Appendix II

Swale Strategic AQAP 2018 - 2022

Report 1: Source Apportionment and Options Assessment

Swale Strategic AQAP 2018 Report 1: Source Apportionment and Options Assessment

March 2018

Swale Borough Council

Swale House East Street
Sittingbourne
Kent
ME10 3HT

	Name	Date
Written By	Nigel Jenkins Emilia Pruszkowski	22/03/2018
Checked By	Emilia Pruszkowski	26/03/2018
Authorised By	Nigel Jenkins	27/03/2018
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1. Introduction

1.1 This report forms the first report in the series of reports to support Swale Borough Council in the development of the Swale Strategic Air Quality Action Plan (AQAP) 2018 - 2022.

1.2 The Swale Strategic AQAP will be developed through early 2018, for consultation in mid-2018.

Swale Strategic AQAP Stages

1.3 The 2017 Swale Interim AQAP set out the program for developing the Swale Strategic AQAP. The Strategic AQAP program is being developed through 3 stages:

Stage I

Review and update existing AQAP and set out strategic approach and potential measures for development of Swale Strategic AQAP.

- Output: Interim AQAP (2017). (Completed September 2017)

Stage II

Further develop AQAP steering groups and develop AQAP options/measures to be assessed. Assess viability and air quality benefits of measures for internal engagement and consultation.

- Output: Strategic AQAP assessment (2017/18).

Stage III

Draft Strategic AQAP for Swale BC consultation and preparation for public consultation (early 2018), finalise Strategic AQAP and implementation plans.

- Output: Swale Strategic AQAP (2018 – 2022)

Strategic AQAP - Stage II program

1.4 To support the AQAP Stage II development, the following air quality assessments and reports will be provided by Phlorum Ltd.

1.5 Stage II is the assessment stage of the Strategic AQAP development. A review of current air quality and emissions from pollutant sources is undertaken to assess the sources of local pollution. In the case of the Swale Air Quality Management Areas (AQMAs), the main emissions sources of concern are from local traffic.

1.6 The main focus of the Stage II assessments will be to determine current transport emissions and develop measures and strategies to reduce emissions and exposure.

1.7 The Stage II program is presented in Table 1.1 below.

Table1.1: Swale Strategic AQAP program

Task	Assessment	Reports
I	**AQMA review:** Traffic data review and commissioning ANPR and ATC surveys	
II	**AQMA assessment:** Traffic assessment Source apportionment Baseline AQMA Air Quality modelling AQAP options assessment	**Report 1:** **Source apportionment and options assessment report**
III	**AQMA options appraisal:** Emissions reduction assessment AQMA options modelling Cost benefit analysis (CBA)	**Report 2:** **AQMA options assessment and Cost Benefit Analysis**
IV	**Final Report:** Options consultation and review Options appraisal	**Report 3:** **Final AQAP Report**

1.8 This report (Report 1) forms part of Stage II development of the Strategic AQAP and includes Task I and II results.

2. Swale Strategic AQAP

Objectives of the Swale Strategic AQAP

2.1 A Swale Interim AQAP was developed in 2017 to set out the objectives of the Council to develop a Swale Strategic AQAP (2018 – 2022).

2.2 The objectives of the Swale Strategic AQAP are to include:

- Clear vision and direction for the Swale Strategic AQAP;
- Strategic and focused actions and measures to improve air quality across the borough and as well as within the declared Swale AQMAs;
- Detailed assessment and qualification of agreed actions and measures within the AQAP;
- Full consultation and engagement process with all stakeholders and delivery partners on the key actions and measures within the AQAP; and
- Implementation and delivery plan for the AQAP through 2018 – 2022.

2.3 The Swale Strategic AQAP is to be delivered between 2018 and 2022 and will target reductions in concentrations of local air pollutants and exposure to air pollution.

2.4 The key priority of the Strategic AQAP is to deliver compliance of the AQS within the AQMAs, but also to improve air quality across the Borough. The key AQAP priorities are:

Priority 1:

- Undertake revised impact assessment of AQMA traffic and emissions reductions measures required at each AQMA.

Priority 2:

- Development of local AQMA and wider strategic measures.

Priority 3:

- Develop measures which focus on key emissions reduction measures from the HGV and LGV fleet travelling through the AQMAs.

Priority 4:

- Ensure wider engagement with all key stakeholders and lead by example in promoting clean air initiatives and measures to reduce emissions.

3. Swale Air Quality Management Areas

Swale Air Quality Management Areas

3.1 Swale Borough Council has 5 locations which exceeded the annual air quality standard (AQS) for nitrogen dioxide (NO_2) and subsequently declared 5 AQMAs within the Borough.

3.2 The AQMAs are listed below:

- AQMA 1: Newington, (A2 /High St) declared 2009;
- AQMA 2: Ospringe Street, Faversham (A2/Ospringe) declared in June 2011 and revised (as AQMA 6) to the Mount in May 2016;
- AQMA 3: East Street, Sittingbourne (A2/Canterbury Road) declared January 2013;
- AQMA 4: St Pauls Street, Milton, Sittingbourne (B2006) declared January 2013; and
- AQMA 5: Teynham (A2/London Rd) declared December 2015.

3.3 AQMAs 1, 2, 4 and 5 are situated on the A2 which is a major transport corridor through Swale. AQMA 3 is located within the Sittingbourne urban centre.

Pollutants of concern

3.4 The major pollutant of concern is NO_2, however small respiratory sized particulates are also a concern to human health. Therefore, although the assessment of air quality within the AQMAs will focus on NO_2 impacts and reduction measures, particulates smaller than 10 and 2.5 microns in size (PM_{10} and $PM_{2.5}$) will also be assessed. The PM_{10} and $PM_{2.5}$ results will be provided in the final report.

3.5 The sources of pollutants which impact the Swale AQMAs are presented in the Chapter 6 (NOx Emissions Source Apportionment). The major source of emissions which impact the concentration exposures at receptors in these locations is from road traffic.

3.6 Other (background) air pollutant sources contribute to local pollution. These include emissions from; domestic, commercial, industrial, marine or transboundary emissions. These emissions are accounted for in this assessment and identified as background emissions.

3.7 Background concentrations of NO_2 account for up to one third of the total of NO_2 concentrations within the urban centre AQMA at St. Pauls, whereas background concentrations of NO_2 account for up to one fifth of NO_2 in other AQMA locations on the A2. The background concentrations for each AQMA are identified in Chapter 7.

4. Assessment Methodology

4.1 Each AQMA will be assessed in line with the AQAP priorities and options for improving air quality through AQAP measures.

4.2 The methodology for assessing each AQMA follows the LAQM TG(16) (updated Feb 2018[1]) methodology set-out in sections 2.09 - 2.35. The key assessment methodology this assessment follows is detailed in sections 2.13 – 2.24; these include sections titled:

- 2 - Undertake Appropriate Local Monitoring and Assessment (Source Apportionment) for Development Phase
- 3 - Decide what Level of Actions are Required

Assessment Process

4.3 The assessment process for determining the concentrations of pollutants in Swale's AQMAs and assessing potential Action Plan options is as follows:

1. Traffic assessment:
    - Undertake up-to-date detailed traffic assessments.
        - Categorise the fleet: volumes, type and Euro classifications.
2. Source Apportionment:
    - Assess the NOx sources of pollutants from the traffic.
        - Undertake NOx source apportionment of vehicle types, Euro class and volumes.
3. Baseline air quality modelling:
    - Detailed dispersion modelling assessment is undertaken to provide a detailed picture.
        - Modelling assessment of current and future years (2020/2022) to determine baseline AQMA NO_2 concentrations.
4. NO_2 source apportionment:

[1] https://laqm.defra.gov.uk/technical-guidance/

- Identify the extent to which different key sources contribute to the air quality exceedances that have been identified.
    - Determine vehicle sector contributions of NO_2 within the AQMAs and required concentration reductions to achieve compliance.

5. AQMA options review:
    - Determine the scale of effort required in the AQAP to tackle air pollution within AQMAs required to attain the objectives.
        - Quantifying the (NOx) emission reduction required for the area of concern will allow a range or combination of measures that have the potential to deliver the emissions reductions.

5. Traffic Assessments

Traffic Assessment

5.1 Traffic assessments are required for detailed air quality assessments to determine key factors used in the source apportionment of transport emissions, air quality modelling and determining Action Plan options and measures.

5.2 Detailed traffic count data required for the assessment are:

- Volumes
- Vehicle classes (cars, LGV, HGV, bus/coach etc.)
- Speed
- Euro category (EU emissions standards)

5.3 Euro categories are an essential element to determining the emissions from the local traffic and identifying higher emitting sectors of the vehicle categories. Identifying the Euro categories enable emissions calculations to be more accurate for the fleet of vehicles in each locality. Euro categories have introduced stricter pollutant emissions limits over time (since 1993 (Euro 1/I)[2] and therefore detailed data enables a more detailed understanding of which vehicles are emitting pollutants locally.

Traffic Count Sources

5.4 Traffic data can be acquired through Department for Transport (DfT) count sites, local traffic counts undertaken by the Highways Authority (Kent County Council (KCC)) or commission traffic surveys.

5.5 The DfT provide traffic data for major roads across the UK[3]. There are specific DfT traffic count points across Kent including the A2 sections close to the Swale AQMAs with the exception of the St. Pauls AQMA.

5.6 DfT counts provide annual average daily flows (AADF) data on vehicle categories and total volumes.

5.7 There were no available Kent County Council Traffic data for the AQMA locations.

[2] Euro category stages are typically referred to as Euro 1, Euro 2, Euro 3, Euro 4, Euro 5 and Euro 6 for Light Duty Vehicle standards. The corresponding series of standards for Heavy Duty Vehicles use Roman numerals.
[3] https://www.dft.gov.uk/traffic-counts/cp.php?la=Kent

5.8 Traffic counts were commissioned by Swale Borough Council with Traffic Data Centre (TDC) at locations in or adjacent to the AQMAs. The traffic surveys were undertaken using Automatic Traffic Counters (ATC) and Automatic Number Plate Recognition (ANPR) cameras.

