City & County of Swansea
2016 Air Quality Progress Report

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

December 2016

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Executive Summary

The Environment Act 1995, Part IV established a national framework for air quality management that requires all local authorities to conduct air quality reviews of their areas having had regard to any guidance issued. If the reviews undertaken indicate that the objective for any of the identified pollutants will not be met by the date for compliance then an Air Quality Management Area must be declared.

The City and County of Swansea following the first round of review and assessment concluded that there was a requirement to declare the Hafod area as an Air Quality Management Area due to exceedances of the nitrogen dioxide annual mean objective. This area was declared in September 2001 and a map outlining the area can be seen within Annexe 1.

During August 2010 and due to exceedances of the nitrogen dioxide annual mean objective being measured within the Sketty and Fforestfach areas of the authority, the Hafod Air Quality Management Area was amended by Council to include these newly identified areas and renamed the Swansea Air Quality Management Area 2010. The areas now making up the Swansea Air Quality Management Area 2010 can be seen within Annexe 2.

This report contains the latest air quality monitoring results within the City and County of Swansea. The conclusions reached are that the objectives for benzene, lead and sulphur dioxide will be met and that there is no requirement to proceed further with these pollutants. However, there is evidence that the annual mean objective for nitrogen dioxide of 40ug/m^3 will continue to be exceeded within the existing Swansea Air Quality Management Area 2010. Latest monitoring undertaken also indicates areas of exceedances of the nitrogen dioxide annual mean objective outside of the Swansea Air Quality Management Area 2010 within city centre area of the authority. It is therefore proposed to undertake a Detailed Assessment into nitrogen dioxide concentrations within the city centre area. Several other areas also exhibit the potential to exceed the annual mean objective as the measured annual means are within the range 37-40 ug/m^3.

All monitoring sites remain compliant with both the annual mean and daily mean exceedance (35 days permitted) for Particulate matter PM_{10}.

Ozone is monitored at four sites within Swansea. Compliance with the 8-hour mean UK objective (not set in regulation) has been seen during 2015 at all monitoring stations.

The City and County of Swansea participates in the UK Heavy Metals Monitoring Network and had monitoring stations within the Glais, Clydach and Morriston areas monitoring the high level stack discharge from the nickel refinery within Clydach. During late 2007 the company installed improved abatement management on the high level stack discharge. Additional monitoring stations had been established during 2007/2008 both upwind and downwind of the release point taking the total monitoring locations to four. Two of these stations at Glais and YGG Gellionnen were adopted onto the UK Heavy Metals Monitoring network and wholly funded by this council. Monitoring results since 2009-2015 have indicated compliance with the 4th Daughter Directive critical threshold monitoring target value for nickel at all monitoring stations. Improvements continue to be made at the refinery and these improved abatement techniques are becoming increasingly evident within the monitoring results. However, the equipment at Glais has suffered from numerous, expensive breakdowns. These breakdowns coupled with the analytical costs have resulted in monitoring ceasing at this site during early 2013. Similarly, due to budget constraints, monitoring has ceased at YGG Gellionnen during January 2014. Only the two UK Heavy Metal Network funded sites at Gellionnen Cemetery and Morriston Groundhog remain to confirm continued and ongoing compliance with the 4th Daughter Directive critical threshold monitoring target value for nickel.

Whilst the extent of nitrogen dioxide measurements using passive diffusion tubes has been scaled back in some areas of the authority, the number of monitoring points within the city centre has been dramatically increased. Indications from exiting nitrogen dioxide monitoring within the Kingsway, Orchard Street, High Street and Westway areas indicate that whilst the 1-hour objective has not been exceeded that the annual mean objective is being exceeded at several locations. The authority has commissioned a major review into the city centre and detailed talks have now started with the companies shortlisted for Swansea city center's regeneration. This review will encompass both the economic regeneration of the city centre and the road infrastructure serving the city centre. Footfall within the city centre will aid the economic recovery and plans to increase the number of dwellings within the city are seen as the means to provide this increased footfall. Therefore, from an air quality perspective the number of people living within the city centre will bring air quality challenges should the existing road infrastructure remain. It is envisaged that the additional monitoring undertaken within the city centre and the Detailed Assessment that is now proposed will inform the design process as to the suitability of certain locations for the provision of dwellings thus protecting in the long term, the health of city centre residents.

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1 Introduction

1.1 Description of Local Authority Area

The City and County of Swansea unitary authority covers a mixed area of extensive coastline, rural villages and the City of Swansea itself. The latest Census (March 2011) estimate for the population of Swansea is 239,000. The 2011 Census also indicates some important changes within the age profile from the previous 2000 Census:-

- **Aged under-5**: a significant growth of around 1,100 (+8.8%)
- **Aged 5-14 years** (school-age): a decline of 1,600 (-6.0%), probably due in large part to reductions in the number of births recorded in the late 1990's / early 2000's.
- **15-19 age** groups: an increase of around 1,200 (+7.8%). This could mainly reflect the increasing inflow of 18 and 19 year olds to Swansea's universities.
- **20-24**: a pronounced growth of almost 5,000 (+31.8%) over the ten-year period, again linked to increasing levels of student in-migration and initial retention, including those from elsewhere in Wales, the UK and (to some extent) overseas.
- **25-29**: a significant increase in the population of this cohort over the period by 3,100(+24.5%). This growth could be attributable to a number of factors, including economic in-migration and the retention of graduates.
- **30-39**: a moderate decrease of 1,200 (-3.8%).
- **40-49**: an increase of 9.7% (+2,900), possibly linked to the 1960s 'baby boom'.
- **50-64**: a steady increase of 8.5% (+3,500), again slightly higher than the equivalent overall rate of population increase for Swansea over the period (+6.9%)
- **Older population** (all aged 65+): an increase of 1,900 (+4.6%), indicative of an ageing population, in line with established national trends. However, population growth in the older groups has been most dramatic in the population aged over 85, which is estimated to have increased in Swansea by 900 (+18.8%) over the ten year period from around 4,900 in 2001 to 5,800 in 2011.

To the west of the City of Swansea stands the gateway to the Gower Peninsula, an officially designated Area of Outstanding Beauty that boasts wide-open beaches and rugged shorelines. To the east of the City and County of Swansea lies the only major operational traditional "heavy industry" in the form of the Tata Steelworks complex at Port Talbot. Heavy industry has declined steadily within the boundaries of the authority during the last century. This former industrial activity has left its scars – most notably to the Lower Swansea Valley. From the early 1970's the areas once blighted by slag heaps have undergone extensive remediation and greening. New "light industry" and retail outlets have moved back into the Lower Swansea Valley following the establishment of Enterprise Zone's and industrial parks. Considerable regeneration is now ongoing within the Swansea area notably the docks re-development and within the city centre/marina area.

The major source of pollution is now vehicular. The topography of the Lower Swansea Valley is complex and it is thought that this aggravates pollution loading in the area. Swansea is connected to major road and rail links. The M4 motorway travels through northern area of the authority, connecting Swansea with Carmarthenshire in the west and to Cardiff and Bristol to the east. The major artery routes of the A483, A4067 and A48 connect Swansea city centre with the M4 motorway junctions to the north. Local traffic also use these routes as primary routes into the city centre.

Swansea is well served with rail links to the majority of the UK. The Inter-City 125 service from London Paddington terminates at Swansea. Local services operate from Swansea to Mid and West Wales. A major locomotive-servicing centre operates within Swansea at Landore Diesel Sheds, primarily to service the power units of the Inter City 125 service. The majority of diesel locomotives operated by First Great Western are also serviced and maintained at this facility.

The older and established areas of Swansea comprise of traditional terraced housing. These areas tend to be, but are not exclusively within approximately 3 miles of the city centre. Areas of high density terraced housing still exist around the centres of population established during the Industrial Revolution.

As would be expected, new housing provision tends to be either of detached, or semi-detached, and during the last 20 – 30 years these developments have mainly been located in areas greater than 3 miles away from the city centre. This trend is changing however and within the last 5 years Swansea has seen the SA1 development within the old docks area provide a springboard for new housing development both within the SA1 development site and more lately within the marina area. This regeneration is now also extending into the heart of the city centre with several residential developments taking the place of retail/business premises or occupying the upper floors of former wholly retail premises.

The Tawe Riverside Corridor Proposals will, when fully implemented see, the regeneration of a large section of the lower Swansea Valley from the Quay Parade bridges up to the Morfa Retail Park. This area is subject to past historical industrial contamination from primarily metals processing and has been in decline for several decades. Some sites have been developed for industrial use but large sections of land remained in the same state following the lower Swansea Valley project of the late 1970's and early 1980's. This project dealt with the legacy of contamination by clearing derelict sites and undertaking limited remediation with extensive landscaping.

1.2 Purpose of Progress Report

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

For Local Authorities in Wales, Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the LAQM process.

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

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in Wales** are set out in the Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138), Air Quality (Amendment) (Wales) Regulations 2002, No 3182 (Wales 298), and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre µg/m^3 (milligrams per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m^3	Running annual mean	31.12.2003
	5.00 µg/m^3	Annual mean	31.12.2011
1,3-butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m^3	Annual mean	31.12.2004
	0.25 µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate matter (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

Table 1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Wales

1.4 Summary of Previous Review and Assessments

The local authority review and assessment process is multi-staged. This Authority carried out its first stage review in 1999. The conclusion reached was to progress to a second and third stage review for Benzene, Particulate Matter (PM_{10}), Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2).

In between these stages, the authority had to deal with, and resolve a burning, disused coal spoil tip at the former Brynlliw Colliery site. This absorbed most resources available between 1999 and 2000.

Along with all other local authorities, this authority has completed its stage 2 and stage 3 reviews. The third stage review and assessment concluded that despite the indication that the air quality objective for benzene would not be met that the declaration of an AQMA was not appropriate. Given the fundamental changes proposed to the Lower Swansea Valley's infrastructure and the technical improvements proposed in the reduction in the benzene content in fuel, it was recommended that a further benzene monitoring study be carried out for a period of at least 12 months. During the stage 3 process, it was determined that the authority would not breach the objectives laid down for Particulate Matter (PM_{10}) and Sulphur Dioxide (SO_2).

Section 83(1) of the Environment Act 1995 requires the Authority to designate as Air Quality Management Areas (AQMA's) those areas where it is likely that the standards for any of the identified pollutants would be exceeded. As a result of the detailed work carried out in the authorities' third stage review and assessment it was found that areas of the Hafod were likely to fail the NO_2 annual mean objective of $40\mu g/m^3$ by the compliance date of 31st December 2005.

On the 12th September 2001 the Authority declared The Hafod Air Quality Management Area (NO_2), cited as the City & County of Swansea (Hafod Air Quality Management Area (NO_2)) Order 2001. The Order came into force on the 14th September 2001. Annexe 1 contains a map indicating the AQMA area.

The Stage 4 review required under Section 84(1) of the Environment Act 1995 confirmed the earlier findings and that the declaration of the Hafod AQMA was justified as several locations were projected to fail the nitrogen dioxide (NO_2) annual mean objective in 2005.

Section 84 of the Environment Act 1995 requires the formulation of a written plan in pursuit of the achievement of air quality standards and objectives within the designated AQMA and has become known as the “Action Plan”. The City and County of Swansea have undertaken a considerable amount of feasibility and infrastructure work in formulating its Action Plan taking a few years to produce the completed Action Plan in December 2004.

In 2004, the authority commenced works on the second round of review and assessment. In accordance with the policy and technical guidance documents, the second round of review and assessment was carried out in two stages;

- An Updating and Screening Assessment (USA) - intended to identify aspects that have changed since the first round of review and assessment (from 1999 in Swansea's case) and identify those that require further assessment; namely
- A Detailed Assessment of those pollutants that have been identified as requiring further work and investigation

The Updating and Screening Assessment was submitted to the Welsh Assembly Government in July 2004 with a recommendation to proceed to a detailed assessment for nitrogen dioxide at identified narrow congested streets and busy junctions. The USA also concluded that particulate matter PM_{10} should also be investigated using real-time techniques at the identified narrow, congested streets and busy junctions, despite the then 2010 provisional objectives not being set in regulation.

A brief summary of the results and conclusions of the Detailed Assessment into NO_2 levels can also be found within the Progress Report 2004 – section 2.3.2.3 page 95. The Detailed Assessment itself was submitted to the Welsh Assembly Government during December 2005. This assessment concluded that there was no justification in declaring additional AQMA's. At the time of submission, there was a debate with the auditors and Welsh assembly Government over the bias factor used to correct the nitrogen dioxide passive diffusion tube data. The authority used the bias factor quoted by Harwell Scientifics to correct for tube bias. Whilst the Detailed Assessment report was eventually accepted by the Welsh Assembly Government and the auditors as a result of the authority providing additional supporting information and justification for the use of the Harwell Scientific bias factor it was agreed that the authority would undertake co-location studies with its chemiluminescent analysers at 3 sites namely, the Swansea AURN on Carmarthen Road, and at the Morfa and Morriston Groundhog sites. This work commenced during December 2006 and was delayed until the Swansea AURN had been relocated and commissioned to prevent any additional uncertainties. The authority has now completed these co-location tasks at all three automatic sites within Swansea and has determined a local bias factor for the correction of the passive nitrogen dioxide diffusion tubes exposed within Swansea during 2008. Further details on this area of work can be found within section 2.1.13

The Progress Report for 2004/05 was submitted for consideration during July 2005

The infrastructure required for a real-time assessment of PM_{10} in Swansea, is still being developed. The authority have purchased ten Met One E-Type light scattering PM_{10} dust samplers and are in the process of deploying these at the identified narrow, congested roads and busy junctions mentioned within the USA submitted in July 2004 and the Detailed Assessment. Identification of suitable sites is now complete but what has proved time consuming are the practical considerations of the site location itself together with the provision of suitable services i.e. un-metered electricity feeds and suitable mounting points. Significant problems have been, and continue to be encountered with the operation of the EType samplers. It is recognised that these analysers do not have formal UK type approval but due to both the expense and considerable practical considerations of deploying Rupprecht & Patashnick Co., Inc. FDMS/TEOM's, these E Type samplers will provide a more accurate assessment than use of the DMRB screening tool would be able to provide. It is thought that if the technical difficulties being experienced with the equipment can be resolved that the modelling will supplement the data collected by the E Type samplers.

Additional works underway include the collection of real-time classified counts of traffic data via the Vodafone GPRS network together with the construction of an emissions database. It is these latter items, particularly communications problems with the GPRS system that have delayed the modelling capabilities to date. The USA dated April 2006 was submitted for consideration to the Welsh Assembly Government in July 2006.

The authority undertook a further Progress Report in 2007 which was submitted to the Welsh Assembly and the auditors during July 2007. The same issues arose from this report with the auditors – the rationale behind the bias factor used to correct the passive diffusion tube was again raised despite the report clearly outlining the authorities' reasons for using the bias factor that was used to correct for tube bias. This issue as mentioned above should now have been resolved with the determination of a local Swansea bias factor

Progress Report 2008

The authority submitted its Updating and Screening Assessment 2008 to the Welsh Assembly Government during July 2009. The conclusions of this assessment were that exceedances of the nitrogen dioxide annual mean objective continued to be seen within the existing Hafod Air Quality Management Area along the Neath Road corridor, Cwm Level Road (Brynhyfryd Cross Roads) and Carmarthen Road (Dyfatty area). Additional monitoring within the then Hafod AQMA area around the High Street Railway Station highlighted the potential of exceedance of both the annual mean and 1-hour nitrogen dioxide objectives. Monitoring from outside of the then existing Hafod AQMA identified new areas that were failing the nitrogen dioxide annual mean objective. These areas are along Gower Road in Sketty, along Carmarthen Road within Fforestfach, and at numerous sites within the city centre. The city centre area was treated with caution as at the time of submission, only the minimum 9 months of data was available for analysis. An update on the city centre monitoring for nitrogen dioxide is presented below within section 2.1.2. The authority doubled its passive nitrogen dioxide tube survey during November 2009 from 134 to 274 sites, as a result of new LAQM Technical Guidance (LAQM.TG(09)) and the conclusions reached within the USA 2009 that used the new guidance, that additional initial screening of narrow/congested streets was required where the AADT flow was greater than 5000 vehicles. Monitoring data is presented for the periods available for the 140 additional sites within section 2.1.2.

Following the USA 2009, the authority intended to amend the existing Hafod Air Quality Management Area to include these newly identified areas (Sketty and Fforestfach) along with the renaming of the declared air quality management area. All declared areas are to be collectively known as The Swansea Air Quality Management Area 2010. However, considerable delays were encountered with the mechanisms of obtaining the necessary Council Order. Details were presented before Council during August 2010. Annexe 2 contains a map indicating the adopted Swansea Air Quality Management Area 2010

Progress Report 2010

The authorities Progress Report 2010 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Sketty and Fforestfach areas of Swansea. These areas have now been included within the Swansea Air Quality Management Area 2010.

