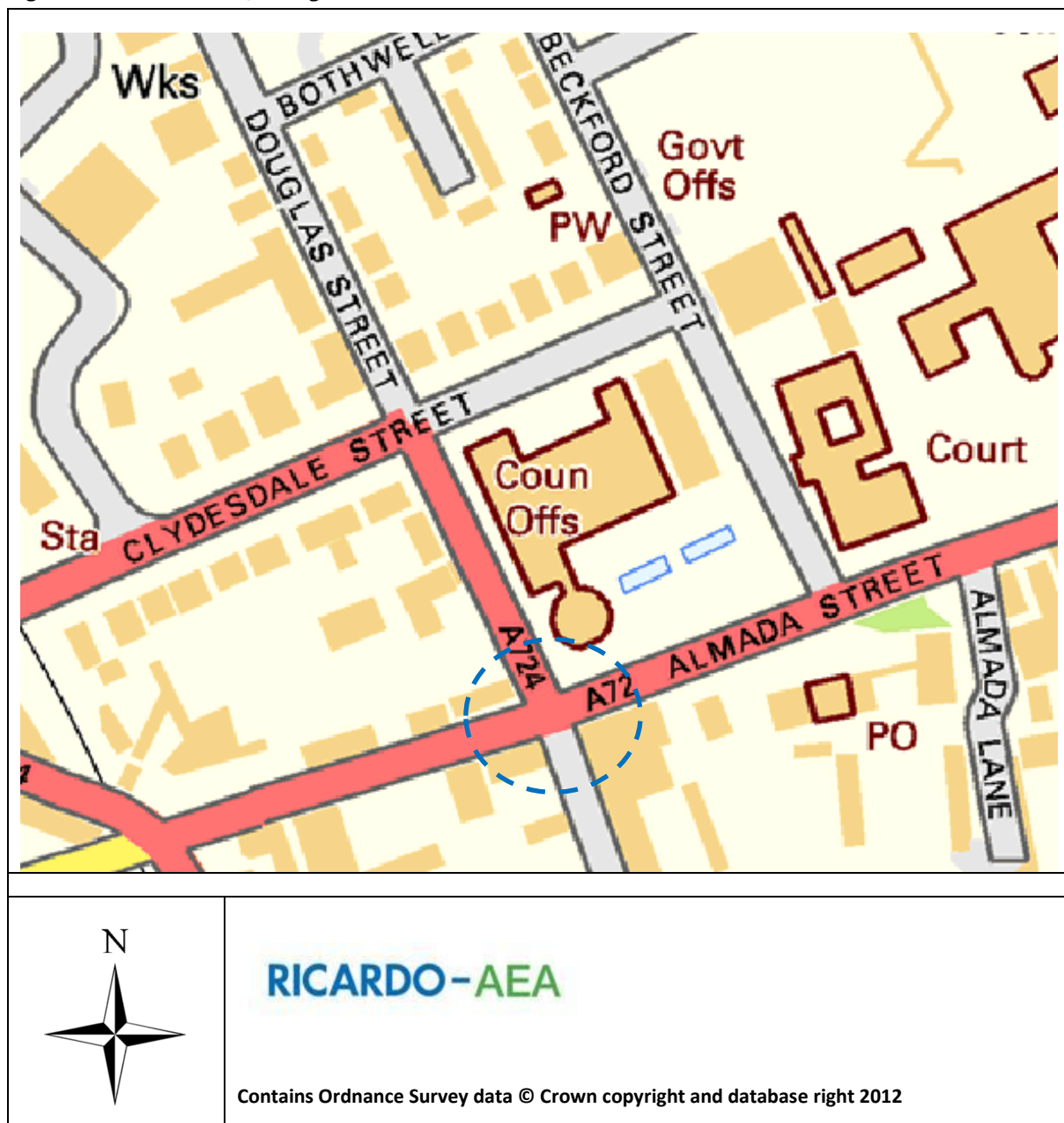


Figure B1d: Almada St / Union St / Burnpark Road Junction