Automatic Traffic Count (ATC) Surveys

5.9 The ATC traffic surveys identify traffic information in each direction of a carriage-way as follows:

- Speeds, vehicle category and total volumes.

5.10 The ATC counts were undertaken over 7 days from 22nd January 2018 and were located at:

- ATC 1 – 7: locations around East Street (A2) AQMA
- ATC 8 -10: at St Pauls AQMA
- ATC 11: London Road (A2) east of A249
- ATC 12: Key Street (A2) in Newington AQMA
- ATC 13: Ospringe AQMA

5.11 ATC locations are provided in Figures 1- 3.

Automatic Number Plate Recognition (ANPR) Surveys

5.12 The ANPR traffic surveys were undertaken using ANPR cameras with on-site ATC counters. ANPR surveys identify vehicles through camera shots after which data was securely archived by TDC and sent to the Driver and Vehicle Licensing Agency (DVLA) to request vehicle information.

5.13 DVLA provided the relevant vehicle information which is used in the assessment,. These include:

- Volumes, vehicle classes and individual vehicle Euro categories.

5.14 The ATC data provided complimentary data to validate the ANPR counts and included additional information on:

- Speed

5.15 The ATC counts provide complementary volume data used in the analysis at the ANPR survey locations as ANPR data capture can be lower than ATCs due to camera obscuration. For example, number plates can be obscured by other vehicles in front, dirty plates or number plates not on a vehicle or in a different position.

5.16 The ANPR surveys were undertaken over a 2-day (48hr) period between the 9th and 10th January 2018 and were located at:

- Newington (A2) AQMA
- Key St (A2) east of A249
- Ospringe (A2) AQMA

5.17 ANPR locations are provided in Figure 4.

Traffic Survey Analysis

5.18 The traffic surveys undertaken in 2018 provided detailed information on vehicular movements through the AQMAs. Tables 5.1 and 5.2 provide the summary data from the traffic surveys undertaken at the ATC and ANPR survey locations.

5.19 Vehicles are categorised in the surveys under six classes:

- Car (passenger cars, taxi)
- LGV (Light Goods Vehicles i.e. vans)
- *OGV1 (Ordinary Goods Vehicle 1 - rigid vehicles with 2 or 3 axles)
- *OGV2 (Ordinary Goods Vehicle 2 rigid vehicles with >4 axles and all articulated vehicles)
- PSV (Passenger service vehicles - buses and coaches)
- Motorcycles

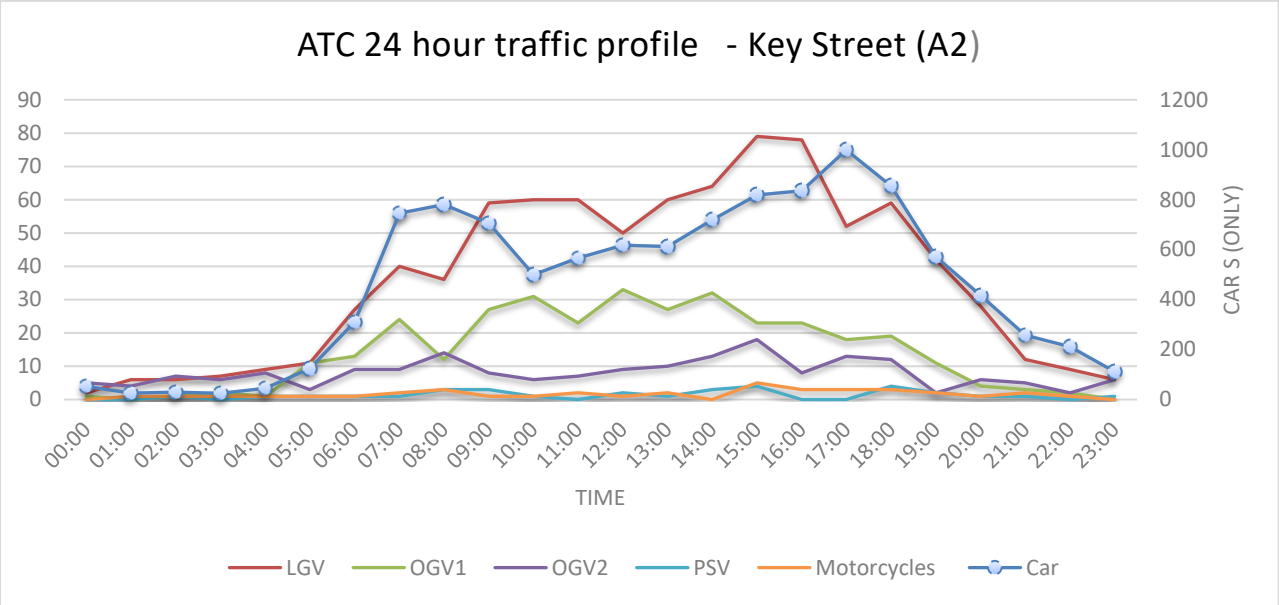
*Note: OGV1 and OGV2 are often combined and categorised as Heavy Goods Vehicles (HGV)

Table 5.1 – Summary of Swale ATC traffic surveys (2018)

Traffic survey locations	AADT	Mean Speed (mph)
1 High Street West of Bell Road	1299	15.1
2 Bell Road South of East Street	7480	23.9
3 Crown Quay Lane South of St Michael's Road	7831	17.1
4 East Street West of West Lane	1677	15.1
5 East Street West of Shakespeare Road	21631	22.0
6 A2 St Michael's Road South of Shortlands Road	18344	21.9
7 A2 St Michael's Road South of Shortlands Road	18344	21.9
8 Staplehurst Road East of Windmill Road	18482	27.9
9 Chalkwell Road South of Romney Court	9818	19.1
10 St Paul's Street West of High Street	17891	26.4
11 Key Street (A2) ANPR	24448	23.6
12 Newington AQMA ANPR	16269	31.0
13 Ospringe AQMA ANPR	19081	24.8

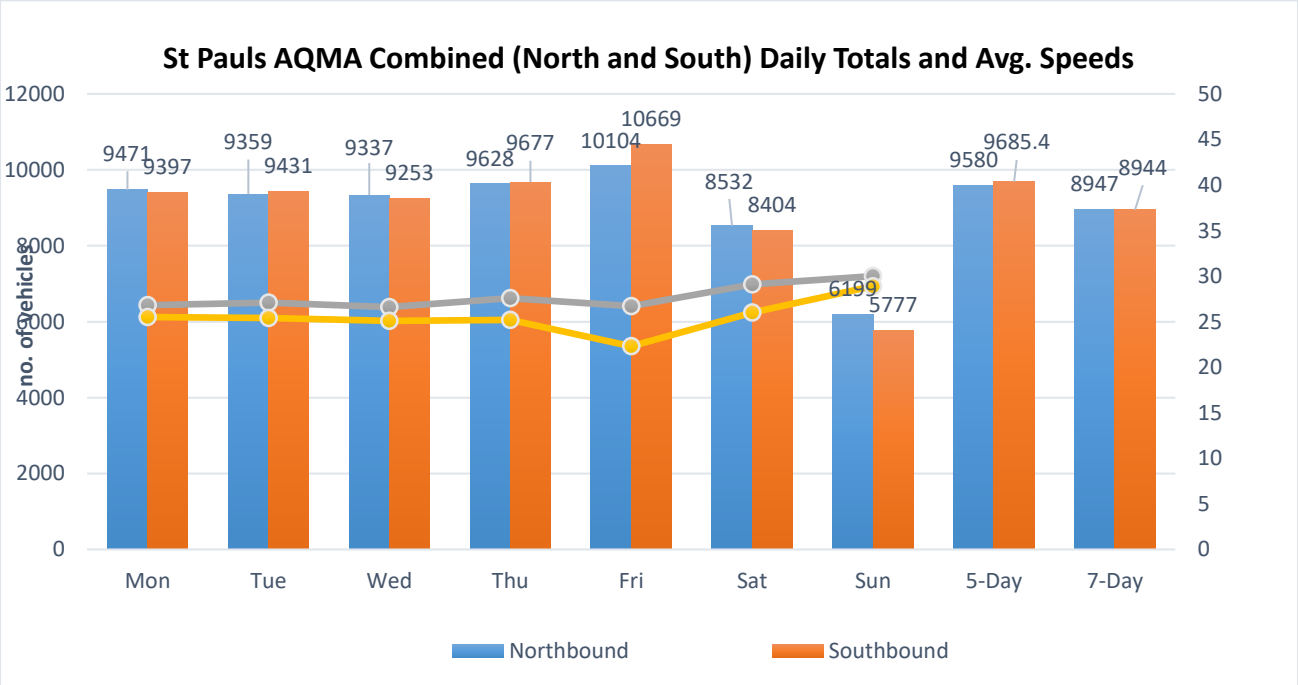
5.20 A typical mid-week traffic flow profile is provided in Graph 5.1.

Graph 5.1 – Typical 24-hour traffic profile – Key Street (A2)



5.21 Daily ATC traffic flows taken in St Pauls AQMA highlighted typical weekly variation in traffic flows.

Graph 5.2 – Typical weekly traffic profile – St Pauls AQMA



5.22 The ANPR survey location data provided the following detailed table identifying volumes, speeds and vehicle classes of the traffic at each location.

Table 5.2 – Summary of Swale ANPR traffic surveys (2018)

2018	Key Street (A2)		Newington AQMA		Ospringe AQMA	
Vehicle Class	Number	%	Number	%	Number	%
Car	21599	87.9	14103	85.9	17488	91.2
LGV	1858	7.6	1505	9.2	677	3.5
OGV1	638	2.6	466	2.8	486	2.5
OGV2	306	1.2	153	0.9	421	2.2
PSV	48	0.2	44	0.3	9	0.0
Motorcycles	111	0.4	140	0.9	100	0.5
Total Vehicles	24558		16409		19181	

5.23 The ANPR survey locations identified similar traffic ratios (percentages) to the ATC sites. As with all the sites on the A2, the traffic volumes were dominated by passenger (car) and light goods vehicles (LGV) sectors.