Progress Report 2011

The authorities Progress Report 2011 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Sketty and Fforestfach areas of Swansea. Additionally, other sites outside of the Swansea Air Quality Management Area 2010 in the Mumbles, Uplands, Morriston, Llansamlet and Ynystawe areas were found to be exceeding the nitrogen dioxide annual mean objective. It was stated that further monitoring would be undertaken to confirm such exceedances before any additional AQMS were declared.

Updating and Screening Assessment 2012

The authorities USA 2012 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Hafod, Sketty and Fforestfach areas of the Swansea AQMA 2010. Additionally, other sites outside of the Swansea Air Quality Management Area 2010 in the Mumbles, Uplands, Morriston, and St.Thomas areas were found to be exceeding the nitrogen dioxide annual mean objective. It was stated that the authority would consider the amendment of the Swansea Air Quality Management area 2010 and that further monitoring would be undertaken within the areas to confirm such exceedances before any additional AQMS were declared. Additional real-time chemiluminescent monitoring has not been possible. Similarly, no passive diffusion tube monitoring has been possible at first floor level within the Newton Road area of Mumbles

Progress Report 2013

The authorities Progress Report 2013 identified continuing exceedances of the nitrogen dioxide annual mean objective within the existing Swansea AQMA 2010 and also outside of the existing AQMA, notably within the city centre, Mumbles and Fabian Way areas.

It was stated that the authority intended to locate a real-time chemiluminescent analyser within the High Street area of the city centre prior to year end 2013. This site is not now planned until July 2014.

Details on the various stages completed by the authority in the Local Air Quality Management process are given below within table 2. Brynlliw Colliery remediation is shown for information purposes due to the delays in the LAQM process that this introduced. This was a long-term burning tip which required large scale monitoring and control.

Progress Report 2014

The authorities Progress Report 2014 identified continuing exceedances of the nitrogen dioxide annual mean objective within the existing Swansea AQMA 2010 and also outside of the existing AQMA, notably within the city centre, Mumbles and Fabian Way areas.

It was stated that the authority intended to locate a real-time chemiluminescent analyser within the High Street area during July 2014. This work was completed on schedule with the site becoming operational on the 7th July 2014. The new site is mentioned within chapter 2.1 below with additional details provided within chapter 2.1.13. The available data is presented within chapter 2.2.2 Automatic Real Time Nitrogen Dioxide data but no conclusions can be reached at present due to the monitoring period achieved so far.

Details on the various stages completed by the authority in the Local Air Quality Management process are given below within table 2. Brynlliw Colliery remediation is shown for information purposes due to the delays in the LAQM process that this introduced. This was a long-term burning tip which required large scale monitoring and control.

Updating and Screening Assessment 2015

The authorities USA 2015 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Hafod, Sketty and Fforestfach areas of the Swansea AQMA 2010. Additionally, other sites outside of the Swansea Air Quality Management Area 2010 in the Mumbles, Uplands, Morriston, and St.Thomas areas were found to be exceeding the nitrogen dioxide annual mean objective. Due to the reductions in nitrogen dioxide annual mean concentrations being witnessed year on year, along Newton road, Mumbles, it was not proposed to declare an AQMA. The authority will work towards the introduction of a Traffic Regulation Order along Newton Road prohibiting delivery vehicles delivering goods during busy periods of the day to restrict congestion along Newton Road. In view of the reductions in annual mean concentrations being measured, concentrations at first floor level above the canopy to flats will not be investigated further.

Due to the wide ranging implications of the City Centre review and likely highway alterations, it was not proposed to declare an AQMA within the city centre until the outcomes and recommendations of the review are known. The review is so wide ranging that the source i.e. the highway network, may be removed from where there are currently receptor locations. Discussions will continue on how best the desired provision of housing within the city centre can be achieved within the overall development proposals both in terms of the air quality implications and also exposure to noise for those residents. These discussions remain ongoing.

Report	Date Completed	Internet URL
1st Stage Review	1999	http://www.swansea.gov.uk/index.cfm?articleid=5563
Brynlliw Colliery Remediation	1999-2000	N/A
2nd & 3rd Stage Review	2001	http://www.swansea.gov.uk/index.cfm?articleid=5565
Declaration of Hafod AQMA	September 2001	http://www.swansea.gov.uk/index.cfm?articleid=5557
Stage 4 Review	October 2003	http://www.swansea.gov.uk/index.cfm?articleid=5568
2nd Round Review USA	July 2004	http://www.swansea.gov.uk/index.cfm?articleid=5561
Hafod AQMA Action Plan	December 2004	http://www.swansea.gov.uk/index.cfm?articleid=9930
Progress Report 2004	July 2005	http://www.swansea.gov.uk/index.cfm?articleid=9929
Detailed Assessment	December 2005	http://www.swansea.gov.uk/index.cfm?articleid=5561
Progress Report 2006	July 2006	http://www.swansea.gov.uk/index.cfm?articleid=9929
USA 2006	April 2006	http://www.swansea.gov.uk/index.cfm?articleid=5561
Progress Report 2007	July 2007	http://www.swansea.gov.uk/index.cfm?articleid=9929
Progress Report 2008	May 2008	http://www.swansea.gov.uk/media/pdf/l/3/Progress_Report_2008.pdf
USA 2009	July 2009	http://www.swansea.gov.uk/media/pdf/e/1/City_and_County_of_Swansea_USA_2009_PDF.pdf
Progress Report 2010	July 2010	http://www.swansea.gov.uk/media/pdf/2/5/Progress_Report_2010.pdf
Progress Report 2011	September 2011	http://www.swansea.gov.uk/media/pdf/d/4/Progress_Report_2011.pdf
USA 2012	September 2012	http://www.swansea.gov.uk/media/pdf/n/1/USA2012.pdf
Progress Report 2013	June 2013	http://www.swansea.gov.uk/media/pdf/i/3/SwanseaProgressReport2013.pdf
Progress Report 2014	July 2014	http://swansea.gov.uk/media/6538/Progress-Report-2014/pdf/Swansea_Progress_Report_2014.pdf
USA 2015	June 2015	http://www.swansea.gov.uk/media/13539/Updating-and-Screening-Assessment-2015/pdf/Swansea_USA_2015.pdf

Table 2 – Summary of Local Air Quality Management actions

The Internet addresses (URL's) that these reports can be downloaded from are given where appropriate.

2 New Monitoring Data

2.1 Summary of Continuous Real Time Monitoring Undertaken

The authority operates a network of monitoring stations, mainly located within the lower Swansea valley area. The network is a mixture of three, fixed point automatic stations, together with open path measurements from two DOAS (Differential Optical Absorption Spectroscopy) stations. Details of all automatic monitoring station are given below in table 3 with site by site operational details provided within section 2.1.1. Two of the fixed point stations (Morfa and Morriston) had datasets extending back to 2001. A summary of the commencement of measurement for each station is given below within section 2.1.8 as table 4.

Details of the Morfa Station are included for completeness but, as explained below this station has been decommissioned during May 2011.

During late 2012 the authority deployed Met One EBams PM_{10} at five locations in Swansea. These sites are detailed below and tend to be either at busy junctions or other areas of high HGV flow i.e. the EBam at Westway to monitor any impact from the Quadrant Bus Station. It is recognised that the Met One EBam has not participated in the equivalency trials to show compliance with the EU reference gravimetric method but as outlined below the data from the EBams correlate well with the Met One Bam 1020 PM_{10} monitor located at the Swansea AURN. The Met One Bam 1020 has participated in equivalency trails and has been accepted as an equivalent method. The use of the MetOne EBams has therefore been restricted to that of a "screening assessment". Table 3 below includes details of these PM_{10} monitoring locations. Whilst the Sketty Cross and Fforestfach Cross EBam sites are within the existing Swansea AQMA 2010 boundary, the AQMA was declared as a result of NO_2 annual mean exceedances and not for exceedances of any PM_{10} objectives.

On the 7th July 2014 a new roadside real-time chemiluminescent Teledyne NOx analyser was commissioned. It is located roadside outside a block of flats at Station Court, High Street, Swansea and fronts onto bus stops and mini-roundabouts and is subject to the effects of considerable congestion at peak times. The site is also within

75m of Swansea Railway Station complex. The site details are given below in table 3 and additional description below as part of chapter 2.1.13.

Site Name	Site Type	OS Grid Ref	LAQM Pollutants Monitored	IN AQMA	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location
Swansea Roadside AURN	Roadside	X 265299 Y 194470	NO_2,PM_{10}, $PM_{2.5}$	Y	Y (12m)	4m	N
Morfa Groundhog	Roadside	X 266036 Y 195406	NO_2,PM_{10}, SO_2	Y	Y (34m)	5m	Y
Morriston Groundhog	Roadside	X 267210 Y 197674	NO_2,PM_{10}, and Ozone	N	Y (22m)	4m	N
Cwm Level Park	Urban Background	X 265912 Y 195890	NO_2 and Ozone	Y	N (100m)	78m	N
Hafod DOAS	Roadside	Transmitter X 265927 Y 194453 Receiver X 265991 Y 194706	NO_2 Ozone and Benzene	Y	Y (0.3m)	1.7m	N
St Thomas DOAS	Roadside	Transmitter X 266191 Y 193655 Receiver X 266263 Y 193370	NO_2, SO_2 Ozone and Benzene	N	Y (2m) Varies along path length	1.7m	N
Fforestfach Cross	Roadside	X 263236 Y 195489	PM_{10}	Y	Y (19m)	3m	N
Uplands Crescent	Roadside	X 264078 Y 192888	PM_{10}	N	Y (12m)	1m	
Sketty Cross	Roadside	X 262681 Y 192871	PM_{10}	Y	Y (14m)	1m	
Westway Quadrant Bus Station	Roadside	X 265256 Y 192731	PM_{10}	N	Y (11m)	2m	
SA1 Junction Port Tennant	Roadside	X 266670 Y 193179	PM_{10}	N	Y (6m)	3m	
Station Court High Street	Roadside	X 265705 Y 193686	NO_2		Y (1m)	2m	N

Table 3 Details of Automatic Monitoring Sites

* Where NO_2 is listed as a pollutant monitored, NO_x and/or NO concentrations are also available.

2.1.1 Automatic Continuous Real Time Monitoring Sites

2.1.2 Swansea Roadside AURN, Carmarthen Road, Waun Wen

The Swansea AURN was located in the heart of the city centre on the pedestrian area of Princess Way. Due to the redevelopment of the David Evans complex, the monitoring station was scheduled for decommissioning on the 14th August 2006. The data logger failed on the 3rd August 2006 following a power surge at the site and in effect, data from the site ceased on this date as it was decided not to undertake any repairs to the data logger. Every effort had been made to re-establish the monitoring station within the city centre. However, DEFRA had amended the siting criterion which has resulted in a suitable site being unable to be identified. The station has now been relocated roadside on Carmarthen Road at Waun Wen. The Annual Average Daily Traffic flow (AADT) for 2014 was 21,120 vehicles. The relocated site is detailed and outlined below and is now sited within the boundary of the Swansea Air Quality Management Area 2010. The site has receptors close by with additional sensitive receptors in close proximity - a Nursing Home and a Primary School are within 100m of the monitoring location.

The AUN station at Princess Way had been affiliated onto the UK National Network during late 1994 and had been operational ever since until 3rd August 2006. The new roadside site has also been affiliated onto the UK National Network with data capture commencing on the 20th September 2006 at 13:00hrs. The station has been given a site classification Roadside[1]. Map 1 below is an aerial view of the site and the surrounding locations. The site is located in an open aspect approximately 55m above sea level with direct views over Swansea Bay. It is therefore more exposed to the prevailing south westerly winds than the monitoring sites located on the valley floor (Morfa, Morriston and Hafod DOAS). It is thought probable that this site may well sit above any inversions that form within the lower Swansea Valley and therefore, does not experience the elevated concentrations seen at the other monitoring stations during such conditions.

[1] *Source LAQM.TG(16) Table 7.8 page 7-41*

Map 1 – Aerial view of Swansea Roadside AURN

All equipment is housed within an air-conditioned unit and operated continuously. The equipment comprises of an Advanced Pollution Instrument (API) real-time analyser measuring NO_x with Thermo FDMS units measuring PM_{10} and $PM_{2.5}$ until the 16th November 2011 when they were removed due to their unreliability and were replaced with Met One1020 BAM units on the 28th November 2011. The API gas analyser has been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the analyser. In addition officers from this authority performed routine fortnightly manual calibrations. The analyser is subjected zero cylinder generated zero air to assess the analyser's response to zero air. The analyser is also subjected to traceable calibration gases at a known concentration and the response of the analyser recorded. All manual calibration data is then forwarded to Ricardo (formerly AEA Energy and Environment) to perform data management procedures. The data is then further subjected to full network QA/QC procedure's undertaken by Ricardo on behalf of the Department of Environment, Food and Rural Affairs (DEFRA). The station is serviced and maintained twice yearly by Enviro Technology Services Plc. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc. All equipment on site is fully audited twice yearly by Ricardo together with the calibration gases stored on site

Hourly ratified data for 2015 covering the pollutants Nitrogen Dioxide and Particulate Matter PM_{10} and $PM_{2.5}$ (BAM 1020) has been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector . These data have then been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation.

During 2007, the UK Automatic Network underwent a review by DEFRA. During this review, numerous stations were either decommissioned from the network, or, as in the case of the Swansea AURN, a limited number of analysers from the station were kept within the UK monitoring framework. This review was undertaken by DEFRA in response to their changing EU commitments. Whilst data from the CO and SO_2 analysers are no longer collected (post 1st October 2007) or ratified by DEFRA (by the then AEA Energy and Environment), this authority had decided to continue to fund their operation and data collection. However, due to budgetary constraints and the relatively low concentrations being recorded, this authority decided to cease measurements of CO and SO_2 during October 2010. The dataset from 1st October 2007 to 27th October 2010 for the above mentioned pollutants was therefore ratified by the authority. No presentation or analysis of CO and SO_2 since 2010 is made within this report as all objectives set in regulation had previously been met comfortably for several years at the AURN site. Full details relating to these pollutants have been reported within previous LAQM reports submitted by this authority. Therefore, only NO_2 $PM_{2.5}$ and PM_{10} data are now reported here.

The ozone analyser that was surplus to requirements at the site following the DEFRA review has been relocated at the Cwm Level Park urban background monitoring station during December 2008.

2.1.3 Morfa Groundhog

The Morfa station had been operational since August 2000 and was located in a fairly open area on a grass bank to the Morfa / Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. During May 2011 measurements ceased at this site due to the loss of the electricity supply to the station. The station was within the boundary of the Swansea Air Quality Management Area 2010 and had been given a site classification Roadside[2].

As with the majority of monitoring stations, the location finally chosen for monitoring has to be a compromise between the ideal desired location and the practicalities of siting a station of this size. It is recognised that this station having being sited adjacent to a roundabout is not ideally placed. However, in saying this, the station satisfied the majority of the monitoring criteria required by this authority with receptor locations (dwellings) being located within 35m. Due to its location in a fairly open aspect of the lower valley area, this station did not truly reflect the conditions experienced within the nearby narrow congested streets within the Neath Road corridor (see Hafod DOAS) that form part of the Swansea Air Quality Management Area 2010.

All equipment was housed within an air-conditioned unit and operated continuously. The equipment comprised of Advanced Pollution Instruments (API) real-time analysers measuring CO, SO_2 and NO_x. The R&P TEOM measuring PM_{10} was upgraded to a Thermo FDMS unit again measuring PM_{10} on the 28th November 2006 with data capture for the FDMS unit commencing at 13:00. The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine monthly manual calibrations. The analysers are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analysers are also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

[2] *Source LAQM.TG(16) Table 7.8 page 7-41*

The station was operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data has been re-scaled by the authority according to the calibration factors (monthly span and overnight/monthly zeros). The station was serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority had a 48 hour call out response for any on-site equipment problems with Enviro Technology Services Plc. Since the awarding of the contract by the Welsh Assembly Government to AEA Energy & Environment to run the Welsh Air Quality Forum in April 2004, all equipment on site was fully audited yearly by AEA Energy & Environment together with the calibration gases stored on site. The L10 span gas cylinders were replaced on a regular basis and were to a certified and traceable standard.

A map showing the location of the Morfa Groundhog station is given below as map 2. The boundary of part of the existing Swansea Air Quality Management Area 2010 is shown as the black/yellow dashed line.

Map 2 Location of Morfa Groundhog Station

As mentioned above, measurements ceased at this site during May 2011. Prior to this, the CO and SO_2 measurements ceased during August 2010 due to budgetary restrictions. No presentation or analysis of data for these pollutants is made within this report as all objectives set in regulation had previously been met comfortably for several years. Full details relating to these pollutants have been reported within previous LAQM reports submitted by this authority. Therefore, no data are reported here for pre 2011 and its inclusion here is for information only.

2.1.4 Morriston Groundhog

Morriston Groundhog has been operational since September 2000 and is located adjacent to the southbound slip road to the busy A4067 dual carriageway at Morriston Underpass. The Swansea Air Quality Management Area 2010 (former Hafod AQMA) boundary is approximately one mile south of this location. Receptor locations can be found to the right of the station in the form of terraced housing. To the left of the site and on the opposite side of the dual carriageway is Morriston Primary School. The school buildings abut the red brick retaining wall to the northbound Morriston slip road exit. The A4067 carries on for approximately one mile northbound where it meets the M4 motorway at junction 45. The station has been given a site classification Roadside[3]. Map 3 below is an aerial view of the site and the surrounding locations.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring O_3, and NO_x . The R&P PM_{10}TEOM was upgraded to a Thermo FDMS PM_{10} unit on the 27th October 2006 with data capture for the FDMS unit commencing at 17:00. The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine fortnightly manual calibrations. The analysers are subjected to scrubbed internal generated zero air to assess the analyser’s response to zero air. The analysers are also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

[3] *Source LAQM.TG(16) Table 7.8 page 7-41*

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc. Since the awarding of the contract by the Welsh Assembly Government to Ricardo (formally AEA Energy & Environment) to run the Welsh Air Quality Forum in April 2004, all equipment on site will be fully audited yearly by Ricardo AEA together with the calibration gases stored on site. The L40 span gas cylinders are replaced on a regular basis and are to a certified and traceable standard.

Map 3 - Aerial view - Morriston Groundhog
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However, due to budgetary constraints and the historically relatively low concentrations being recorded, this authority decided to cease measurements of CO during April 2010, and SO_2 during October 2010. The H_2S analyser had proved highly problematic and expensive to repair and measurements had already ceased some considerable time ago. No presentation or analysis of data for these pollutants is made within this report as all objectives set in regulation have previously been met comfortably for several years. Full details relating to these pollutants have been reported within previous LAQM reports submitted by this authority. Therefore, only NO_2, Ozone and PM_{10} (FDMS) data are reported here for 2015.

2.1.5 Cwm Level Park, Landore

The authority established a NO_x and Ozone urban background monitoring station [4] at Cwm Level Park, Landore during late November/ early December 2008 within the compound of its 30m Meteorological monitoring mast.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring NO_x and Ozone. The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine monthly manual calibrations. The analysers are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The NO_x analyser is subjected to traceable calibration gas at a known concentration and the response of the analyser and data-logger is recorded. The internal span calibration is used with the ozone analyser. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc. Since the awarding of the contract by the Welsh Assembly Government to Ricardo AEA (formally AEA Energy & Environment) to run the Welsh Air Quality Forum in April 2004, all equipment on site will be fully audited yearly by Ricardo AEA, together with an audit of the calibration gases stored on site. Data is re-scaled by Ricardo following the authority supplying routine monthly calibration reports. The L10

[4] *Source LAQM.TG(16) Table 7.8 page 7-41*

Map 4 Cwm Level Park Monitoring

span gas cylinders (NO) will be replaced on a regular basis and are to a certified and traceable standard.

A map showing the location of the Cwm Level Park station is given above as map 4. The boundary of part of the Swansea Air Quality Management Area 2010 (former Hafod AQMA) is shown as the black/yellow dashed line.

There are no “major” sources closes by as would be expected with the site classification, with the nearest road being nearly 80m away and having an Annual Average Daily Traffic flow (AADT) during 2015 of 14,112 vehicles. Some light industry / warehouse front the site but are insignificant as a source. Receptor dwellings are within 100m of the site.

2.1.6 The OPSIS Hafod Differential Optical Absorption Spectroscopy (DOAS) Monitoring Station

The OPSIS DOAS open path light source measures the pollutants Nitric Oxide, Nitrogen Dioxide, Ozone and Benzene along a 250-metre section of Neath Road, within the Hafod district of the lower valley area and within the Swansea Air Quality Management Area 2010 (former Hafod AQMA). These measurements take place at first floor level - a height of approximately 3 metres and less than 0.3m away from the front facade of the terraced dwellings. The DOAS transmitter ❶ is fixed externally to the front wall of a terraced dwelling that fronts onto Neath Road at one end of the open path measurement. The receiver module ❷ is located on the front wall of another dwelling that also fronts onto Neath Road at the other end of the open path measurement length. The receiver focuses the light received and transmits the light via fibre optic cable into a spectra analyser. Map 5 below shows an aerial photograph of the location of the transmitter and receiver heads. This section of Neath Road has an annual average daily traffic flow (AADT) during 2014 of 16272 vehicles and forms the “traditional” route up/down the Swansea Valley. The whole length of Neath Road through the Lower valley area is characterised by slow moving traffic through the narrow, congested, B route corridor. Habits of a lifetime may prove difficult to break!

The transmitter emits a light beam from a xenon lamp and contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser that measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored.

Map 5 Hafod Opsis DOAS Monitoring

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants, as the carriageway is approximately 2 metres away from the front facade of these dwellings. The highway at this location can loosely be referred to as a "street canyon". Valid data capture commenced on the 8th January 2004 at 16:00hrs. The station has been given a site classification Roadside[5].

The DOAS system returns data in the form of cyclonic means, not always of the same averaging period - the system has been configured to measure each pollutant for a set period of time: 1 minute each for NO and Benzene and 30 seconds each for nitrogen dioxide and ozone. This gives a cycle time of approximately 3 minutes. The system stores the information as a cycle period of measurement for each pollutant within a "logger value" dataset. During the QA/QC processes that have been completed, conditions were imposed on the minimum acceptable light levels and maximum standard deviations of the measurements permitted on the individual

[5] *Source LAQM.TG(16) Table 7.8 page 7-41*

cycled means for each pollutant. The validation process produces the same cyclonic means within a separate database. All individual measurement points that have not met the QA/QC conditions (detailed below) are replaced with null values within the new dataset. The user can then compile 5 minute means from the validated dataset and undertake analysis.

- **QA/QC for NO, Nitrogen Dioxide and Ozone**

  If (C1 >0 and C1 > 2 * C2 and C3 > 10) then result: = C1 else result: = C0

  C0 – Null value
  C1 – Pollutant Concentration
  C2 – Standard Deviation of pollutant
  C3 – Light Level of pollutant

- **QA/QC for Benzene**

  If (C1 >0 and C1 > 2 * C2 and C3 > 40) then result: = C1 else result: = C0

  C0 – Null value
  C1 – Pollutant Concentration
  C2 – Standard Deviation of pollutant
  C3 – Light Level of pollutant

It should be noted that the data presented here represents the spatial average over the whole of the 250-meter measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations. It should also be noted that the DOAS methodology of monitoring does not comply with the EU Directive methods of measurement (chemiluminescent for NO_2, UV fluorescence for SO_2 etc.) at present but the system has achieved MCERTS certification and TUV certification.

Monitoring data from the site has been subject to interruption as the property owner at the transmitter site ❶ undertook extensive renovation works to the property. The transmitter head was removed from the front façade during these works to prevent damage. The equipment was removed from the façade of the property at 11:00 on the 22nd April 2005 and was replaced at 10:00 16th May 2006. There is therefore, significant data loss for both 2005 and 2006, with in total, just over a years' worth of monitoring data being lost. This is frustrating and regrettable but the loss was outside of the control of this authority.

To compound and frustrate matters further an Area Renewals Project commenced during January 2008 to properties at the receiving end ❷ of the open path measurement. This renewal project resulted in scaffolding erected to the front facades of the terrace properties blocking the light path to the receiver between the 3rd January 2008 and July 2008. Full functionality was not restored until the site had been serviced and calibrated on the 26th August 2008.

The station is now subject to Xenon lamp changes on a quarterly basis, with zero and span calibrations now taking place on an annual basis. These works are undertaken by Enviro Technology Plc, the UK distributor for Opsis of Sweden. The frequency of zero/span calibration has been subject to discussions with Opsis as noticeable drop off in lamp intensity was noticed for the NO channel (which is deep down in the spectrum) during the 5th and 6th months after renewal. Changing the Xenon lamps every 4 months has resolved this data issue concern.

2.1.7 The Opsis St.Thomas Differential Optical Absorption Spectroscopy (DOAS) Monitoring Station

The St.Thomas OPSIS Differential Optical Absorption Spectroscopy (DOAS) has been installed during September 2005 along a 280m path length of Pentreguinea Road within the St.Thomas area to measure the pollutants sulphur dioxide, nitrogen dioxide, and ozone. Valid data capture commenced on the 12th September 2005 at 09:30am. This section of Pentreguinea Road had an annual average daily traffic flow (AADT) during 2014 of 20,184 vehicles and forms the eastside link up/down the Swansea Valley from Whiterock Bridge to Quay Parade bridges. This route is intended for use within the Action Plan to attempt traffic management during forecast pollution episodes by diverting traffic from the central Neath Road corridor

Measurements take place at a height of approximately 3-4 metres and less than 2m away from the front facade of the majority of terraced dwellings. The DOAS transmitter ❶ is fixed on top of a concrete column located north of the junction of Kilvey Terrace and Pentreguinea Road as shown in photo 1 below. The receiver module ❷ is located on top of a concrete column and site housing at the other end of the open path measurement length as shown in photo 2 below.

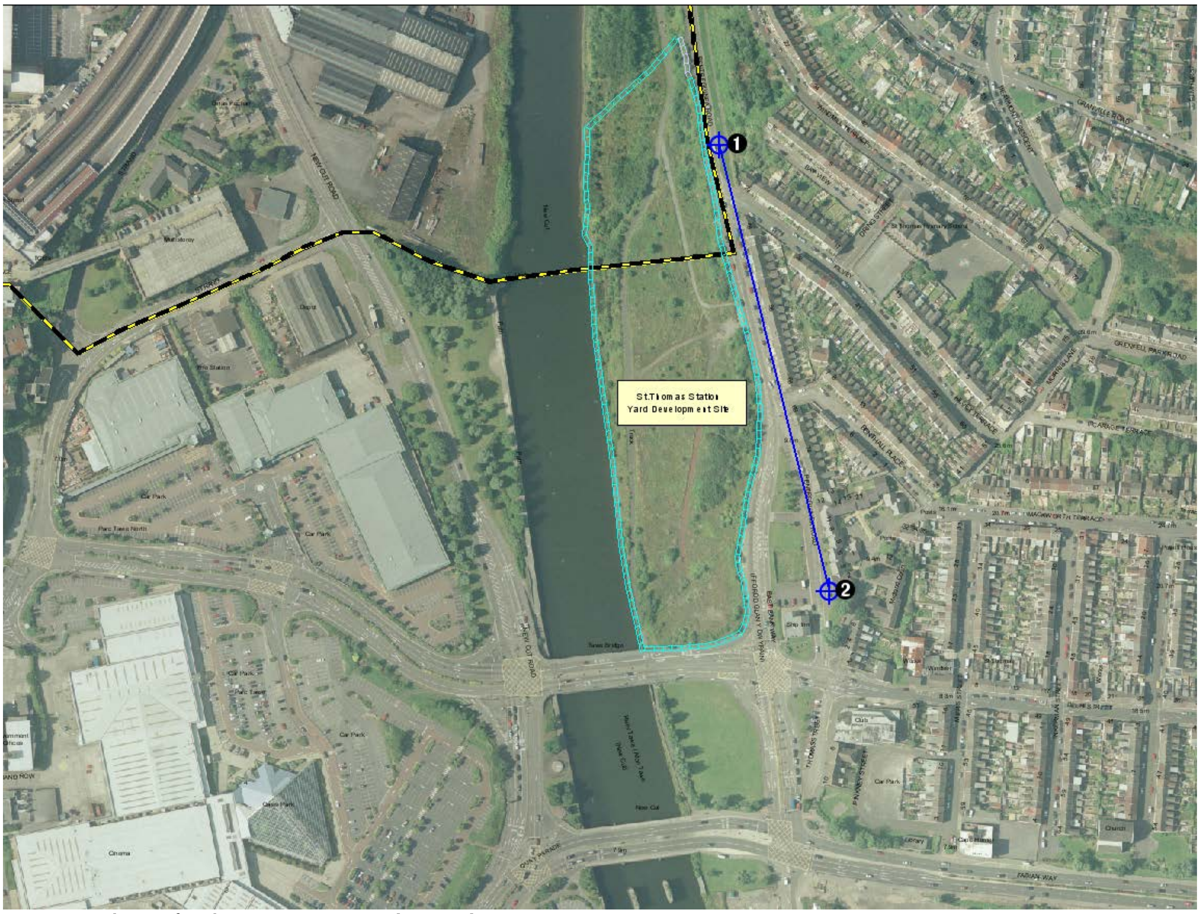
Photo 1 - St Thomas DOAS Transmitter

Photo 2 - St Thomas DOAS Receiver Station

The transmitter emits a light beam from a xenon lamp that contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser that measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored. The station has been given a site classification Roadside[6].

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants. The location of the open path monitoring can be seen within map 6 below. The site of the transmitter lies just outside of the southern boundary of the Swansea Air Quality Management Area 2010 (former Hafod AQMA). The extent of the existing order can be seen within map 6.

[6] *Source LAQM.TG(16) Table 7.8 page 7-41*



Map 6 – Aerial View of St.Thomas OPSIS DOAS and surrounding area

Quay Parade Bridges are to the south of this location. There are numerous dwellings located along this section of Pentreguinea Road with an application already received for residential development on the former St.Thomas Station Yard Site located between Pentreguinea Road and the River Tawe. An application for formal planning consent was received during 2005 but was rejected due to the intensity of the development. It is thought that a modified scheme will eventually be resubmitted to include an element of social housing.

The DOAS system returns data in the form of cyclonic means, not always of the same averaging period - the system has been configured to measure each pollutant for a set period of time: 1 minute for Benzene and 30 seconds each for sulphur dioxide, nitrogen dioxide and ozone. This gives a cycle time of approximately 3 minutes. The system stores the information as a cycle period of measurement for each pollutant within a "logger value" dataset. During the QA/QC processes that have been completed by this authority, conditions were imposed on the minimum acceptable light levels and maximum standard deviations of the measurements permitted on the individual cycled means for each pollutant. The validation process produces the same cyclonic means within a separate database. All individual measurement points that have not met the QA/QC conditions (detailed below) are replaced with null values within the new dataset. The user can then compile 5 minute means from the validated dataset and undertake analysis.

- **QA/QC for SO_2, Nitrogen Dioxide and Ozone**

  If (C1 >0 and C1 > 2 * C2 and C3 > 10) then result: = C1 else result: = C0

  C0 – Null value
  C1 – Pollutant Concentration
  C2 – Standard Deviation of pollutant
  C3 – Light Level of pollutant

- **QA/QC for Benzene**

  If (C1 >0 and C1 > 2 * C2 and C3 > 40) then result: = C1 else result: = C0

  C0 – Null value
  C1 – Pollutant Concentration
  C2 – Standard Deviation of pollutant
  C3 – Light Level of pollutant

The station is subject to Xenon lamp changes on a 6 monthly basis with zero and span calibrations now taking place on a yearly basis. These works are undertaken by Enviro Technology Plc, the UK distributor for Opsis of Sweden. The frequency of lamp change differs to that of the Hafod DOAS as this station does not measure the NO channel and as such does not suffer the drop off/degradation in lamp intensity during the 5^{th} and 6^{th} months of operation. Changing the Xenon lamps every 6 months does not invoke any data issue concerns at this site.

It should be noted that the data presented here represents the spatial average over the whole of the 280-meter measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations. It should also be noted that the DOAS methodology of monitoring does not comply with the EU Directive methods of measurement (chemiluminescent for NO_2, UV fluorescence for SO_2 etc.) at present but the system has achieved MCERTS certification and TUV certification.

2.1.8 Fforestfach Cross - Met One EBam PM_{10}

The Fforestfach Cross EBam PM_{10} station was established during late October 2012 to provide a basic screening opinion on PM_{10} concentrations around the busy Fforestfach Cross junction. The A483 Carmarthen Road has junctions with the A4216 Station Road to the south and Ravenhill Road to the north. Relevant receptors exist at numerous dwellings either side of the junctions. Considerable traffic congestion can be seen on all arms of the junction primarily during working hours. The authority also has numerous NO_2 passive diffusion tube locations within this area. The chosen monitoring location is to the north-west of the junction in front of the war memorial on Carmarthen Road and within 19m of a residential property. Location and ease of connection to an electricity supply dictated the final location.