Euro Category Characterisation

5.24 EU directives have set out European emission standards for passenger and HGV category vehicles known as Euro categories. The identification of vehicle Euro category through ANPR enables the characterisation of the emissions profile of vehicles travelling through the AQMAs.

5.25 ANPR surveys identified number plates and this data was sent to DVLA who provided detailed information on the vehicle Euro category. This Euro category was thereafter used to refine the emissions profile of each AQMA location to provide a more accurate assessment of vehicles traveling through these locations.

5.26 To analyse the Euro categories, the traffic data the data was aggregated to produce Euro category outputs in 3 vehicle categories. The following groups were created; Cars (Cars + motorcycles), LGV and HGV (OGV1 = OGV2 + PSV).

5.27 The ANPR data provided the following summary tables, which identify the volumes and percentages of Euro categories of the traffic at each location.

Table 5.3 – Summary of ANPR survey location Euro categories totals

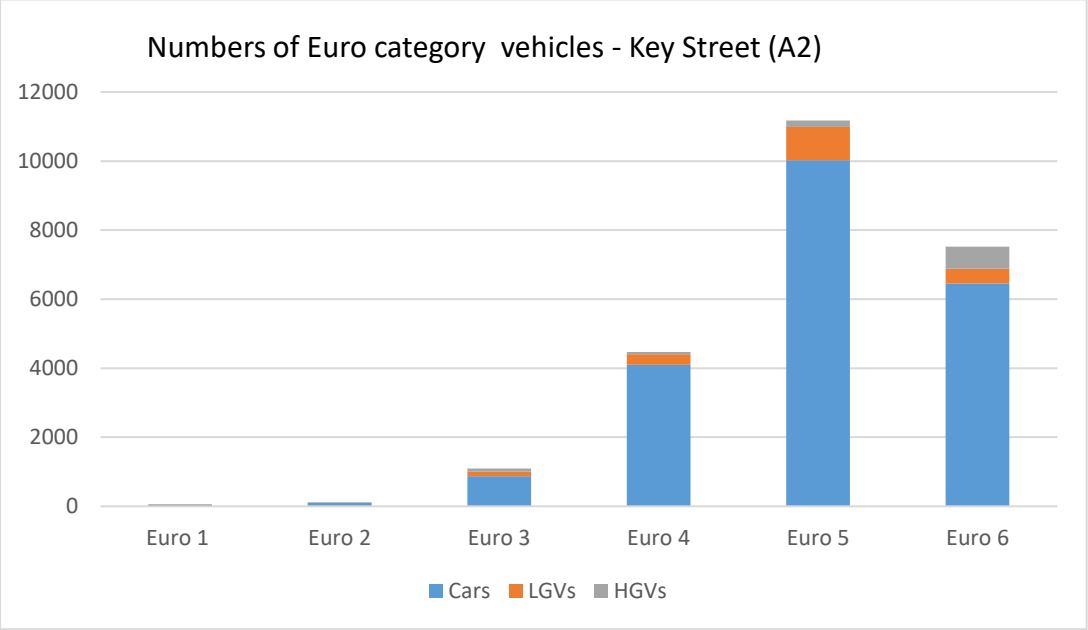
	Key Street (A2)			Newington AQMA			Ospringe AQMA		
Euro Category	Cars	LGVs	HGVs	Cars	LGVs	HGVs	Cars	LGVs	HGVs
Euro 1/I	50	11	4	22	9	7	41	4	2
Euro 2/II	101	9	9	90	12	2	73	1	5
Euro 3/III	876	130	87	698	129	71	823	65	32
Euro 4/IV	4097	312	65	2799	287	80	3796	132	48
Euro 5/V	10019	969	189	6652	746	133	8199	332	154
Euro 6/VI	6455	428	638	3842	322	368	4556	142	675
Totals	21599	1858	991	14103	1505	662	17488	677	916

Table 5.4 – Summary of ANPR survey location Euro categories percentages

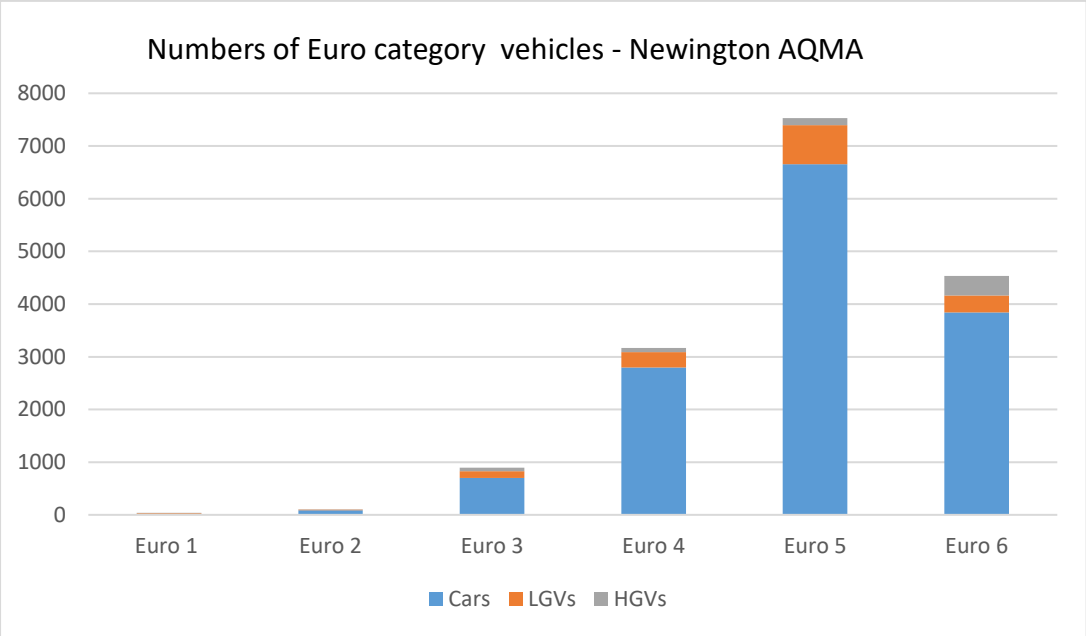
	Key Street (A2)			Newington AQMA			Ospringe AQMA		
Euro Category	**Cars**	**LGVs**	**HGVs**	**Cars**	**LGVs**	**HGVs**	**Cars**	**LGVs**	**HGVs**
Euro 1/I	0%	1%	0%	0%	1%	1%	0%	1%	0%
Euro 2/II	0%	0%	1%	1%	1%	0%	0%	0%	1%
Euro 3/III	4%	7%	9%	5%	9%	11%	5%	10%	3%
Euro 4/IV	19%	17%	7%	20%	19%	12%	22%	19%	5%
Euro 5/V	46%	52%	19%	47%	50%	20%	47%	49%	17%
Euro 6/VI	30%	23%	64%	27%	21%	56%	26%	21%	74%

5.28 The ANPR data provided the following graphs, which illustrate the ratio (percentages) of Euro categories for traffic at each location.

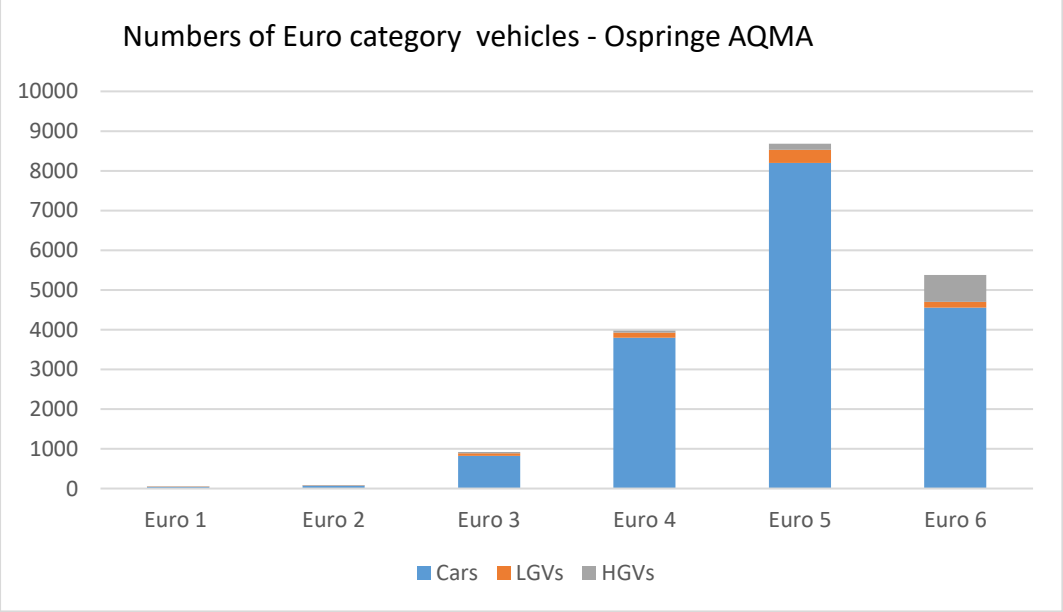
Graph 5.3 – Number of vehicles by Euro category – Key Street (A2)