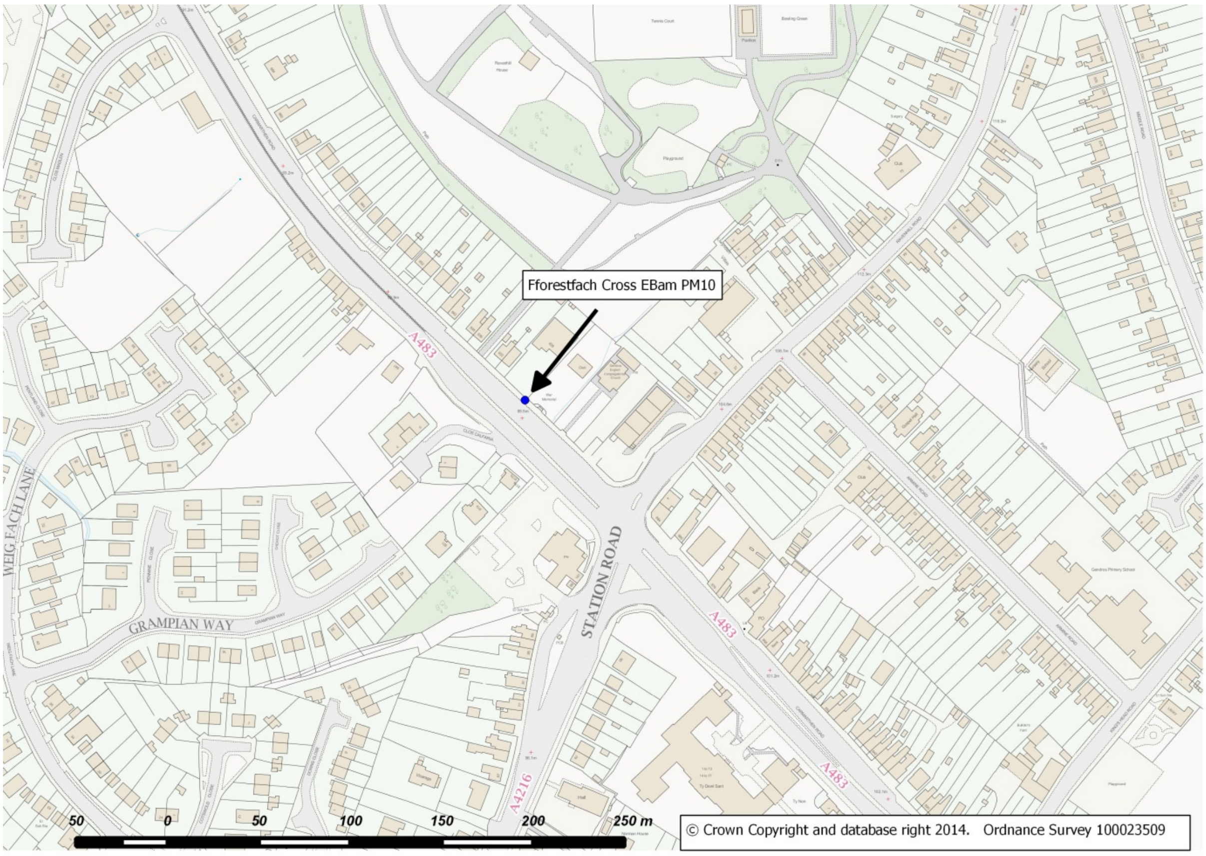
The EBam PM_{10} is similar in operation to the MetOne Bam 1020 deployed at the Swansea AURN approximately 2.3Km away in a south-easterly direction on Carmarthen Road. The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[7]. Installation and operation of the MetOne EBam has been undertaken in accordance with the Operational manual which can be viewed at http://www.metone.com/ebamdocs/E-BAM_Manual(RevL).pdf.

The Met One Instruments, Inc model E-BAM automatically measures and records airborne PM_{10} particulate concentration levels using the principle of beta ray attenuation. This method provides a simple determination of concentration in units of milligrams of particulate per cubic meter of air. A small $_{14}C$ (Carbon 14) element emits a constant source of high-energy electrons known as beta particles. These beta particles are detected and counted by a sensitive scintillation detector. A vacuum pump pulls a measured amount of dust-laden air through the filter tape, which is positioned between the source and the detector thereby causing an attenuation of the beta particle signal. The degree of attenuation of the beta particle signal is used to determine the mass concentration of particulate matter on the filter tape, and the volumetric concentration of particulate matter in ambient air. In this

[7] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

installation a MetOne approved external pump delivering a flow rate of 16.7 l/min has been included within the site enclosure. The integration of sampling has been set at 1-hour with the tape advancing every 3-hours. Tape life is therefore greater than 3 months with the PM_{10} head being cleaned every month between tape exchanges. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc.

A map of the site and surrounding area is given below as map 7.



Map 7 – Fforestfach Cross EBam PM_{10}

2.1.9 Uplands Crescent - Met One EBam PM_{10}

The Uplands Crescent EBam PM_{10} station was established during late October 2012 to provide a basic screening opinion on PM_{10} concentrations along Uplands Crescent which is heavily congested during working hours. The site is located between the signalled controlled junction of Uplands Crescent and Gwydr Square to the west and between the junction of Uplands Crescent with Walter Road/Brynymor Crescent/Eaton Crescent and Mirador Crescent to the east. The authority also has numerous NO_2 passive diffusion tube locations within this area. The chosen monitoring location is adjacent to the GPRS Automatic Traffic Counter site 33. The Annual Average Daily Traffic (AADT) flow for 2015 was 20,736. A summary of the composition of the flow during 2015 is given below:

Vehicle Class	Flow %	Mean Speed (km/h)
Motorcycles	0.6	30.3
Cars or light Vans	93.3	37.5
Cars or light Vans with Trailer	0.1	28.3
Heavy Van, Mini bus, L/M/HGV	4.7	34.6
Articulated lorry, HGV+Trailer	0.2	27.2
Bus	1.0	27.3

Monitoring is undertaken within 11m of residential properties to the north and 17m of residential properties on the opposite side of the road. Location of, and ease of connection to an electricity supply dictated the final location.

The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[8]. Installation and operation of the MetOne EBam has been undertaken in accordance with the Operational manual which can be viewed at http://www.metone.com/ebamdocs/E-BAM_Manual(RevL).pdf.

The Met One Instruments, Inc model E-BAM automatically measures and records airborne PM_{10} particulate concentration levels using the principle of beta ray attenuation. This method provides a simple determination of concentration in units of milligrams of particulate per cubic meter of air. A small $_{14}C$ (Carbon 14) element

[8] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

emits a constant source of high-energy electrons known as beta particles. These beta particles are detected and counted by a sensitive scintillation detector. A vacuum pump pulls a measured amount of dust-laden air through the filter tape, which is positioned between the source and the detector thereby causing an attenuation of the beta particle signal. The degree of attenuation of the beta particle signal is used to determine the mass concentration of particulate matter on the filter tape, and the volumetric concentration of particulate matter in ambient air. In this installation a MetOne approved external pump delivering a flow rate of 16.7 l/min has been included within the site enclosure. The integration of sampling has been set at 1-hour with the tape advancing every 3-hours. Tape life is therefore greater than 3 months with the PM_{10} head being cleaned every month between tape exchanges. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc.

A map of the site and surrounding area is given below as map 8.

Map 8 – Uplands Crescent EBam PM_{10}

2.1.10 Sketty Cross - Met One EBam PM_{10}

The Sketty Cross EBam PM_{10} station was established during late October 2012 to provide a basic screening opinion on PM_{10} concentrations along the A4118 Gower Road which is heavily congested during working hours. The site is located between the signalled controlled crossroad junction of Gower Road with Dillwyn Road and Vivian Road to the north-east and the mini roundabout "junction" of De-La-Beche Road with Gower Road and Sketty Road. A major comprehensive school along with a Welsh Primary School are located along De-La-Beche Road. A significant number of pupils attending the comprehensive school arrive, and depart, by contract bus. The area is subject to congestion during the am and pm peak periods as the A4118 Gower Road forms the main artery into and out of Swansea City Centre (and further eastern destinations) from the west of Swansea and Gower. GPRS ATC counters have been installed on each arm of the signalled controlled junction of Gower Road with Dillwyn Road and Vivian Road. No ATC provision has been possible as yet along De-La-Beche Road. The authority also has numerous NO_2 passive diffusion tube locations within this area.

Monitoring is undertaken within 13m of residential properties on the opposite side of the road. It proved necessary to locate the EBam outside of a petrol station as to site the EBam within pavements fronting any residential properties proved to problematic. Location of, and ease of connection to an electricity supply therefore dictated the final location.

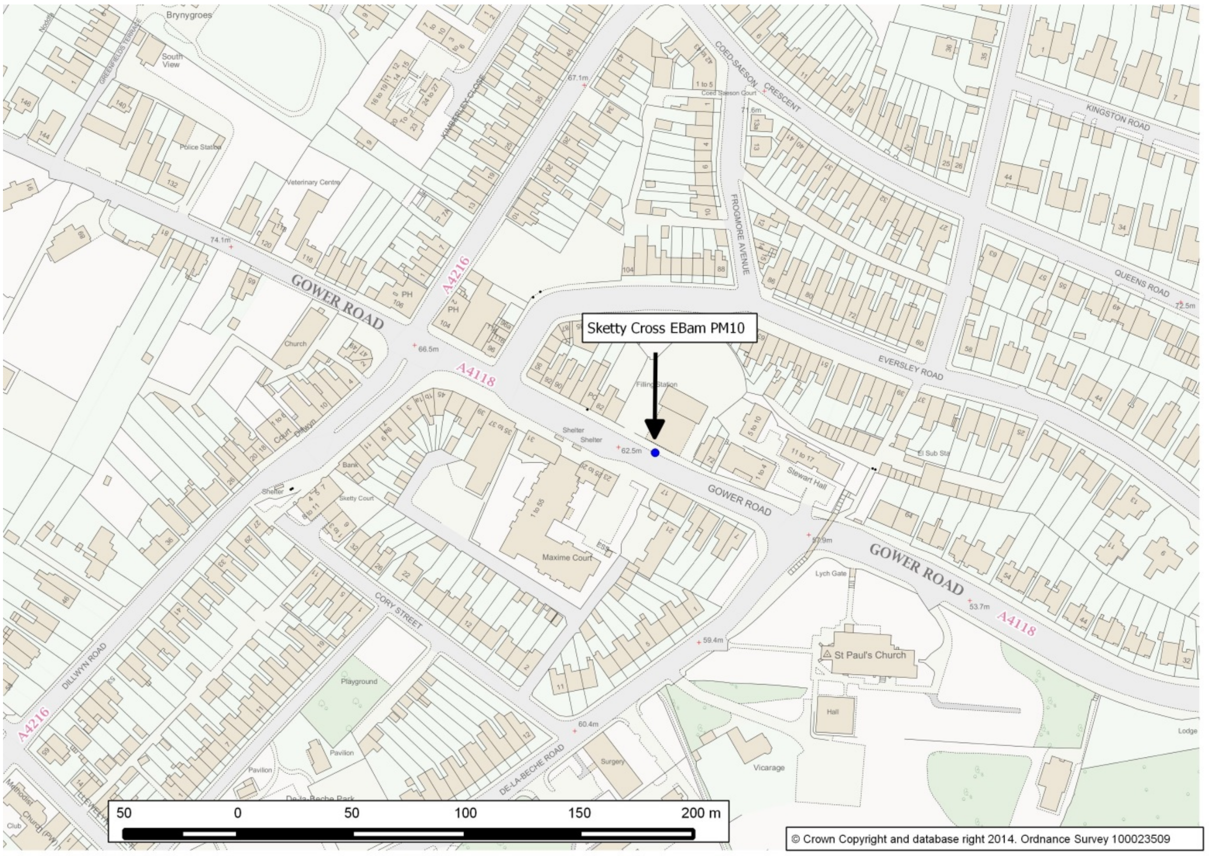
The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[9]. Installation and operation of the MetOne EBam has been undertaken in accordance with the Operational manual which can be viewed at http://www.metone.com/ebamdocs/E-BAM_Manual(RevL).pdf.

The Met One Instruments, Inc model E-BAM automatically measures and records airborne PM_{10} particulate concentration levels using the principle of beta ray attenuation. This method provides a simple determination of concentration in units of

[9] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

milligrams of particulate per cubic meter of air. A small $_{14}C$ (Carbon 14) element emits a constant source of high-energy electrons known as beta particles. These beta particles are detected and counted by a sensitive scintillation detector. A vacuum pump pulls a measured amount of dust-laden air through the filter tape, which is positioned between the source and the detector thereby causing an attenuation of the beta particle signal. The degree of attenuation of the beta particle signal is used to determine the mass concentration of particulate matter on the filter tape, and the volumetric concentration of particulate matter in ambient air. In this installation a MetOne approved external pump delivering a flow rate of 16.7 l/min has been included within the site enclosure. The integration of sampling has been set at 1-hour with the tape advancing every 3-hours. Tape life is therefore greater than 3 months with the PM_{10} head being cleaned every month between tape exchanges. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc.

A map of the site and surrounding area is given below as map 9.



Map 9 – Uplands Crescent EBam PM_{10}

2.1.11 Westway Quadrant Bus Station - MetOne EBam PM_{10}

The Westway EBam PM_{10} station was established during late August 2012 to provide a basic screening opinion on PM_{10} concentrations along Westway opposite the Quadrant Bus Station. This is the major public transport hub within Swansea with both local and “long-haul” services using the facilities provided. Significant volumes of traffic use Westway but it has not been possible due to budget restraints to install the required number of GPRS ATC’s to cover all of the arms and turning movements. The road infrastructure is complex with additional volumes of traffic being attracted not only by the city centre destinations but also by a major superstore located to the south of the site. It is desirable to also record the movements into and out of the superstore as well as the significant number of bus movements/traffic movements along Westway in order to obtain an accurate picture of the total number of movements. As some sections of highway along Westway are 9 lanes in width a total of 3 GPRS ATCs fitted with dual loop cards has been determined as the minimum number necessary to capture all of the movements along Westway. At the present moment in time this financial commitment is not possible.

There are receptor locations within approximately 30m of the boundary of the Quadrant Bus Station and within 3m of Westway itself as there are blocks of warden sheltered flat accommodation over 5 or more stories setback off Westway.

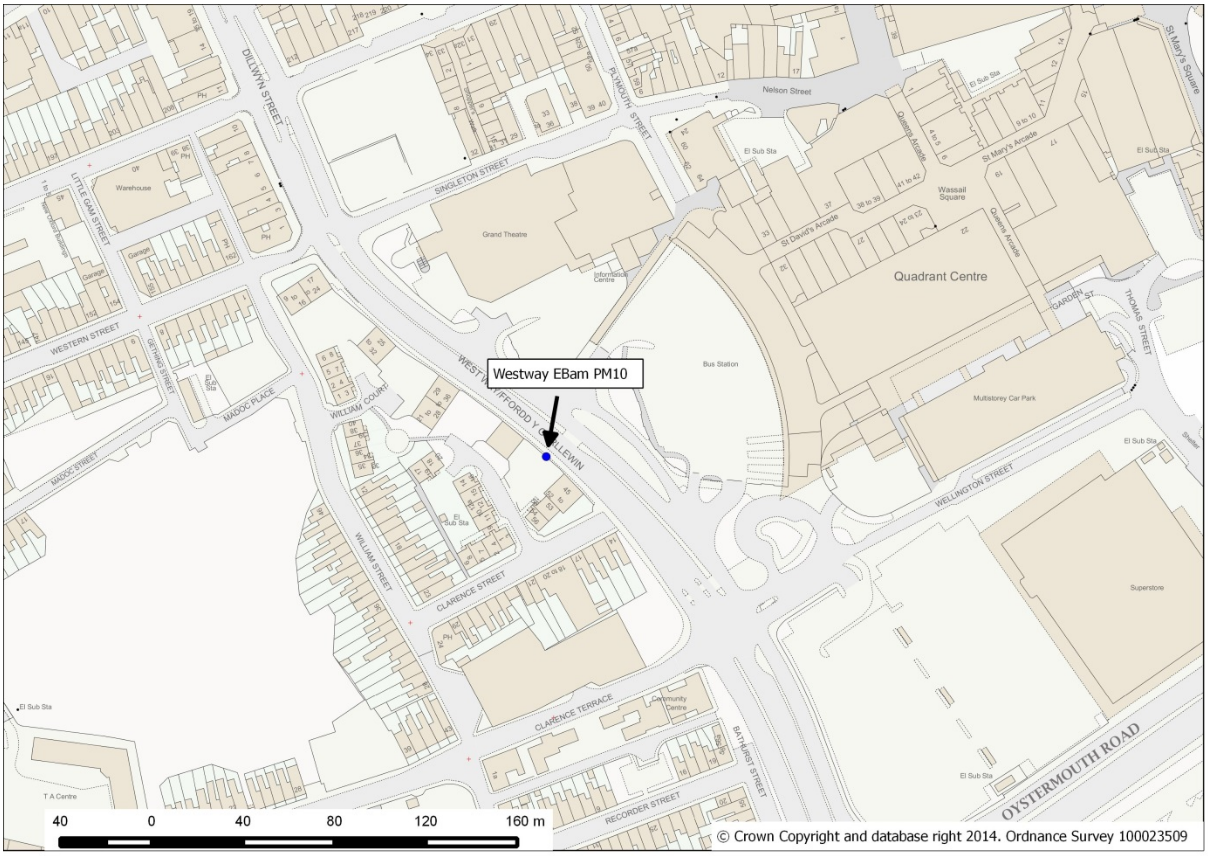
The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[10]. Installation and operation of the MetOne EBam has been undertaken in accordance with the Operational manual which can be viewed at http://www.metone.com/ebamdocs/E-BAM_Manual(RevL).pdf.