Graph 5.4 – Number of vehicles by Euro category – Newington AQMA



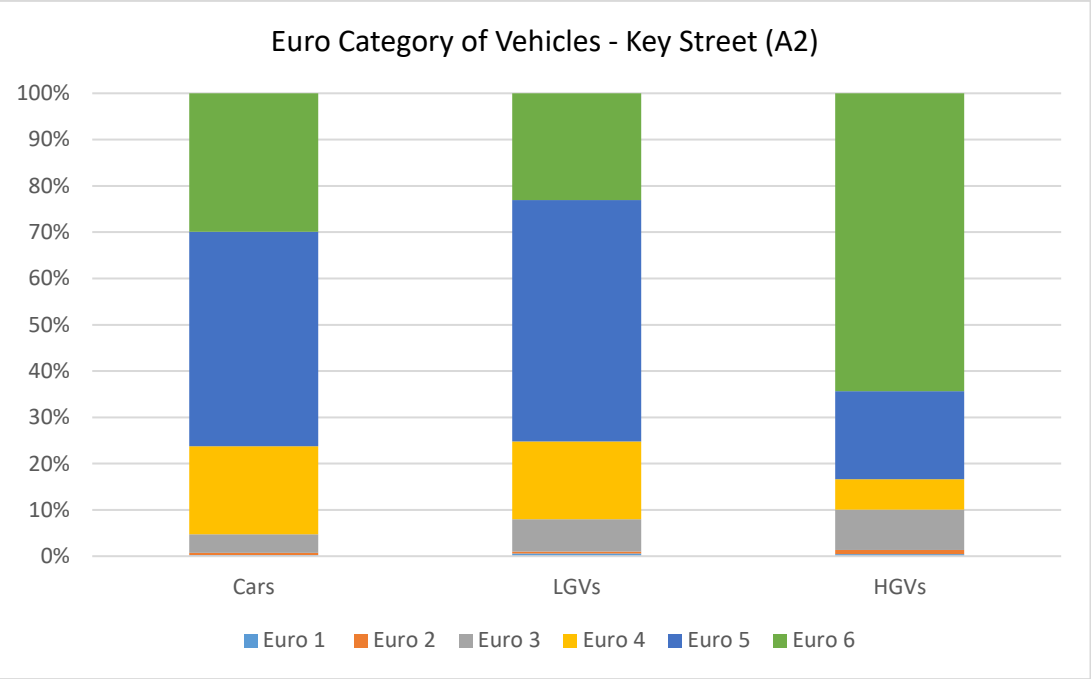
Graph 5.5 – Number of vehicles by Euro category – Ospringe AQMA



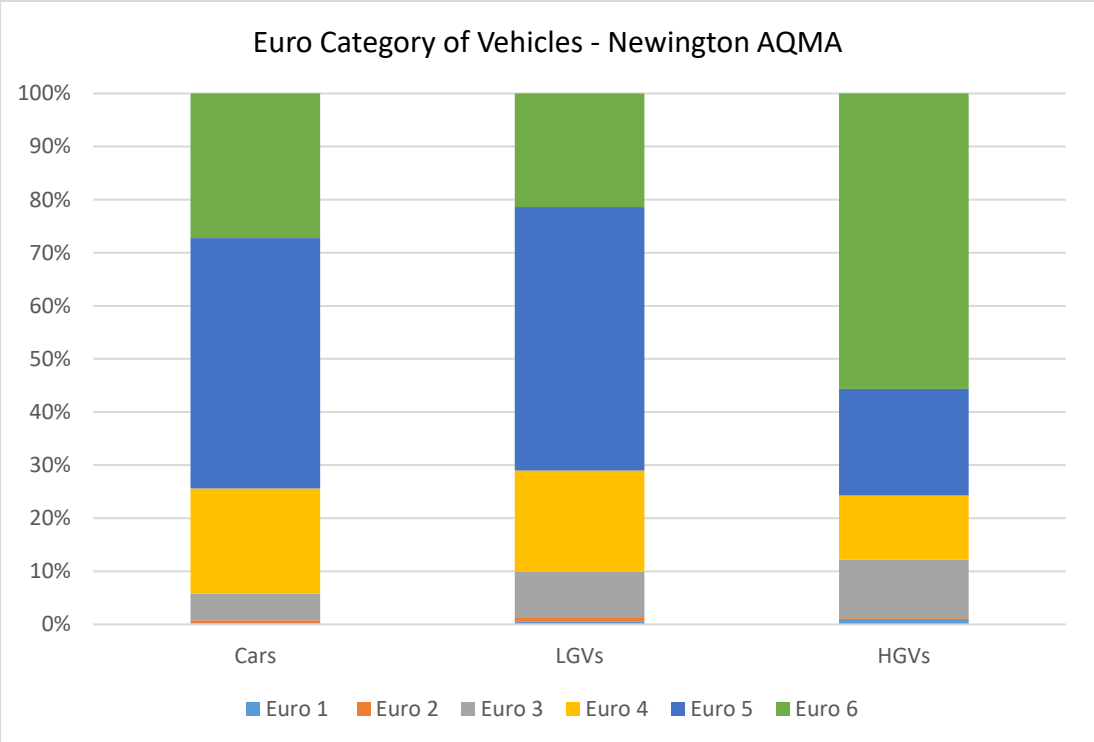
5.29 The range of Euro categories identified in the previous tables and graphs shows the fleet to be dominated by Euro 5 and Euro 6 vehicles at 39% and 38%, respectively. The Euro 4 vehicles make up 16% (average) of the fleet, with 8% (average) of the fleet being pre-Euro 4 (i.e. registered before January 2005).

5.30 Further Euro category analysis of the fleet composition is provided in the following graphs.

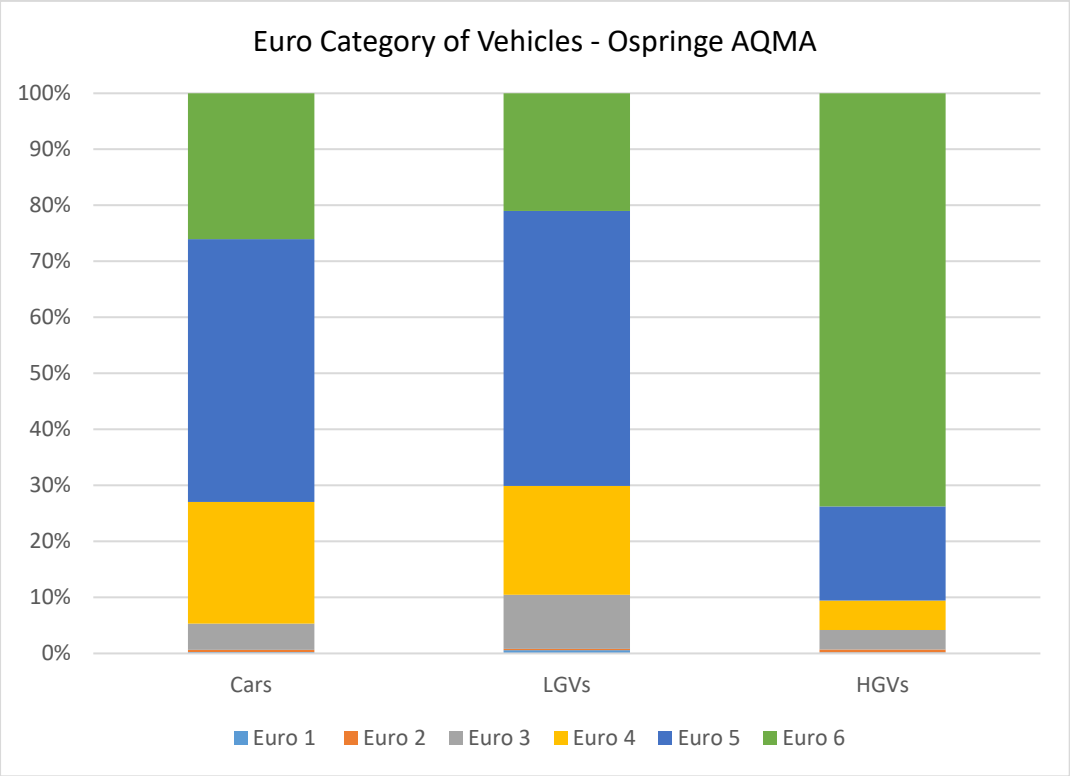
Graph 5.6 – Ratio of Euro categories per vehicle sector – Key Street (A2)



Graph 5.7 – Ratio of Euro categories per vehicle sector – Newington AQMA



Graph 5.8 – Ratio of Euro categories per vehicle sector – Ospringe AQMA



5.31 The ANPR survey at Key St (A2) was undertaken west of the A249. The survey showed a typical ratio (percentage) of Euro categories for Cars and LGVs. This location was dominated by a high percentage of Euro 6 HGVs (64%), indicating a newer fleet than other locations.

5.32 The ANPR survey at Newington AQMA showed a similar ratio (percentage) of Euro categories for Cars and LGVs to Key St (A2) . The exception is that there is a higher ratio of LGVs Euro 4 and below (30%). This location was dominated by a high percentage of Euro 6 HGVs (56%); however, up to 24% of HGVs were Euro 4 or below.

5.33 The ANPR survey at Ospringe AQMA showed a similar ratio (percentage) of Euro categories for Cars and LGVs to Newington AQMA, with a similarly higher ratio of LGVs Euro 4 and below (30%). This location was dominated by a high percentage of Euro 6 HGVs (74%), with only 9% of HGV being Euro 4 or below.

6. NOx Emissions Source Apportionment

Emissions Assessment

6.1 The source apportionment is undertaken using traffic data and Euro category data were provided from the traffic surveys.

6.2 To analyse the Euro categories and traffic survey information, this data is imported into the Defra Emissions Factor Toolkit (EFT) to produce emissions. The EFT utilises the volume data and Euro categories to provide ratios of emissions for different vehicle classes. This data is output as emissions of (all) oxides of nitrogen (NOx).

Source Apportionment

6.3 The NOx source apportionment for the Swale AQMAs provides a break-down of which vehicle categories provide the local emissions of NOx. The ratio of emissions differs due the type of vehicle (i.e. car, HGV, bus), the size of vehicle and fuel type used (i.e. diesel, petrol, other) to determine the amount of NOx emitted.

6.4 The source apportionment for the Swale AQMAs for 2018 is set out in Table 6.1 and Charts 6.1, 6.2, 6.3 and 6.4.

Table 6.1 – AQMA source apportionment table (2018)

	East Street AQMA	Newington AQMA	Ospringe & Teynham AQMA	St Pauls AQMA
Petrol Cars	6.8%	6.8%	8.2%	7.0%
Diesel Cars	51.3%	50.3%	62.8%	53.6%
Petrol LGVs	0.0%	0.0%	0.0%	0.0%
Diesel LGVs	20.4%	22.5%	9.4%	15.4%
Rigid HGVs	11.4%	12.2%	8.2%	14.5%
Artic HGVs	8.1%	6.0%	10.3%	6.6%
Buses/Coaches	1.3%	1.4%	0.3%	2.4%
Motorcycles	0.2%	0.4%	0.2%	0.1%
Full Hybrid Petrol Cars	0.1%	0.2%	0.1%	0.1%
Plug-In Hybrid Petrol Cars	0.0%	0.1%	0.0%	0.0%
Full Hybrid Diesel Cars	0.3%	0.2%	0.3%	0.2%

Notes: Teynham AQMA source apportionment is based on Ospringe AQMA ANPR survey results. East Street source apportionment is based on Key Street (A2) ANPR survey results.

Chart 6.1 – Newington AQMA NOx source apportionment (2018)

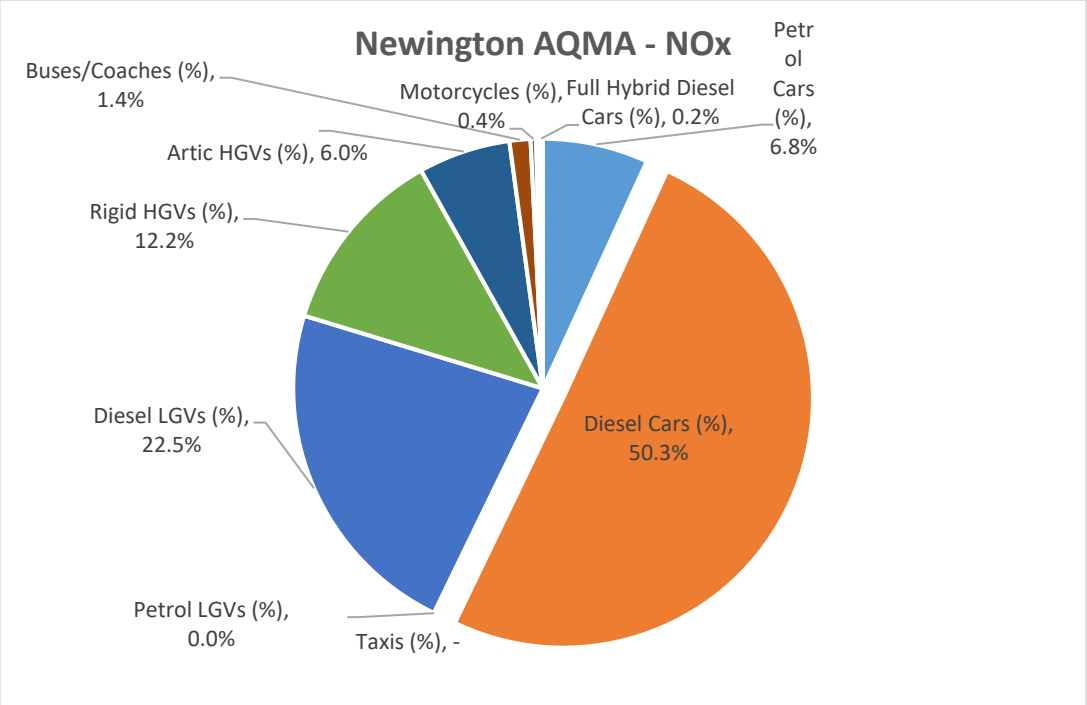


Chart 6.2 – Ospringe AQMA NOx source apportionment (2018)

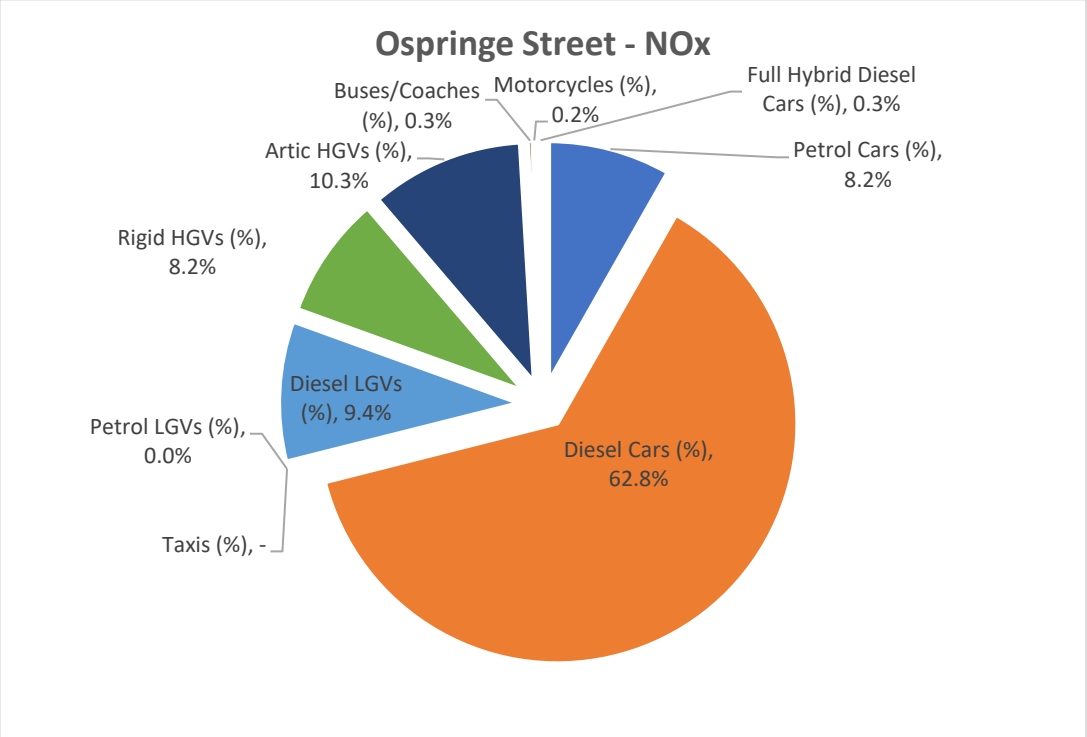


Chart 6.3 – East Street AQMA NOx source apportionment (2018)

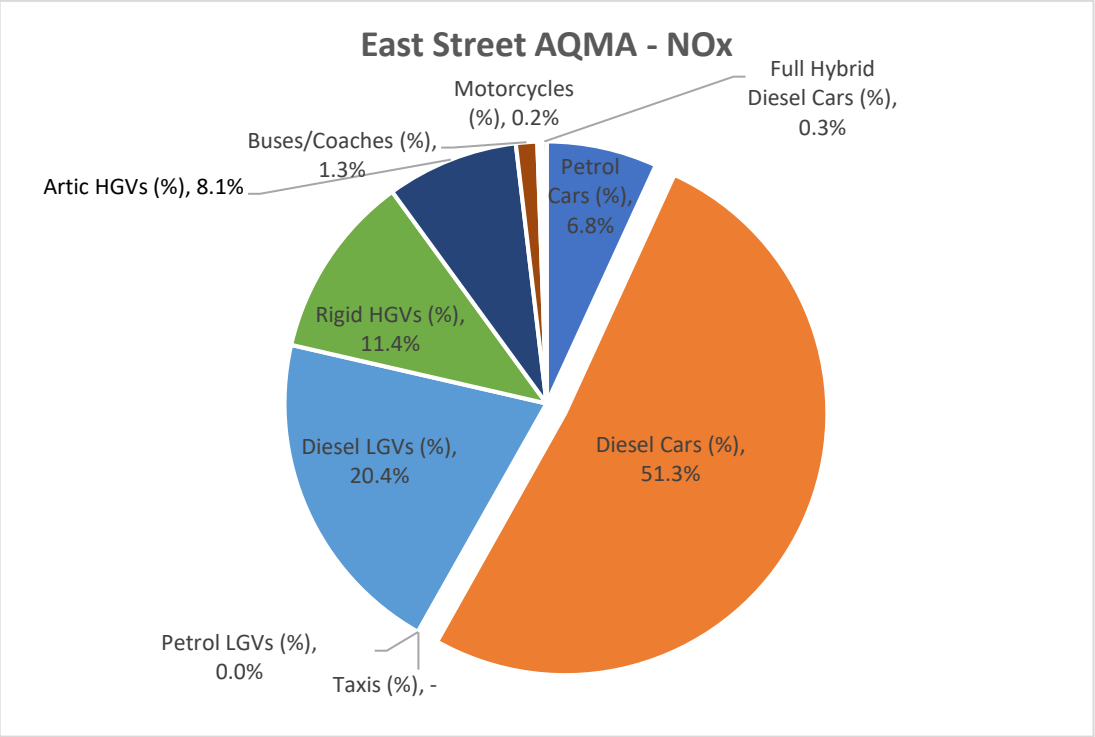
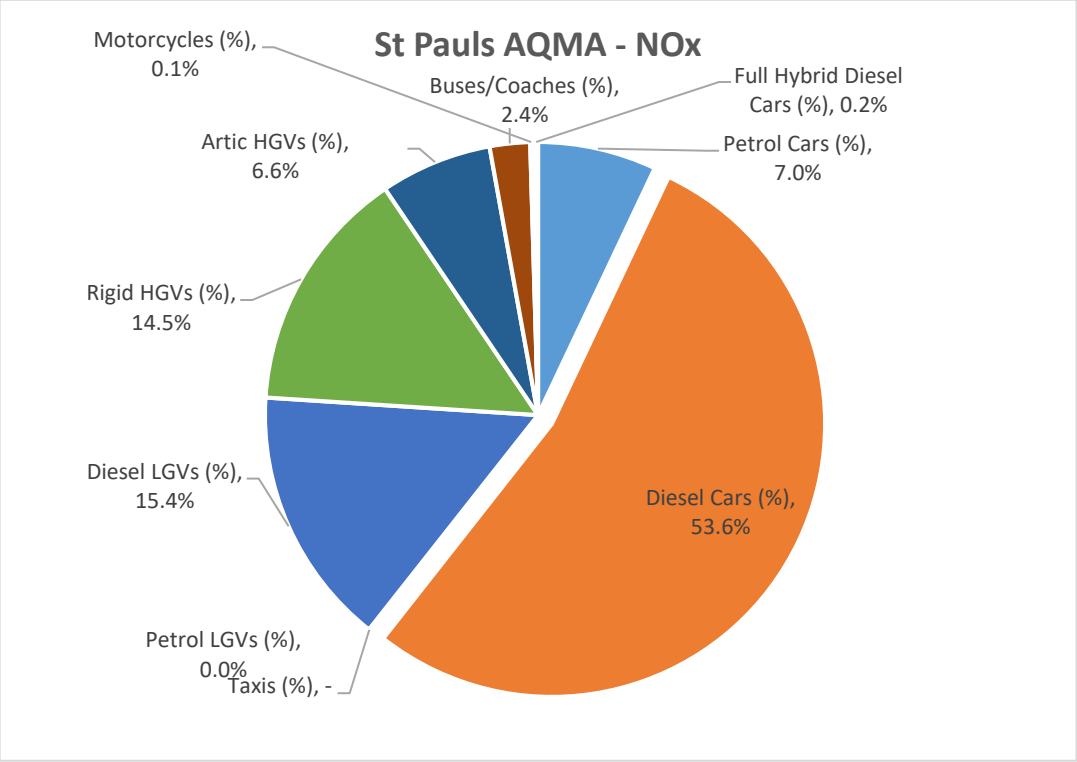