The Met One Instruments, Inc model E-BAM automatically measures and records airborne PM_{10} particulate concentration levels using the principle of beta ray attenuation. This method provides a simple determination of concentration in units of milligrams of particulate per cubic meter of air. A small ^{14}C (Carbon 14) element

[10] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

emits a constant source of high-energy electrons known as beta particles. These beta particles are detected and counted by a sensitive scintillation detector. A vacuum pump pulls a measured amount of dust-laden air through the filter tape, which is positioned between the source and the detector thereby causing an attenuation of the beta particle signal. The degree of attenuation of the beta particle signal is used to determine the mass concentration of particulate matter on the filter tape, and the volumetric concentration of particulate matter in ambient air. In this installation a MetOne approved external pump delivering a flow rate of 16.7 l/min has been included within the site enclosure. The integration of sampling has been set at 1-hour with the tape advancing every 3-hours. Tape life is therefore greater than 3 months with the PM_{10} head being cleaned every month between tape exchanges. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 48 hour call out response for any on-site equipment problems with Enviro Technology Services Plc.

A map of the site and surrounding area is given below as map 10.



Map 10 – Westway EBam PM_{10}

2.1.12 SA1 Junction Port Tennant Road - MetOne EBam PM_{10}

The SA1 Port Tennant EBam PM_{10} station was established during late November 2012 to provide a basic screening opinion on PM_{10} concentrations along the A483 Fabian Way at the recently constructed signal controlled SA1 junction with Port Tennant Road. The A483 Fabian Way is a major artery into/from Swansea centre from/to junction 42 of the M4. The authority operate a GPRS ATC (site 20) approximately 200m west of the EBam monitoring location between Quay Parade bridges and the signalled controlled SA1 junction with Fabian Way/Port Tenant Road. The Annual Average Daily Traffic (AADT) flow for 2015 was 32,640. A summary of the composition of the flow during 2015 is given below:

Vehicle Class	Flow %	Mean Speed (km/h)
Motorcycles	1.0	46.5
Cars or light Vans	93.2	45.9
Cars or light Vans with Trailer	0.2	37.9
Heavy Van, Mini bus, L/M/HGV	4.2	43.6
Articulated lorry, HGV+Trailer	0.4	41.6
Bus	1.0	41.3

Whilst relatively “free flow” is achieved at the ATC site, traffic queues back from the signal controlled junction in both directions. Therefore, significant stationary traffic queues west past the block of terraced housing on Port Tennant Road (their facades are within 6m of the EBam itself) and also eastwards in front of the newly constructed Mariners Court block of flats that front onto Fabian Way. The authority also has a passive NO_2 monitoring location front façade of the terraced properties on Port tenant Road and also several within the general vicinity.

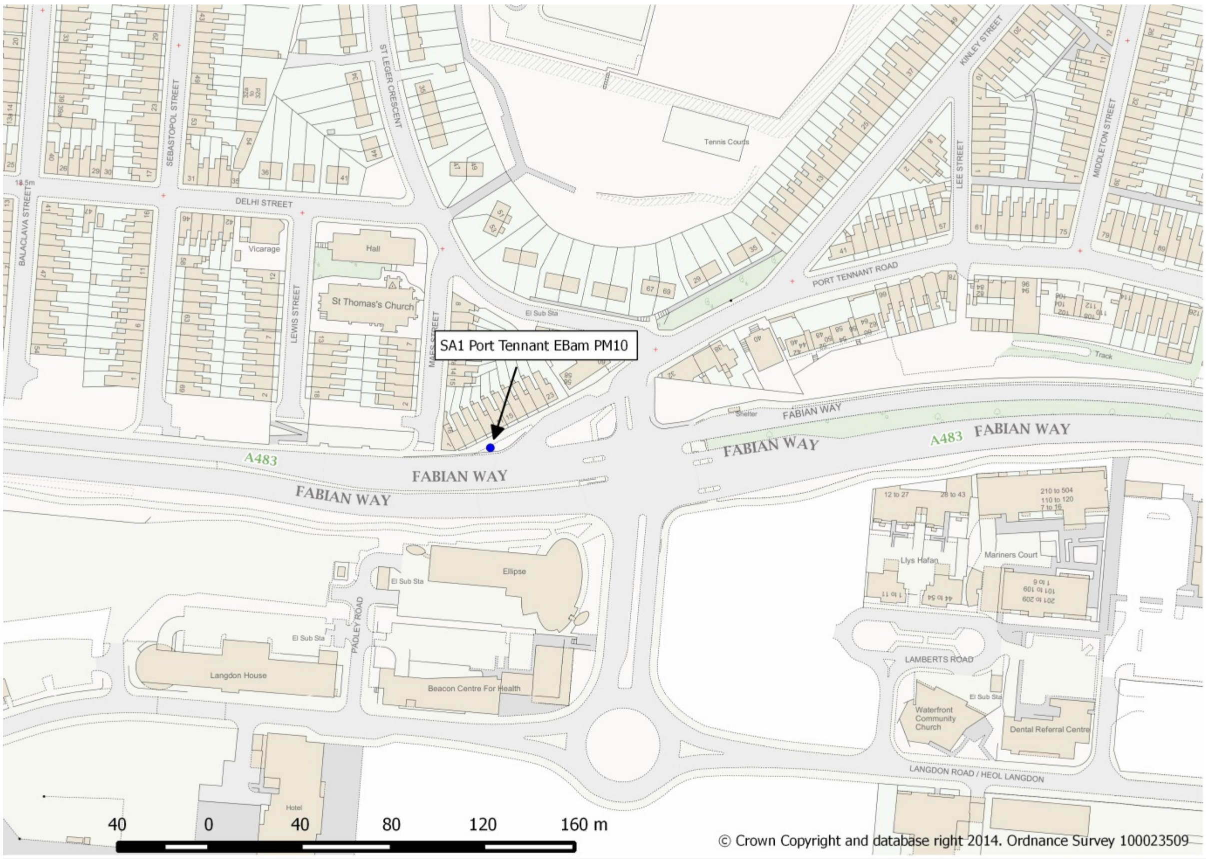
The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[11]. Installation and operation of the MetOne EBam has been undertaken in accordance with the Operational manual which can be viewed at http://www.metone.com/ebamdocs/E-BAM_Manual(RevL).pdf.

The Met One Instruments, Inc model E-BAM automatically measures and records airborne PM_{10} particulate concentration levels using the principle of beta ray attenuation. This method provides a simple determination of concentration in units of

[11] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

milligrams of particulate per cubic meter of air. A small $_{14}C$ (Carbon 14) element emits a constant source of high-energy electrons known as beta particles. These beta particles are detected and counted by a sensitive scintillation detector. A vacuum pump pulls a measured amount of dust-laden air through the filter tape, which is positioned between the source and the detector thereby causing an attenuation of the beta particle signal. The degree of attenuation of the beta particle signal is used to determine the mass concentration of particulate matter on the filter tape, and the volumetric concentration of particulate matter in ambient air. In this installation a MetOne approved external pump delivering a flow rate of 16.7 l/min has been included within the site enclosure. The integration of sampling has been set at 1-hour with the tape advancing every 3-hours. Tape life is therefore greater than 3 months with the PM_{10} head being cleaned every month between tape exchanges. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc.

A map of the site and surrounding area is given below as map 11



Map 11 - SA1 Port Tennant EBam PM_{10}

2.1.13 Station Court High Street – Teledyne Chemiluminescent NOx box

The authority has located a real-time chemiluminescent NOx analyser outside a block of flats at Station Court, High Street, Swansea. This provision had been mentioned in previous LAQM reports but had been delayed due to budget restrictions. Data capture commenced on the 7th July 2014. Details and the limited data set are provided within this report for information only at present as no conclusions can be made from the limited dataset.

The station has been given a site classification of Roadside[12]. Photo 3 below shows its location in relation to a series of bus stops and the block of flats immediately behind the site. The site is opposite Swansea railway station and is heavily influenced by not only the bus stops but congestion caused by its proximity to signal controlled junctions and mini roundabouts. The site lies within the boundary of the existing Swansea 2010 AQMA. Congestion is noticeable most days during peak

[12] *Source LAQM.TG(16) Table 7.8 page 7-41*

periods. The sample inlet can be seen in the photograph to the left top of the site enclosure and is at a height of 1.5m.

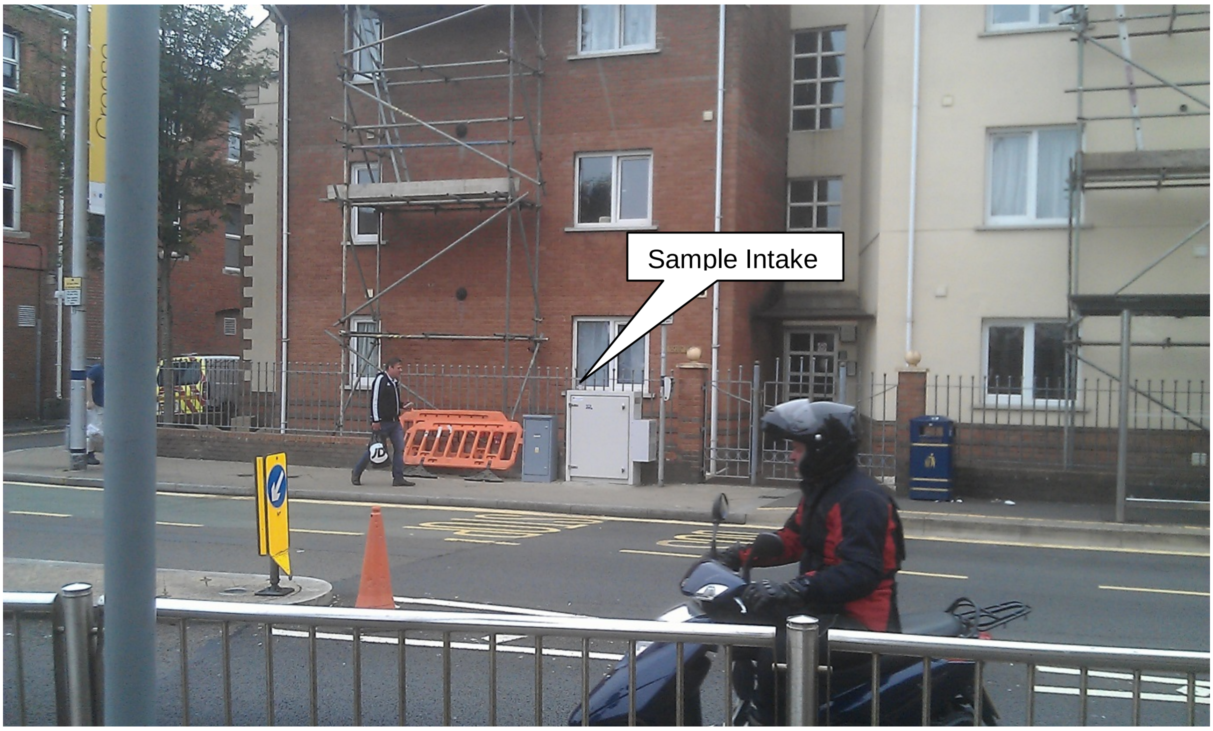
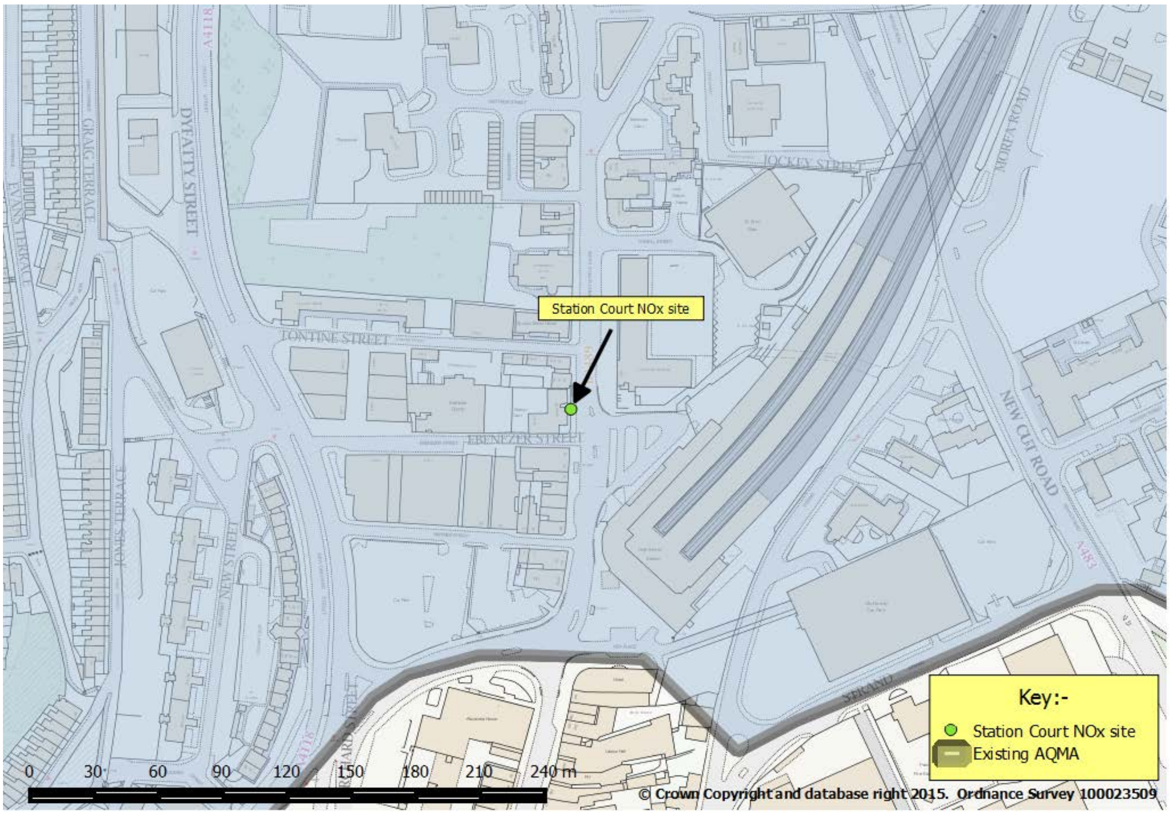


Photo 8 – Station Court, High Street NO_x monitoring site.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of a Teledyne real-time analyser measuring NO_x . The Teledyne gas analyser has been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine fortnightly manual calibrations. The analyser is subjected to scrubbed internal generated zero air to assess the analyser’s response to zero air. The NO_x analyser is subjected to traceable calibration gas at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc.

At present, the data is collected by the Welsh Air Quality Forum but it does not form part of the QA/QC contract with Ricardo. The L10 span gas cylinder (NO) will be replaced on a regular basis and is to a certified and traceable standard.