Chart 6.4 – St Pauls AQMA NOx source apportionment (2018)



6.5 The traffic data taken from across all AQMA locations showed on average that 82% vehicle movements were cars, with 15% being LGV and 3% combined OGVs.

6.6 The source apportionment however identified that:

- 15% LGV = 15- 20% NOx emissions
- 3% HGV = 18- 20% NOx emissions

6.7 The NOx source apportionment study highlighted that targeting key vehicles types such as LGVs and OGVs are likely to produce the substantial NOx reductions within the AQMAs. However as highlighted in Chapter 5, many OGVs and LGV operators are already operating Euro 6 category vehicles, thus the focus should also be on older Euro category vehicles in the vehicle classes.

6.8 Future AQAP measures need also to consider the changing fleet composition over time, which will introduce cleaner vehicles through improving Euro emissions standards beyond Euro 6. The following baseline modelling Chapter provides the future NO_2 concentrations within the AQMAs, so that the Council can assess the required measures needed to achieve the AQS compliance.

7. Air Quality Modelling Assessment

7.1 Undertaking baseline modelling establishes the likely NO_2 concentrations within the AQMAs in future years. This then enables the authority to determine how much of a reduction in NO_2 is needed to comply with the AQS.

7.2 The baseline modelling will also determine if any of AQMAs become compliant before any additional recommended AQAP measures are applied.

Traffic Data

7.3 Roads included in the AQMA modelling are presented in Table 7.1 below All data sources and information are provided in Chapter 5.

Table 7.1 – Modelled Roads

AQMA	Modelled Roads
AQMA 1: Newington	A2 High Street
AQMA 2: Ospringe	A2 Ospringe Street
AQMA 3: East Street	Bell Road Crown Quay Lane East Street A2 Michael's Road
AQMA 4: St Paul's	Staplehurst Road Chalkwell Road St Paul's Street
AQMA 5: Teynham	A2 London Road

UK-AIR Background Pollution

7.4 Defra provides estimated background concentrations of the UKAQS pollutants at the UK Air Information Resource (UK-AIR) website[4]. These estimates are produced using detailed modelling tools and are presented as concentrations at central 1km^2 National Grid square locations across the UK. These were updated in November 2017 and are based on monitoring data from 2015.

7.5 Being background concentrations, the UK-AIR data are intended to represent a homogenous mixture of all emissions sources in the general area of a particular grid square location. Concentrations of pollutants at various sensitive receptor locations can, therefore, be calculated by modelling the emissions from a nearby pollution source, such as a busy road, and then adding this to the appropriate UK-AIR background datum.

7.6 The predicted background pollution concentrations for NO_2 for 2017 to 2022 are presented in Table 7.2. These data were taken from the central grid square location closest to the AQMAs.

Table 7.2: 2017 to 2022 background concentrations of NO_2

Central grid square location	Predicted NO_2 background concentration ($\mu g.m^{-3}$)				Averaging period	AQS concentration ($\mu g.m^{-3}$)
	2017	2018	2020	2022		
East Street AQMA						
591500, 163500	16.6	16.0	15.1	14.2	annual mean	40
St Paul's AQMA						
590500, 164500	15.4	15.0	14.1	13.5	annual mean	40
Newington AQMA						
585500, 164500	12.4	12.0	11.2	10.5	annual mean	40
586500, 164500	12.5	12.1	11.3	10.6		
Teynham AQMA						
595500, 162500	9.8	9.5	8.9	8.3	annual mean	40
Ospringe AQMA						
600500, 160500	11.3	10.8	9.9	9.2	annual mean	40

AQMA Modelling Approach

7.7 Detailed air quality modelling was undertaken to establish the baseline concentrations of NO_2 within the Swale AQMAs. Each AQMA was modelled using the detailed dispersion model ADMS Roads (version 4.1.1).

4 Defra: UK-AIR. www.uk-air.defra.gov.uk (accessed 11/01/2018).

7.8 It is recommended, following guidance set out in LAQM.TG(16), that the model results be compared with measured data to determine whether they need adjusting to more accurately reflect local air quality. This process is known as verification and reduces the uncertainty associated with local effects on pollution dispersion and allows the model results to be more site-specific.

7.9 A verification study has been undertaken using the local authority monitoring data within each AQMA for 2017. The model was found to be under-predicting concentrations, which is not unusual, and therefore adjustment factors for each AQMA have been applied to the model results. Full details of this modelling study will be provided in a separate modelling report.

7.10 The AQMA modelling assessment requires baseline modelling to determine the likely concentrations within AQMA in future years. The baseline modelling assumes projected changes in vehicle volumes and vehicle Euro categories without any other variables. Future year projection data is based on the national Trip End Model Presentation Program (TEMpro) Road Traffic Forecast (RTF) model for Kent (SE region) and the EFT for changes in the Euro category changes.

7.11 All future year ADMS baseline modelling uses 2017 as the metrological data year.

7.12 Future baseline modelling was undertaken for the years 2018, 2020 and 2022.

7.13 Modelling was undertaken to assess against the annual average AQS for NO_2 (40µg/m³).

7.14 Emissions factor calculation were taken from the latest EFT and applied to the year of assessment. The EFT includes data on Euro category emission factors for specific years and also accounts for the increased natural turn-over of the fleet. This turn-out of vehicles relates to the reduction of older vehicles leaving the fleet and newer vehicles replacing them. This turn-over results in lower fleet emissions as time moves forward.

7.15 Each AQMA was modelled and representative sensitive receptors were based on previous assessment reports for comparison. The following table 7.3 provides a list of the locations of the 2 most sensitive receptors within each AQMA. These receptors were selected to provide the worst-case locations of exposure.

Table 7.3 – AQMA sensitive receptor locations.

Receptor no.	Receptor location		
	X(m)	Y(m)	Z(m)
East Street AQMA			
12	591404	163489	1.5
21	591485	163473	1.5

St Paul's AQMA			
6	591188	163538	1.5
8	591203	163705	1.5
Newington AQMA			
24	585909	164804	1.5
28	585907	164794	1.5
Teynham AQMA			
10	595232.4	162447.3	1.5
12	595217	162452.3	1.5
Ospringe AQMA			
14	600388.6	160851.3	1.5
15	600374.4	160856.2	1.5

7.16 Detailed information of the modelling assessment will be provided in a separate modelling report, these will include model verification, full lists of sensitive receptors and results.

Baseline Modelling Results

7.17 2018 baseline modelling was undertaken for the Swale AQMAs to determine the predicted current year concentration exposures within the AQMAs.

7.18 A selection of sensitive receptors is presented in the following assessment results. Theses receptors have been selected as the most sensitive/highest exposure locations within the AMQAs.

7.19 Table 7.4 presents the baseline AQMA modelling results for the selected receptors.

Table 7.4 – Summary of Swale AQMA modelling results for 2018 - 2022

Receptor no.	Predicted annual average NO_2 concentration ($\mu g.m^{-3}$)		
	2018	2020	2022
East Street AQMA			
12	**61.8**	**57.2**	**44.5**
21	**55.3**	**46.9**	**40.0**
St Paul's AQMA			
6	**41.7**	36.0	32.1
8	**42.3**	36.5	32.4
Newington AQMA			
24	**47.1**	**39.3**	34.4
28	**44.9**	37.4	32.7
Teynham AQMA			
10	**56.1**	**48.8**	**42.6**

12	**54.0**	**47.0**	**41.0**
Ospringe AQMA			
14	**60.0**	**59.4**	**45.7**
15	**57.8**	**57.2**	**44.0**

***Bold** denotes an exceedance of the 40µg/m³ AQS.

7.20 The baseline modelling results identified continued exceedances of the AQS for NO_2 in all AQMAs in 2018.

7.21 Results in 2020 identified a reduction in concentrations across all the AQMAs, these included predicted NO_2 concentrations lower than the AQS at all sensitive receptors in St Paul's and Newington.

7.22 The 2022 modelling results indicate that reductions in NO_2 concentrations continue as background sources and fleet emissions continue to reduce as expected. The AQMAs in East Street, Teynham and Ospringe continue to be in exceedance of the NO_2 AQS.

7.23 These modelled results are baseline modelled results without any Kent or Medway authorities Local Plan (LP) committed developments. LP data was not available at the time of the assessment preparation.

Minimum Required NO_2 Reductions

7.24 To determine the amount of reduction required to gain AQS compliance, a simple calculation is undertaken by subtracting 40(µg/m³) from the AQMA NO_2 total in the years 2020 and 2022. The required minimum reductions in NO_2 are provided in Table 7.5.

Table 7.5 – Minimum required NO_2 concentration reductions in each AQMA.

Receptor no.	Minimum required NO_2 concentration reduction ($\mu g.m^{-3}$)	
	2020	2022
East Street AQMA		
12	17.2	4.5
St Paul's AQMA		
8	Not required	Not required
Newington AQMA		
24	Not required	Not required
Teynham AQMA		
10	8.8	2.6
Ospringe AQMA		
14	19.4	5.7

7.25 East Street AQMA and Ospringe AQMA require significant reductions in NO_2 in 2020; however, the required concentration reduction reduces significantly in 2022.

7.26 St Pauls and Newington AQMA are likely to be compliant with the AQS, therefore a reduction target is not required.

7.27 Teynham AQMA requires significant reductions in 2020 to comply; however, as 2022 approaches, the minimum reduction reduces to 2.6µg/m³.

8. NO_2 Source Apportionment

8.1 The baseline modelling assessment identified the predicted future baseline concentrations of NO_2 at the worst-case locations within each AQMA and the minimum require reductions.

Road Traffic NO_2 Sources

8.2 To determine what sector of the vehicle fleet should be considered, an assessment of the NO_2 sources is undertaken.

8.3 The breakdown of the sources of NO_2 from road traffic has been assessed for each AQMA with the exception of Newington. Tables 8.1 to 8.3 provide the source apportionment of the NO_2 concentration sources at the worst-case receptor locations in each AQMA for 2020 and 2022.

Table 8.1 – East Street AQMA NO_2 source apportionment

	2020		2022	
	NO_2 conc.	%	NO_2 conc.	%
Petrol Cars	2.88	5.03	2.28	5.13
Diesel Cars	23.07	40.32	16.99	38.19
Taxis	0.00	0.00	0.00	0.00
Petrol LGVs	0.01	0.02	0.01	0.02
Diesel LGVs	6.96	12.17	4.71	10.58
Rigid HGVs	4.96	8.68	3.01	6.76
Artic HGVs	3.77	6.59	2.21	4.96
Buses/Coaches	0.77	1.35	0.46	1.03
Motorcycles	0.05	0.08	0.04	0.08
Full Hybrid Petrol Cars	0.08	0.14	0.09	0.20
Plug-In Hybrid Petrol Cars	0.01	0.01	0.01	0.03
Full Hybrid Diesel Cars	0.24	0.43	0.29	0.65
Background	14.41	25.19	2.28	5.13

Table 8.2 – Teynham AQMA NO_2 source apportionment

	2020		2022	
	NO_2 conc.	%	NO_2 conc.	%
Petrol Cars	3.35	6.87	3.22	7.57
Diesel Cars	25.56	52.39	22.72	53.35
Taxis	0.00	0.00	0.00	0.00
Petrol LGVs	0.01	0.01	0.00	0.01
Diesel LGVs	3.15	6.45	2.57	6.04
Rigid HGVs	4.48	9.19	3.19	7.49
Artic HGVs	2.82	5.78	1.97	4.62
Buses/Coaches	0.14	0.28	0.10	0.23
Motorcycles	0.06	0.12	0.05	0.12
Full Hybrid Petrol Cars	0.09	0.19	0.12	0.29
Plug-In Hybrid Petrol Cars	0.01	0.02	0.02	0.04
Full Hybrid Diesel Cars	0.27	0.56	0.39	0.91
Background	8.85	18.15	8.23	19.33

Table 8.3 – Ospringe AQMA NO_2 source apportionment

	2020		2022	
	NO_2 conc.	%	NO_2 conc.	%
Petrol Cars	3.81	6.41	3.15	6.89
Diesel Cars	30.52	51.41	23.45	51.30
Taxis	0.00	0.00	0.00	0.00
Petrol LGVs	0.01	0.01	0.00	0.01
Diesel LGVs	3.53	5.95	2.49	5.45
Rigid HGVs	6.54	11.01	4.13	9.03
Artic HGVs	4.30	7.25	2.62	5.74
Buses/Coaches	0.20	0.34	0.12	0.27
Motorcycles	0.06	0.10	0.05	0.11
Full Hybrid Petrol Cars	0.10	0.17	0.12	0.26
Plug-In Hybrid Petrol Cars	0.01	0.02	0.02	0.03
Full Hybrid Diesel Cars	0.32	0.55	0.40	0.88
Background	9.96	16.78	9.16	20.03

8.4 The NO_2 source apportionment tables show the high proportion of NO_2 sourced from the diesel sector of the fleet. The diesel sector includes diesel cars, diesel LGVs, rigid HGVs, artic HGVs and buses/coaches and accounts for over 65-75% of the NO_2 source.

8.5 Diesel cars are the most dominant source of NO_2 across all AQMAs, due to the high volumes of private cars passing through the AQMAs, of which >50% are currently diesel cars.

8.6 East Street AQMA has a significant proportion of diesel LGVs accounting for up to 3.5µg/m³ of the NO_2 in the AQMA. HGVs account for approximately 8.8-5.2µg/m³ of the NO_2 in 2020 and 2022, respectively.

8.7 Teynham AQMA has an even spread of sources of NO_2 from diesel LGVs, rigid HGV and artic HGVs between 3 – 2.5µg/m³, 4.5 – 3.2 µg/m³ and 2.8 – 1.9 µg/m³ respectively for 2020 and 2022.

8.8 Ospringe AQMA has a similar profile of NO_2 sources as Teynham; however, it has double the reduction targets for 2020 and 2022.

9. AQMA Options Review

9.1 The NO_2 source apportionment identifies several vehicle categories which can be targeted to achieve the required (minimum) NO_2 reductions in each AQMA

9.2 The key sectors to consider in the AQMA options assessment are sectors that are high emitters and are in low numbers. The high emitters as indicated in the source apportionment studies are the diesel fleet vehicles.

9.3 The NOx source apportionment identified that LGVs accounted for 15% of the fleet, but produced up to 20% of NOx emissions, whereas HGVs made up only 3% of the fleet, but are responsible for between 18 and20% of NOx emissions.

9.4 The study also identified that the older vehicles, i.e. the early Euro category vehicles, produce significantly higher emissions than newer Euro 5 and 6 vehicles.

9.5 The primary vehicle groups to target to achieve compliance of AQSs are therefore:

- HGV vehicle and LGV (diesel) sector
- Early Euro category vehicles (Euro 1 - 4)

AQMA Euro Category NO_2 assessment

9.6 To assess the required Euro category vehicles that will be required to reduce their emissions, the following assessment sets out the required vehicle categories to target.

9.7 These figures are based on the baseline model results without any AQAP measures.

9.8 Tables 9.1 and 9.2 present the assessment results showing predicted NO_2 concentration values per Euro category for Cars, LGVs and HGVs in the AQMAs. The tables show the relevant concentration proportioned to the all the vehicles in each class and Euro category.

Table 9.1 – Euro category NO_2 concentration (µg/m³) apportionment (2020)

		Euro 1/I	Euro 2/II	Euro 3/III	Euro 4/IV	Euro 5/V	Euro 6/VI
East Street AQMA	Cars	**0**	**0**	**1.04**	**4.94**	**11.96**	7.8
	LGVs	**0.07**	**0**	**0.49**	**1.19**	**3.64**	1.61
	HGVs	**0**	**0.09**	**0.7**	**0.61**	**1.67**	5.63
Teynham AQMA	Cars	**0**	**0**	**1.44**	**6.36**	13.58	7.51
	LGVs	**0.03**	**0**	**0.31**	**0.60**	1.55	0.66
	HGVs	**0**	**0.073**	**0.21**	**0.36**	1.24	5.40
Ospringe AQMA	Cars	**0**	**0**	**1.71**	**7.55**	**16.13**	8.92
	LGVs	**0.03**	**0**	**0.35**	**0.67**	**1.73**	0.74
	HGVs	**0**	**0.10**	**0.32**	**0.54**	**1.84**	8.02

9.9 The required minimum NO_2 concentration (µg/m³) reductions set out in Table 7.2 for each AQMA in 2020 is:

- East Street = 17.2
- Teynham = 8.8
- Ospringe = 19.4

9.10 The required vehicle Euro categories that need to be targeted to achieve the reductions without any additional AQAP measures are highlighted in **bold.**

9.11 Significant reductions will be required across all AQMAs to achieve AQS compliance.

Table 9.2 – Euro category NO_2 concentration (µg/m³) apportionment (2022)

		Euro 1/I	Euro 2/II	Euro 3/III	Euro 4/IV	Euro 5/V	Euro 6/VI
East Street AQMA	Cars	**0.00**	**0.00**	**0.77**	3.67	8.88	5.79
	LGVs	**0.05**	**0.00**	**0.33**	**0.80**	2.44	1.08
	HGVs	**0.00**	**0.05**	**0.47**	**0.36**	**0.99**	3.33
Teynham AQMA	Cars	0.00	0.00	1.30	5.71	12.19	6.74
	LGVs	**0.06**	**0.00**	**0.61**	**1.15**	2.96	1.27
	HGVs	**0.00**	**0.05**	**0.15**	**0.26**	0.88	3.82
Ospringe AQMA	Cars	**0.00**	**0.00**	**1.33**	5.85	12.50	6.92
	LGVs	**0.03**	**0.00**	**0.25**	**0.48**	**1.23**	0.53
	HGVs	**0.00**	**0.07**	**0.20**	**0.34**	**1.15**	5.00

9.12 The required minimum NO_2 concentration (µg/m³) reductions set out in Table 7.2 for each AQMA in 2022 is:

- East Street = 4.5
- Teynham = 2.6
- Ospringe = 5.7

9.13 The required vehicle Euro categories that need to be targeted to achieve the reductions without any additional AQAP measures are highlighted in **bold.**

9.14 Major reductions will be required across all AQMAs to achieve AQS compliance.

Summary of Results

9.15 The NO_2 source apportionment results based on the baseline modelling for 2020 and 2022 indicate that significant emissions reductions will be required in the majority of the AQMA locations.