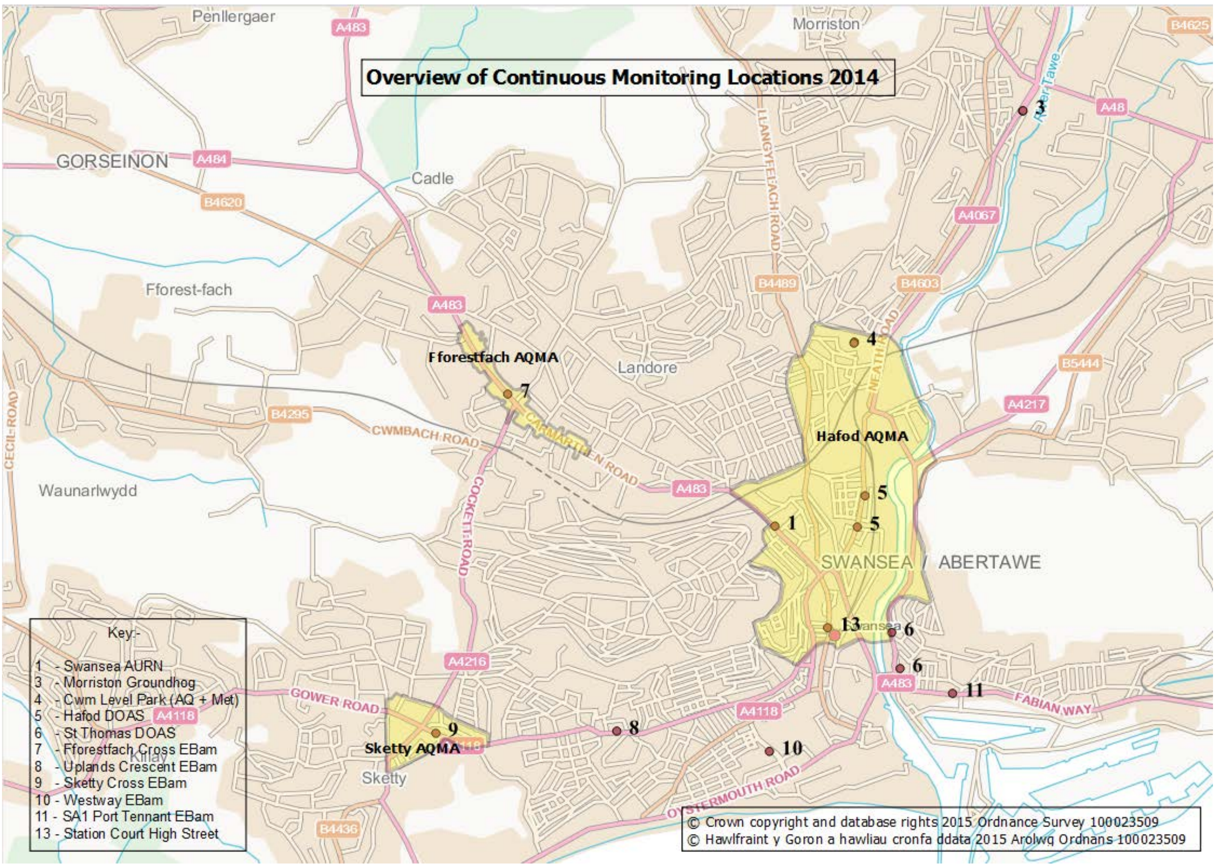
Map 12 – Station Court High Street, Swansea NOx box

2.1.14 Summary of Automatic Continuous Real-Time Monitoring Locations.

For ease of reference and in order for the reader to familiarise themselves spatially with the locations that the City and County of Swansea undertake automatic continuous monitoring, all such sites are presented below within map 13. Also included within map 13 is the extent of the Swansea Air Quality Management Area 2010 which was declared during August 2010.

Included with this spatial view is the meteorological monitoring that is currently being undertaken within the lower Swansea Valley area. This currently only includes a dedicated 30m mast at Cwm Level Park. The AQ500 SODAR remote sensing instrument previously reported as being located in Vale Nickel Refinery Clydach, has been removed from site during 2014 and put into temporary storage due to noise complaints from local residents surrounding the facility. It is envisaged that the meteorological monitoring from Cwm Level Park will provide the datasets required by the air quality modelling that is currently under development, with sufficient details of the meteorological conditions experienced within the complex topographical area that exists in the lower valley area..

From map 13, the reader will no doubt realise that no continuous and automatic chemiluminescent NO_x monitoring has been, or is currently being undertaken within the Sketty and Fforestfach areas of the Swansea Air Quality Management Area 2010. This is unlikely to change for a considerable period of time given the current budgetary restraints. Monitoring of NO_2 within these areas has been, and will continue to be undertaken, via passive nitrogen dioxide diffusion tubes.



Map 13 – Overview of continuous monitoring locations 2016

Table 4 below details the commencement date of monitoring at each of the automatic sites, pollutants monitored and other site criteria details.

Site Name	Site ID	Site Type	Commencement Date of Measurements	Pollutants Monitored	IN AQMA	Inlet height	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location
Swansea Roadside AURN	**1**	Roadside	**20th September 2006**	NO_2, PM_{10}, $PM_{2.5}$	Y	2.5m	Y (12m)	4m	N
Morfa Groundhog	**2**	Roadside	**24th July 2000**	NO_2,PM_{10},	Y	2.5m	Y (34m)	5m	Y
Morriston Groundhog	**3**	Roadside	**11th October 2000**	NO_2, PM_{10}, and Ozone	N	2.5m	Y (22m)	4m	N
Cwm Level Park	**4**	Urban Back ground	**(O_3) 28th November 2008** **(NOx) 21st January 2009**	NO_2 and Ozone	Y	1.5m	N (100m)	78m	N/A
Hafod DOAS	**5**	Roadside	**8th January 2004**	NO, NO_2 Ozone and Benzene	Y	N/A	Y (0.2m)	1.7m	Y
St Thomas DOAS	**6**	Roadside	**4th May 2005**	SO_2, NO_2 Ozone and Benzene	N	N/A	Y(2m) Varies along path	1.7m	N
Fforestfach Cross	**7**	Roadside	**October 2012**	PM_{10}	Y	5m			
Uplands Crescent	**8**	Roadside	**October 2012**	PM_{10}		5m			
Sketty Cross	**9**	Roadside	**October 2012**	PM_{10}	Y	5m			
Westway Quadrant Bus Station	**10**	Roadside	**August 2012**	PM_{10}		5m			
SA1 Junction Port Tennant	**11**	Roadside	**November 2012**	PM_{10}		5m			
Station Court High Street	**13**	N/A	**7th July 2014**	NO_2	Y	1.5m	Y (1m)	2m	N

Table 4 - Automatic Continuous Measurements Commencement Dates

2.1.15 Additional Continuous Monitoring

2.1.16 Heavy Metals Monitoring

The Department of the Environment, Transport and the Regions (DETR) is funding a monitoring study to determine ambient concentrations of lead, cadmium, arsenic, mercury and nickel in the vicinity of a wide-variety of industrial processes.

The City and County of Swansea were requested to participate in this study from its inception during 1999/2000 due to the nickel refinery at Vale INCO (now Vale) being located within the authority's area at Clydach.

On the 16th July 2003 the European Commission adopted a proposal for a Directive relating to arsenic, cadmium, nickel, mercury and polycyclic hydrocarbons (PAH) in ambient air[13]. The target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of Best Available Technique (BAT). There are therefore, as yet, no binding obligations to reduce these pollutants. Ambient air concentrations of these substances only have to be monitored once emissions have passed a critical threshold.

Annexe 1 of the Directive details the target values for arsenic, cadmium, nickel and benzo(a)pyrene and these are reproduced below as table 5.

Pollutant	Target value ng/m^{-3}
Arsenic	6
Cadmium	5
Nickel	20
Benzo(a)pyrene	1

Table 5 - Target Values 4th Daughter Directive - Heavy Metals Monitoring

Glais Primary School, School Road, ❷ was chosen as the initial monitoring location due to its proximity to the refinery ❶ and for additional security issues with the equipment at the time. A Rupprecht & Patashnick Co., Inc. Partisol 2000 sampling unit, fitted with a PM_{10} sampling inlet with a flow rate of 16.7 l/min, has been installed on a flat roof at Glais Primary School.

During July 2006, two additional monitoring locations were added: one at Coed-Gwilym Cemetery ❸ upwind of the high level stack release and one at the Morriston Groundhog ❺ some 4.1 kilometres downwind of the stack release point (see section 2.1.4 for site location of the Morriston Groundhog and section 2.1.8 for spatial

[13] *COM 2003 (423)*

location). Both additional units were Partisol 2025 units with automatic filter cartridge exchange and are fitted with PM_{10} sampling inlets with flow rates of 16.7 l/min. Four filters are housed in the main exchange drum and the unit automatically regulates weekly exposure of each filter.

During July 2007, the building that the Partisol 2000 unit was located on at Glais Primary School was demolished due to subsidence. The site was therefore decommissioned and did not become operational again until December 2007. Whilst the site was recommissioned during 2007 it ceased to form part of the UK Heavy metals monitoring Network from the 1st January 2008. However, this authority is no longer able to continue to fund heavy metals monitoring at this site. **Monitoring ceased at Glais Primary School due to continued breakdown repair costs and analytical costs in April 2013**

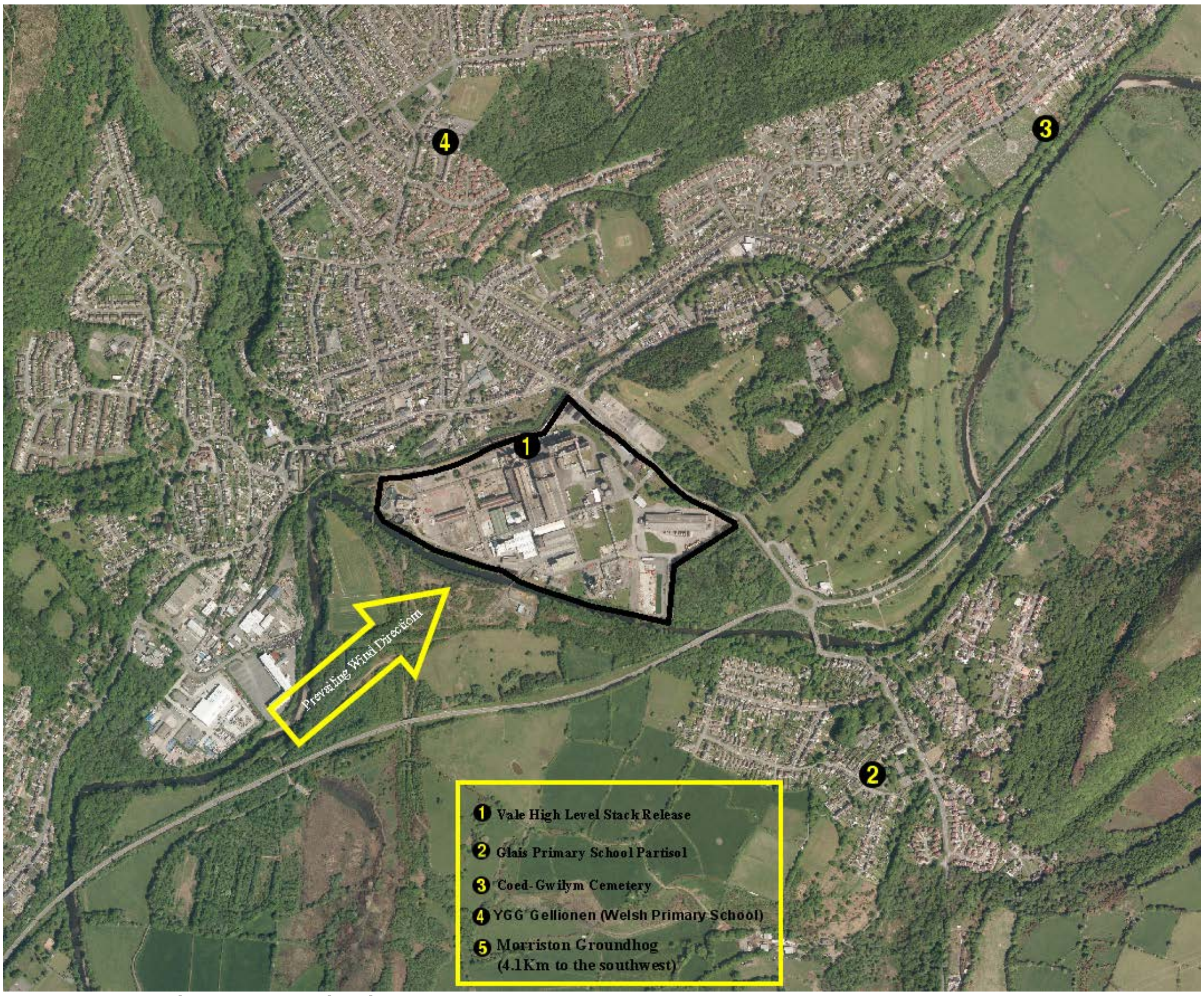
A further site has been established to the north of the high level stack release point during November 2007 at YGG Gellionnen ❹ (Welsh Primary School). The site is located on top of a flat roof within the school complex and has an uninterrupted view down to the refinery complex. **This authority continued to fund heavy metals monitoring at YGG Gellionnen until January 2014 when due to the analytical costs involved, monitoring ceased.**

During December 2007, there were changes made to those sites that form part of the UK Heavy Metals Monitoring Network – these changes took effect on the 1st January 2008. Two monitoring locations now formed part of the UK network within Swansea – these are the site upwind of the high level stack release at Coed-Gwilym Cemetery ❸ and the site located downwind of the release point at the Morriston Groundhog❺. Both the sample units deployed at these sites are Rupprecht & Patashnick Co., Inc. Partisol 2000 sampling units.

The authority as stated above, can no longer fund heavy metals monitoring at the Glais Primary School ❷ and at the YGG Gellionnen ❹ (Welsh Primary School) sites.

All monitoring locations (both UK Network sites and the two Swansea funded sites) have/had an Industrial classification[14]. **Data from 2014 has only been captured from points directly to the north (Coed-Gwilym Cemetery ❸) and from south (Morriston Groundhog❺) of the high level stack release point.**

The location of Vale and the sampling locations (including those now decommissioned) can be seen below within map 14.



Map 14 Heavy Metals Monitoring, Vale, Glais

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Filters are exposed on a weekly basis and sent to the National Physics Laboratory (NPL) for analysis. The analysed parameters are: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Magnesium (Mn), Nickel (Ni), Lead (Pb), Platinum (Pt), Vanadium (V), Zinc (Zn) and Mercury(Hg). Analysis for particulate-phase metals took place at NPL using a PerkinElmer Elan DRC II ICP-MS, following

[14] *Source LAQM.TG(16) Table 7.8 page 7-41*

NPL's UKAS accredited procedure, which is fully complaint with the requirements of EN 14902:2005.

Upon arrival at NPL, the filters were cut accurately in half, and each portion digested at temperatures up to 220°C using a CEM Mars X microwave. The digestion mixtures used were:

- Hg & Pt: 5 ml of nitric acid and 5 ml hydrochloric acid.
- All other metals: 8 ml of nitric acid and 2 ml hydrogen peroxide.

ICP-MS analysis of the digested solutions took place using at least four gravimetrically-prepared calibration solutions. A QA standard was repeatedly analysed (after every two solutions), and the change in response of the QA standard was mathematically modeled to correct for the long-term drift of the instrument. The short-term drift of the ICP-MS was corrected for by use of an internal standards mixture (containing Y, In, Bi, Sc, Ga & Rh) continuously added to the all samples via a mixing block. Each sample is analysed in triplicate, each analysis consisting of five replicates.

The amount of each metal in solution (and its uncertainty) was then determined by a method of generalised least squares using XGenline (an NPL-developed program) to construct a calibration curve[15].