9.16 The baseline 2020 source apportionment study identified:

- Significant reductions in NO_2 required to achieve AQS compliance; and
- East St and Ospringe AQMA need significant emission reductions from all Euro 1 – 5 vehicles including cars as well as HGV and LGVs to achieve AQS compliance.
- The St Pauls and Newington AQMA are likely to be compliant by 2020, without the need for additional AQAP measures.

9.17 The baseline 2022 source apportionment study identified:

- Smaller reductions required across the AQMAs;
- Table 9.2 show Teynham AQMA compliance are achievable with reasonable measures to restrict/remove LGVs and HGVs below Euro 4/IV;
- East St and Ospringe AQMA require less reductions than 2020, however reductions will also likely to be required from Euro V HGVs as well as LGVs up to Euro 3;
- Emissions reductions from the older Euro vehicles (i.e. Euro 1/I – 4/IV) becomes more challenging in 2022. This is due to older (more polluting) vehicles being phased out and replaced with new cleaner vehicles.

9.18 Both 2020 and 2022 baseline assessments have identified that significant reductions in NOx emissions will be required across the A2 AQMAs. Swale Council will therefore need to consider a variety of strategic measures that impact on NOx emissions from a range vehicle classes and Euro categories.

9.19 The *Swale Strategic AQAP 2018 - 2022 Report 2* will provide a review and assess potential AQAP options that target the required NOx emissions reductions.

Figures

Figures 1 - 4: ATC and ANPR traffic survey location

Figure 1 - ATC 1 - 10: St Pauls and East Street AQMA

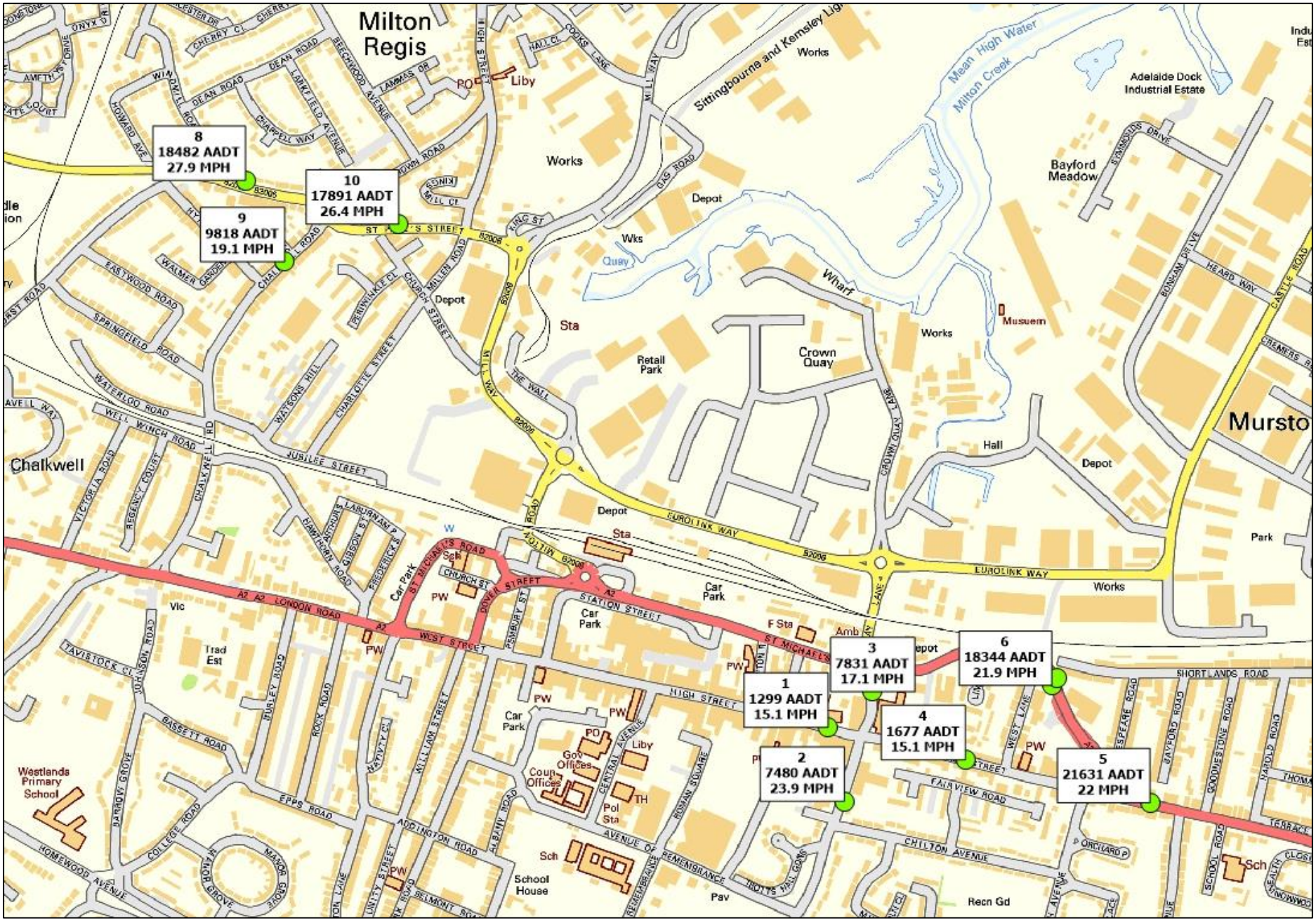


Figure 2 - ATC 11 and 12: London Road and Key Street AQMA

Figure 3 - ATC 13: Ospringe Street AQMA

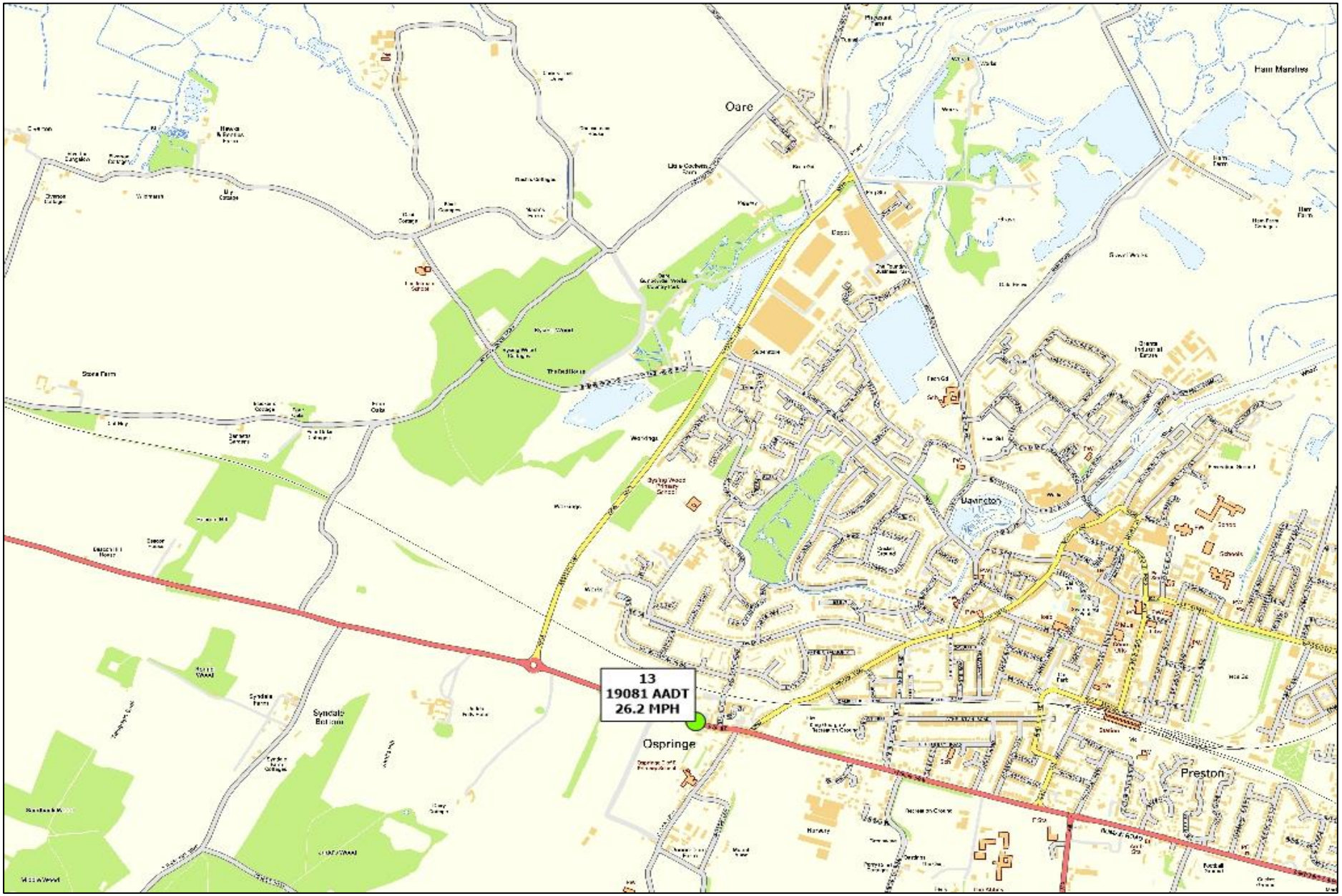


Figure 4 - ANPR sites: 1. Newington (A2) AQMA 2. Key St (A2) east of A249 3. Ospringe (A2) AQMA

Phlorum Limited

Head Office & Registered Office:
Unit 12
Hunns Mere Way
Woodingdean
Brighton
East Sussex
BN2 6AH
T: 01273 307 167

Northern Office:
Ground Floor
Adamson House
Towers Business Park
Wilmslow Road
Didsbury
Manchester
M20 2YY
T: 0161 955 4250

Western Office:
One Caspian Point
Pierhead Street
Cardiff Bay
Cardiff
CF10 4DQ
T: 029 2092 0820

Maidenhead Office:
Meliora
Briar Glen
Cookham
Maidenhead
Berkshire
SL6 9JP
M: 07736 292 106

info@phlorum.com
www.phlorum.com