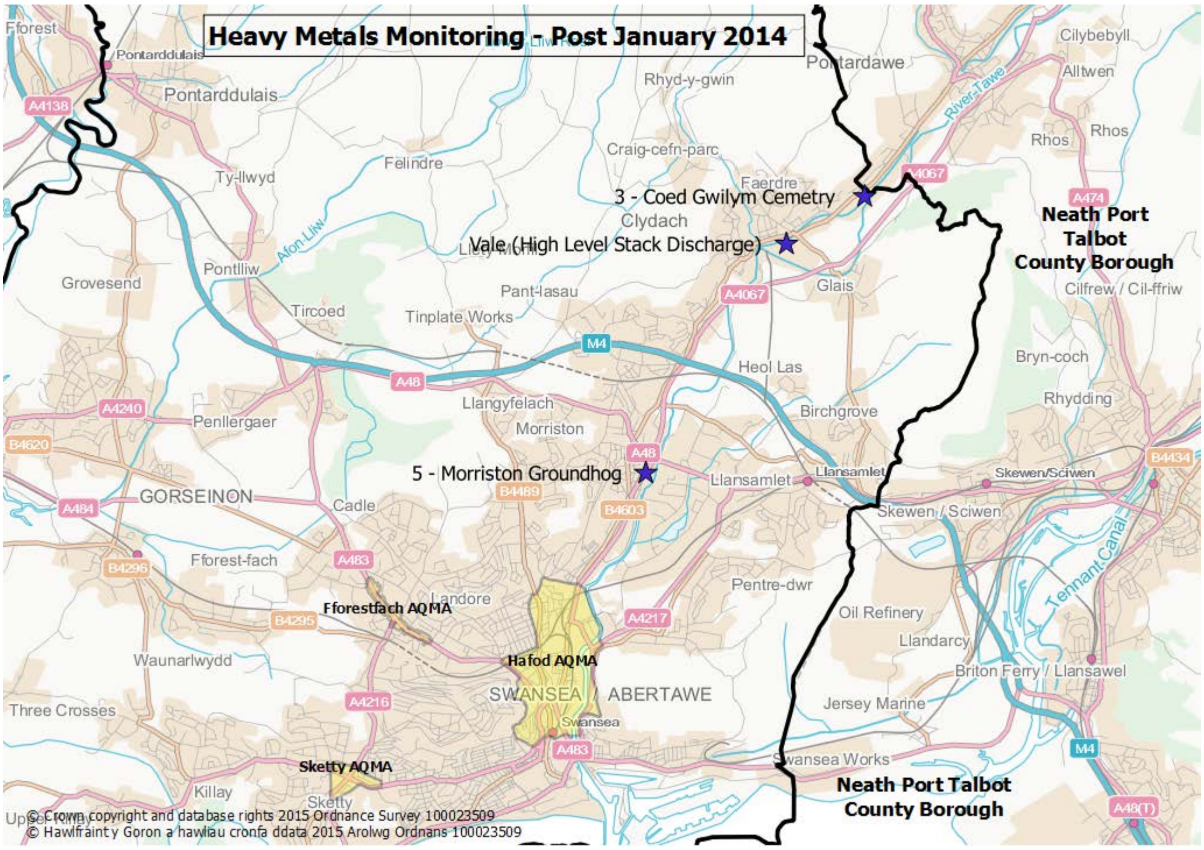
The uncertainty weighted mean for a series of N measurements, where the i^{th} measurement produces a value, x_i, with a measurement uncertainty, u_i, the uncertainty-weighted mean of the measurement, $\bar{x}_u$, would be given by:

$$\bar{x}_u = \frac{\sum_{i=1}^{i=N} \left(x_i / u_i^2 \right)}{\sum_{i=1}^{i=N} \left(1 / u_i^2 \right)}$$

15 2008 NPL Report-AS 34 (March 2009) Annual Report for 2008 on the UK Heavy Metals Monitoring Network

Again, in order for the reader to be aware spatially of the UK Heavy Metal Monitoring sites within Swansea post January 2014, the monitoring locations are presented within map 15 below. The Swansea Air Quality Management Area 2010 (former Hafod AQMA) is indicated for reference purposes.

Neath Port Talbot Borough Council also undertake Heavy Metals Monitoring within their boundary at a number of sites in Pontardawe. Monitoring within Pontardawe is undertaken north of both the high level discharge point at Vale and Coed Gwilym Cemetery. Additional nickel sources have been identified within Pontardawe that were at one time masked by the release from Vale.



Map 15 Swansea *UK Heavy Metal Monitoring Sites Post January 2016*

2.1.17 Continuous PAH Monitoring

The authority operate a continuous PAH monitoring site at the Cwm Level Park station (see 2.1.5 for location) on behalf of DEFRA and the Welsh Assembly Government using a Digitel DHA-80 Air sampling System with PM_{10} inlet. This network has been upgraded during 2007 to provide fully compliant data for assessment of PAH under the 4th Daughter Directive and the National Assembly for Wales Statutory Instrument 2007 W 63 Environmental Protection Wales and the Air Quality Standards (Wales) Regulations 2007. The site has been designated as urban background,[16] with the purpose of the site to assess the levels of PAH before / as a consequence of, the influence of industry to the east and North of the Swansea area.

2.1.18 Non-Automatic Monitoring

The authority has operated a network of passive nitrogen dioxide diffusion tubes for several years. Some sites have provided data to the UK Non-Automatic (NO_2) Network until this network ceased to operate on a weekly and monthly basis in December 2005. The remainder of the sites form part of specific studies within areas of concern. The datasets from these studies may therefore be for a limited time frame whilst conditions are assessed.

The authority expanded the coverage of monthly exposure of passive NO_2 tubes from 71 sites to 134 sites during July 2008 with a further doubling of the survey during November 2009 from 134 to 274 sites and eventually to 291 sites during late 2009 and early 2010. This new commitment to yet more additional monitoring was as a direct result of the new LAQM Technical Guidance (LAQM.TG(09)) and the conclusions reached within the USA 2009 that additional initial screening of narrow/congested streets was required where the AADT flow was greater than 5000 vehicles. However, due to budgetary constraints starting to be introduced within the authority during April 2011 a decision was made to cease monitoring at all sites that have consistently returned a bias corrected annual mean below 30ug/m^3. Monitoring ceased at these sites during May 2011 and these sites are no longer included within table 6 below. Additionally, in January 2014 a further decision was made to cease monitoring at all sites that, for the last 3-4 years had again consistently returned a bias corrected annual mean below 30ug/m^3 unless these sites would provide useful information due to the proximity to failing areas etc.

[16] *Source LAQM.TG(16) Table 7.8 page 7-41*

Monitoring is focused primarily on roadside locations with particular emphasis in determining NO_2 levels around several busy junctions and busy/narrow/congested roads. Wherever possible, passive diffusion tubes are located directly on receptor locations – typically front façade of dwellings, mainly on front down pipes etc. Where this has not been possible, the tubes have been located on the nearest lamppost etc. to the dwelling and concentrations corrected to facade. Full details of the sites chosen are presented below within table 6 and a map showing the monitoring locations is included below as map 16. Due to the number of passive diffusion tube locations, it is not possible to label the site numbers within map16. For clarity and completeness, the additional areas that make up The Swansea Air Quality Management Area 2010 are shown within map 16. In addition to map 16 and to allow a more detailed view of the number of monitoring locations, map 17(city centre area), map 18 (Sketty/Uplands area), map 19 (Morriston/Ynysforgan/Llansamlet/M4) , map 20 (Fforestfach) and map 21 (Hafod) area, are presented below with the site numbers labelled within the more densely monitored areas.

Due to the proposals to regenerate the city centre, additional passive diffusion tube sites have been established during January/February 2015. It is thought that these regeneration proposals will increase the footfall within the city centre by increasing the level of residential occupancy, significantly benefiting the city centre traders. However, as has been previously reported, nitrogen dioxide concentrations have exceeded the annual mean objective at several locations along key routes in the city centre. Previously, any assessment made has been primarily to establish if any exceedances of the 1-hour nitrogen dioxide objective may have been breached around the café type restaurants which exist roadside to the café environment. However, with the aspiration to increase the number of dwellings along these roads as part of the redevelopment proposals, additional monitoring has been undertaken. The locations and results of this additional city centre monitoring are reported within this Progress Report (sites 331 to 364). Please note sites 357-364 commenced monitoring during April 2015 with sites 369-372 commencing during May 2015 so do not achieve the minimum data capture rate of 75%. The results for these sites have been annualised using the background chemiluminescent NOx analyser located at Cwm level Park using the methodology outlined in box 7.10 of LAQM Technical Guidance (TG16). A City Centre Infrastructure Study is underway with a focus on these key areas of proposed redevelopment. As mentioned above, map 17 presents the NO_2 passive diffusion tube locations established within the city centre area.

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
4	262497	192857	Roadside	NO_2	Y	Y (0.1m)	4m	
5	262548	192943	Roadside	NO_2	Y	Y (0.1m)	3m	
6	262612	192995	Roadside	NO_2	Y	Y (0.1m)	4.5m	
7	262691	192852	Roadside	NO_2	Y	Y (0.1m)	2m	
8	262990	195820	Roadside	NO_2	Y	Y (0.1m)	3m	
9	263190	195205	Roadside	NO_2		Y (0.1m)	6m	
10	263219	195513	Roadside	NO_2	Y	Y (0.1m)	5m	
11	263344	195474	Roadside	NO_2	Y	Y (0.1m)	2m	
12	263680	195103	Roadside	NO_2	Y	Y (0.1m)	2m	
13	264830	193066	Roadside	NO_2		Y (0.1m)	8m	
14	265285	192696	Roadside	NO_2		Y (0.1m)	2.5m	
15	265334	192608	Roadside	NO_2		Y (0.1m)	12m	
16	265339	192534	Roadside	NO_2		Y (0.1m)	11m	
18	265526	195807	Roadside	NO_2	Y	Y (0.1m)	2m	
19	265597	194061	Roadside	NO_2	Y	Y (0.1m)	5m	
20	265594	194175	Roadside	NO_2	Y	Y (0.1m)	1.5m	
21	265634	195316	Roadside	NO_2	Y	Y (0.1m)	2m	
22	265682	195374	Roadside	NO_2	Y	Y (0.1m)	2m	
23	265728	195494	Roadside	NO_2	Y	Y (0.1m)	2m	
25	265845	195547	Roadside	NO_2	Y	Y (0.1m)	3.5m	
26	265876	194318	Roadside	NO_2	Y	Y (0.1m)	2m	
27	265922	194428	Roadside	NO_2	Y	Y (0.1m)	2m	
28	265949	194891	Roadside	NO_2	Y	Y (0.1m)	14m	
29	265973	195222	Roadside	NO_2	Y	Y (0.1m)	3.5m	
31	266153	196003	Roadside	NO_2		Y (0.1m)	2.5m	
32	266209	193867	Roadside	NO_2		Y (0.1m)	5m	
33	266236	193488	Roadside	NO_2		Y (0.1m)	5m	
34	266272	196168	Roadside	NO_2		Y (0.1m)	1.5m	
35	266314	193298	Roadside	NO_2		Y (0.1m)	2m	
36	266455	193300	Roadside	NO_2		Y (0.1m)	2m	
38	266662	193181	Roadside	NO_2		Y (0.1m)	6m	
40	266951	198278	Roadside	NO_2		Y (0.1m)	8m	
41	266953	198085	Roadside	NO_2		Y (0.1m)	2m	
43	267093	198063	Roadside	NO_2		Y (0.1m)	2m	
44	267639	199543	Roadside	NO_2		Y (0.1m)	23m (M4)	
45	267661	199451	Roadside	NO_2		Y (0.1m)	10m (M4)	
48	268011	193101	Roadside	NO_2		Y (0.1m)	9m	
50	268530	197419	Roadside	NO_2		Y (0.1m)	6m	
54	268693	197416	Roadside	NO_2		Y (0.1m)	9m	
55	268789	197420	Roadside	NO_2		Y (0.1m)	4m	
56 *	269306	198661	Roadside	NO_2		Y (166m)	2m	Y
58	264052	192884	Roadside	NO_2		Y (8m)	2m	Y
59	265918	194463	Roadside	NO_2	Y	Y (0.2m)	1.5m	
60	265036	192931	Roadside	NO_2		Y (0.1m)	2m	
61	264959	192878	Roadside	NO_2		Y (0.1m)	2m	
63	262675	192775	Roadside	NO_2	Y	Y (6.0m)	1.5m	Y
64	262719	192840	Roadside	NO_2	Y	Y (3.0m)	1m	Y
65	262735	192855	Roadside	NO_2	Y	Y (0.1m)	5m	
66	262802	192829	Roadside	NO_2	Y	Y (0.1m)	8m	

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
67	265903	193683	Roadside	NO_2	Y	Y (5.0m)	1m	Y
68	265573	193432	Roadside	NO_2		Y (0.1m)	6m	
69	265543	193450	Roadside	NO_2		Y (4m)	3m	Y
70	266649	195435	Roadside	NO_2		Y (7m)	1m	Y
71 **	266514	195485	Roadside	NO_2		Y (138m)	2m	Y
72	264091	192900	Roadside	NO_2		Y (0.1m)	18m	
73	264138	192868	Roadside	NO_2		Y (0.1m)	9m	
74	264163	192853	Roadside	NO_2		Y (0.1m)	12m	
75	264072	192869	Roadside	NO_2		Y (0.1m)	8m	
76	263968	192880	Roadside	NO_2		Y (0.1m)	9m	
78	263819	192948	Roadside	NO_2		Y (0.1m)	7m	
79	263842	192896	Roadside	NO_2		Y (0.1m)	10m	
83	262785	192838	Roadside	NO_2	Y	Y (0.1m)	7.5m	
84	262714	192839	Roadside	NO_2	Y	Y (0.1m)	6.5m	
85	262702	192847	Roadside	NO_2	Y	Y (0.1m)	6.5m	
86	262704	192865	Roadside	NO_2	Y	Y (0.1m)	4.5m	
87	262697	192798	Roadside	NO_2	Y	Y (0.1m)	6m	
88	262605	192916	Roadside	NO_2	Y	Y (0.1m)	4m	
89	262587	192956	Roadside	NO_2	Y	Y (0.1m)	4.5m	
90	262631	192996	Roadside	NO_2	Y	Y (0.1m)	4.5m	
91	262534	192950	Roadside	NO_2	Y	Y (0.1m)	3m	
92	262545	192869	Roadside	NO_2	Y	Y (3.0m)	4.5m	
93	263406	195534	Roadside	NO_2		Y (0.1m)	2m	
94	263444	195572	Roadside	NO_2		Y (0.1m)	2m	
95	262815	196090	Roadside	NO_2		Y (0.1m)	8m	
96	262922	195950	Roadside	NO_2		Y (0.1m)	3m	
97	262946	195902	Roadside	NO_2	Y	Y (0.1m)	4m	
98	263142	195548	Roadside	NO_2	Y	Y (0.1m)	4m	
99	263387	195332	Roadside	NO_2	Y	Y (0.1m)	2m	
100	263470	195250	Roadside	NO_2	Y	Y (0.1m)	4m	
101	263843	195047	Roadside	NO_2	Y	Y (0.1m)	4m	
102	266379	193307	Roadside	NO_2		Y (0.1m)	2m	
104	268538	197389	Roadside	NO_2		Y (0.1m)	8m	
107	268765	197420	Roadside	NO_2		Y (0.1m)	5m	
108	267608	199461	Roadside	NO_2		Y (0.1m)	15m (M4)	
109	267510	199487	Roadside	NO_2		Y (0.1m)	16.5 (M4)	
110	267369	199521	Roadside	NO_2		Y (0.1m)	35m (M4)	
111	267705	199426	Roadside	NO_2		Y (0.1M)	17m (M4)	
114	264622	192971	Roadside	NO_2		Y (0.1m)	7m	
115	265031	193097	Roadside	NO_2		Y (0.1m)	5m	
116	265192	193138	Roadside	NO_2		Y (0.1m)	4m	
117	265288	193211	Roadside	NO_2		Y (0.1m)	5.5m	
⊗118	265483	193385	Roadside	NO_2		Y (17M)	7m	
119	265522	193390	Roadside	NO_2		Y (0.1M)	2m	
120	265570	193366	Roadside	NO_2		N (6.0M)	2m	Y
121	265706	193662	Roadside	NO_2	Y	Y (0.1M)	3m	
122	265694	193505	Roadside	NO_2		Y (0.5M)	3m	

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
123	265655	193423	Roadside	NO_2		Y (0.1M)	4m	
⊗124	265651	193253	Roadside	NO_2		Y (2M)	4m	
⊗125	265641	193162	Roadside	NO_2		Y (3m)	1m	Y
⊗126	265475	193144	Roadside	NO_2		Y (10m)	5m	
⊗127	265348	193110	Roadside	NO_2		Y(4m)	0.5m	
⊗128	265297	193085	Roadside	NO_2		N (>50m)	4.5m	
⊗129	265153	193098	Roadside	NO_2		Y (5m)	7m	
⊗130	265139	192912	Roadside	NO_2		Y (27m)	3.5m	Y
131	265137	192846	Roadside	NO_2		Y(30m)	5m	
132	265229	192753	Roadside	NO_2		Y (5M)	2m	Y
133	265350	192566	Roadside	NO_2		Y (0.1m)	2m	
⊗134	265113	192903	Roadside	NO_2		Y(0.1m)	4m	
^136	262612	192995	Roadside	NO_2	Y	Y(0.1m)	4.5m	
^137	262631	192996	Roadside	NO_2	Y	Y(0.1m)	4.5m	
140	266863	199009	Roadside	NO_2		Y(0.1m)	1.5m	
143	267089	198608	Roadside	NO_2		Y(0.1m)	2m	
144	267141	198591	Roadside	NO_2		Y(0.1m)	2m	
145	267139	198578	Roadside	NO_2		Y(0.1m)	2m	
146	267156	198571	Roadside	NO_2		Y(0.1m)	2m	
147	267165	198580	Roadside	NO_2		Y(0.1m)	2m	
148	267170	198564	Roadside	NO_2		Y(0.1m)	2m	
149	267204	198561	Roadside	NO_2		Y(0.1m)	4m	
150	267205	198545	Roadside	NO_2		Y(0.1m)	3m	
151	267192	198518	Roadside	NO_2		Y(0.1m)	3m	
160	269049	201744	Roadside	NO_2		Y(0.1m)	3m	
180	259064	197781	Roadside	NO_2		Y(0.1m)	1.5m	
182	259050	197790	Roadside	NO_2		Y(0.1m)	2m	
183	259036	197795	Roadside	NO_2		Y(0.1m)	2.5m	
197	258797	198701	Roadside	NO_2		Y(0.1m)	2m	
198	258811	198701	Roadside	NO_2		Y(0.1m)	2m	
206	261565	188211	Roadside	NO_2		Y(0.1m)	1.5m	
207	261561	188222	Roadside	NO_2		Y(0.1m)	2.5m	
208	261541	188215	Roadside	NO_2		Y(0.1m)	2.5m	
209	261534	188198	Roadside	NO_2		Y(0.1m)	1.5m	
210	261516	188207	Roadside	NO_2		Y(0.1m)	2.5m	
211	261501	188188	Roadside	NO_2		Y(0.1m)	1.5m	
212	261486	188200	Roadside	NO_2		Y(0.1m)	2.5m	
213	261490	188186	Roadside	NO_2		Y(0.1m)	1.5m	
214	261315	188193	Roadside	NO_2		Y(0.1m)	4m	
215	261299	188191	Roadside	NO_2		Y(0.1m)	4m	
216	261276	188190	Roadside	NO_2		Y(0.1m)	4m	
238	266902	197660	Roadside	NO_2		Y(0.1m)	3.5m	
239	266181	196022	Roadside	NO_2		Y(0.1m)	1.5m	
240	266169	195995	Roadside	NO_2		Y(0.1m)	1.5m	
241	266159	196013	Roadside	NO_2		Y(0.1m)	1.5m	
242	265655	193423	Roadside	NO_2		Y(0.1m)	4m	
243	265474	194949	Roadside	NO_2		Y(0.1m)	4m	
244	265466	194930	Roadside	NO_2	Y	Y(0.1m)	2m	
245	265448	194922	Roadside	NO_2	Y	Y(0.1m)	2m	
247	265394	194899	Roadside	NO_2	Y	Y(0.1m)	2m	
249	265326	194871	Roadside	NO_2	Y	Y(0.1m)	2m	
251	265263	194845	Roadside	NO_2	Y	Y(0.1m)	2m	
252	265226	194830	Roadside	NO_2	Y	Y(0.1m)	2m	
256	264995	194777	Roadside	NO_2		Y(0.1m)	2m	

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
271	266879	198078	Roadside	NO_2		Y(0.1m)	1.5m	
272	266888	198074	Roadside	NO_2		Y(0.1m)	1.5m	
275	265658	194856	Roadside	NO_2	Y	Y(2.0m)	1.5m	
276	265610	194871	Roadside	NO_2	Y	Y(0.1m)	3m	
277	265596	194875	Roadside	NO_2	Y	Y(0.1m)	3m	
278	265573	194882	Roadside	NO_2	Y	Y(0.1m)	3m	
279	265555	194926	Roadside	NO_2	Y	Y(0.1m)	1.5m	
280	265542	194980	Roadside	NO_2	Y	Y(2.0m)	1m	
281	265542	194872	Roadside	NO_2	Y	Y(3.0m)	1m	
282	265540	194840	Roadside	NO_2	Y	Y(3.0m)	1m	
284	265452	195899	Roadside	NO_2		Y(0.1m)	2m	
285	266955	197415	Roadside	NO_2		Y(0.1m)	2m	
286	266938	197377	Roadside	NO_2		Y(0.1m)	4m	
287	265715	193902	Roadside	NO_2	Y	Y(0.1m)	2m	
288	265698	193878	Roadside	NO_2	Y	Y(0.1m)	2m	
289	265702	193842	Roadside	NO_2	Y	Y(0.1m)	2m	
290	263014	195737	Roadside	NO_2	Y	Y(0.1m)	2m	
291	267952	193121	Roadside	NO_2		Y(0.1m)	5m	
295	258998	198698	Roadside	NO_2		Y(5m)	0.5m	Y
296	259054	198679	Roadside	NO_2		Y(0.1m)	3m	
323	266765	193224	Roadside	NO_2		Y(0.1m)	3m	
324	269815	197657	Roadside	NO_2		Y(0.1m)	10m	
325	266338	199647	Roadside	NO_2				
326	266299	199642	Roadside	NO_2				
327	266253	199637	Roadside	NO_2				
328	266183	199626	Roadside	NO_2				
329	266127	199620	Roadside	NO_2				
330	266363	199669	Roadside	NO_2				
331	265741	193545	Roadside	NO_2				
332	265679	193506	Roadside	NO_2				
333	265673	193477	Roadside	NO_2		Y(4m)	0.5m	
334	265688	193483	Roadside	NO_2				
335	265682	193461	Roadside	NO_2				
336	265664	193395	Roadside	NO_2				
337	265637	193335	Roadside	NO_2		Y(4m)	0.5m	
338	265651	193331	Roadside	NO_2				
339	265652	193313	Roadside	NO_2				
340	265632	193292	Roadside	NO_2				
341	265635	193224	Roadside	NO_2		Y(3m)	1.5m	
342	265655	193197	Roadside	NO_2		Y(3.5m)	1m	
343	265640	193173	Roadside	NO_2				
344	265658	193169	Roadside	NO_2		Y(3m)	0.5m	
345	265661	193140	Roadside	NO_2		Y(3m)	0.5m	
346	265681	193096	Roadside	NO_2				
347	265562	193518	Roadside	NO_2	Y			
348	265572	193549	Roadside	NO_2	Y			
349	265578	193576	Roadside	NO_2	Y			
350	265577	193606	Roadside	NO_2	Y			
351	265606	193466	Roadside	NO_2				
352	265602	193429	Roadside	NO_2				
353	265596	193389	Roadside	NO_2		Y(4.5m)	0.5m	
354	265595	193377	Roadside	NO_2		Y(4m)	1m	
355	265574	193269	Roadside	NO_2		Y(3.5m)	0.5m	
356	265471	193359	Roadside	NO_2				
357	265498	193162	Roadside	NO_2		Y(5m)	0.5m	

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
358	265414	193141	Roadside	NO_2		Y(6.5m)	1m	
359	265396	193111	Roadside	NO_2		Y(4m)	0.5m	
360	265267	192750	Roadside	NO_2				
361	265303	192719	Roadside	NO_2				
362	265271	192774	Roadside	NO_2				
363	265287	192797	Roadside	NO_2				
364	265301	192814	Roadside	NO_2				
365	265258	193075	Roadside	NO_2				
366	265237	193056	Roadside	NO_2				
367	265189	193044	Roadside	NO_2				
368	265143	193083	Roadside	NO_2		Y(5m)	0.5m	
369	260356	192927	Roadside	NO_2				
370	260394	192938	Roadside	NO_2				
371	260402	192910	Roadside	NO_2				
372	260291	192892	Roadside	NO_2				

Table 6 – Nitrogen Dioxide Passive Diffusion Tubes 2015

*** Site 56** is located on Ynysallan Road, Ynystawe to the frontage of a potential housing development site that would be 10-15m from the eastbound carriageways of the M4. Relevant exposure is given at present to the nearest existing dwelling within a separate development setback from the monitoring location.
**** Site 71** Copper Quarter 3 is on the frontage of an existing housing development site that will see dwellings fronting onto the access road to Morfa Retail Park and the Liberty Stadium. Relevant exposure is given at present to the nearest existing dwelling on the development site. The nearest potential dwelling within the development (setback from the monitoring location) will be within 10m of the monitoring location when construction is complete.
***** Site 125** Army Careers Centre, City Centre – Relevant exposure is given to a block of flats over commercial premises
⊗ City centre sites along busy roads – relevant exposure is given to either restaurants where there is a Café environment or to blocks of flats. Assessment where Café environment exists is for 1 hour NO_2 objective
^Sites 135-137 are located at first floor level of properties in addition to exposure at 2.5 on the same dwelling to assess if concentrations change with height
**** **Site 295** High Street, Gorseinon is located on a lamppost outside a primary school playground. The intention here is worst case scenario to establish concentrations against the 1-hour objective fronting onto the school playground area

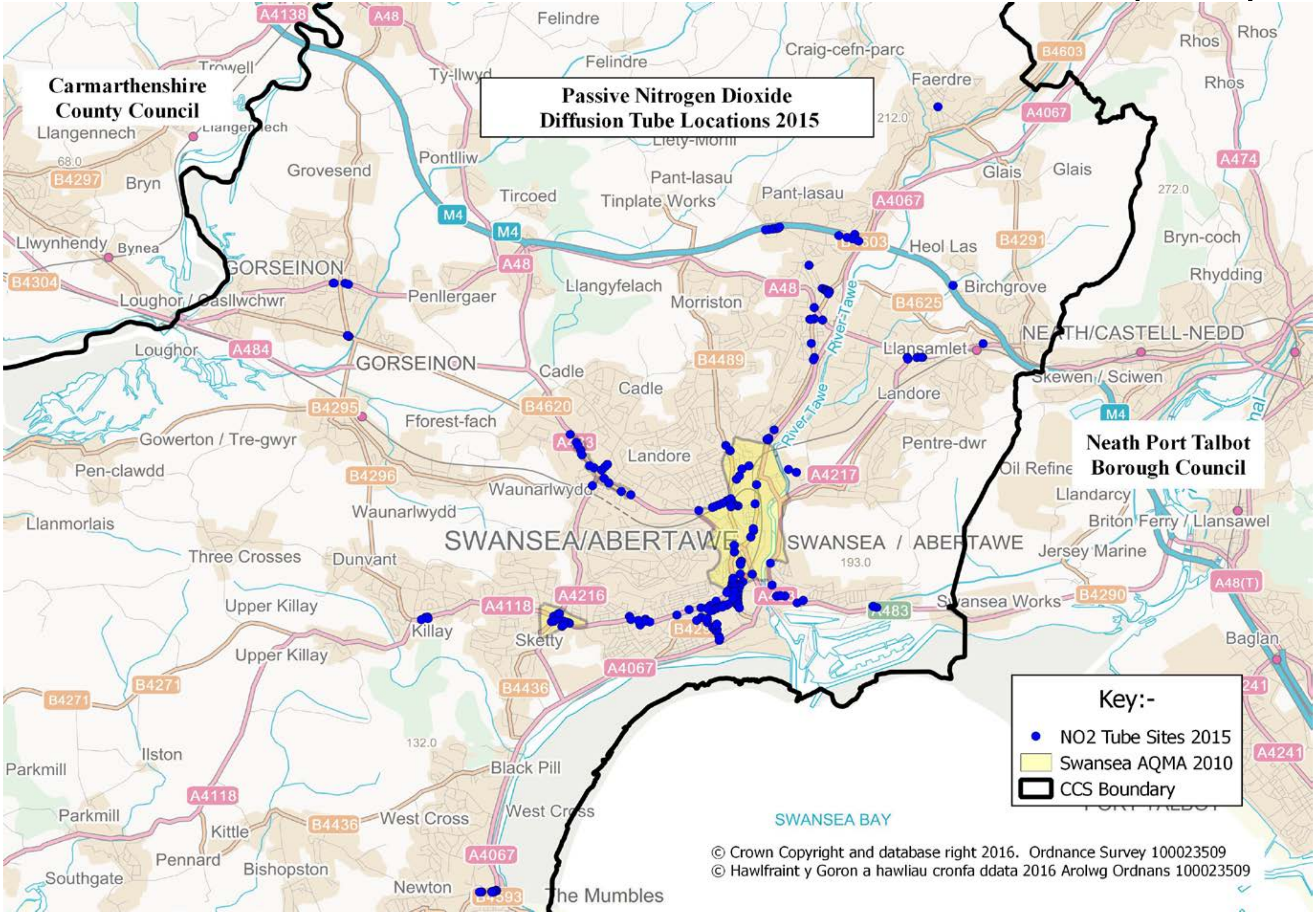
The contract for the supply and analysis of all passive diffusion tubes has been awarded to Environmental Scientifics Group (ESG) Moorbrook Southmead Industrial Estate Didcot, Oxon. Previously this group was known as Harwell Scientifics.

This contract laboratory has been operating for over 20 years and has extensive UKAS accreditation. In addition, all work is accredited to BS EN ISO 9001. Its predecessor the EMS Division, Harwell, carried out Swansea's original NO_2 mapping in 1985/86.

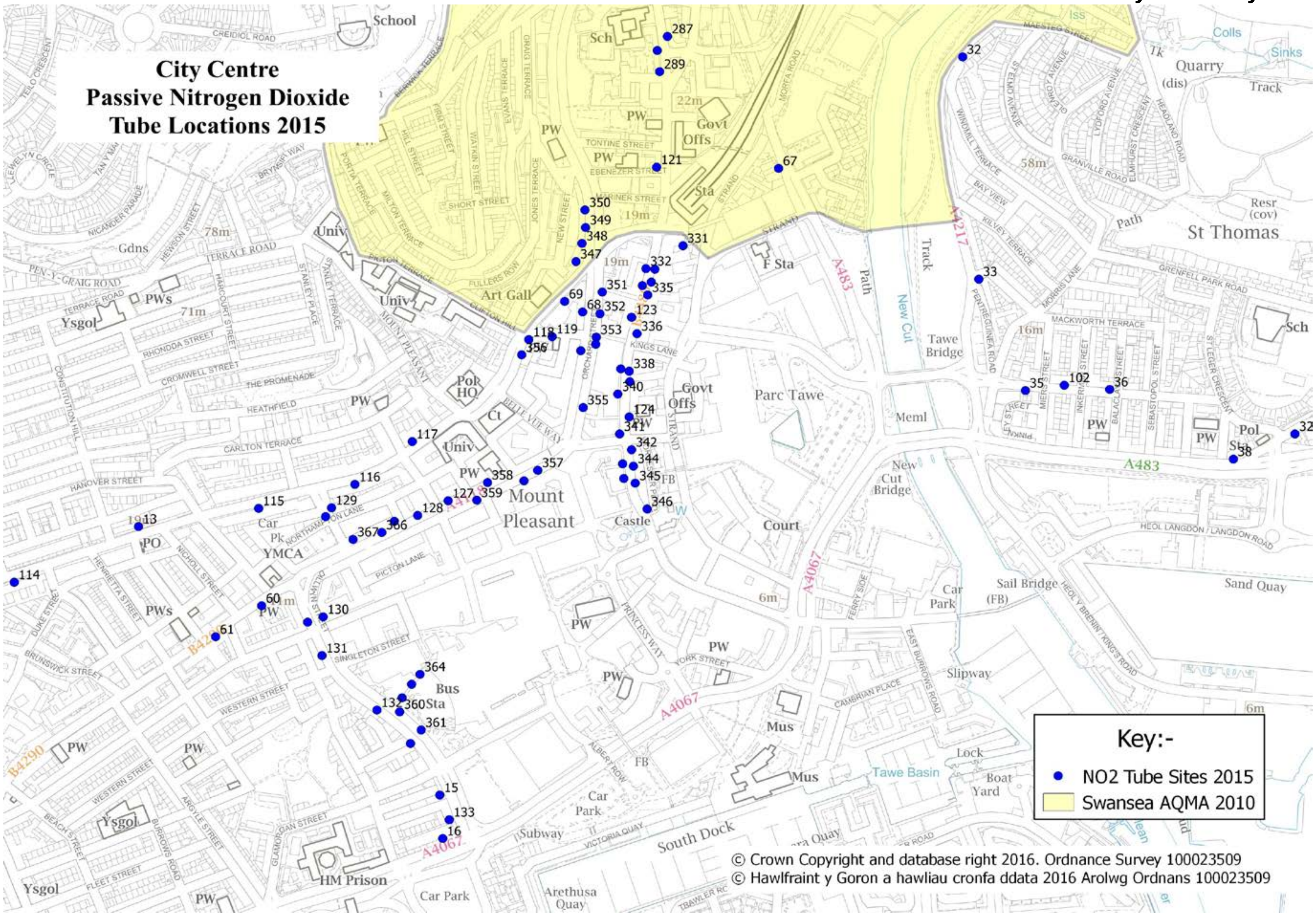
All samples have been analysed in accordance with the Harwell Scientifics standard operating procedure HS/GWI/1015 issue14. This method meets the guidelines set out in DEFRA's "Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance". All tubes are prepared by spiking acetone:triethanolamine (50:50) onto grids prior to the tubes being assembled. The tubes were desorbed with distilled water and the extract analysed using a segmented flow auto-analyser with ultraviolet detection. The analytical methods employed by Environmental Scientifics Group follow the procedures set out in the Harmonisation Practical Guidance.

ESG take part in the Workplace Analysis Scheme for Proficiency (WASP) operated by HSL. The WASP scheme is an independent proficiency testing scheme operated by the Health and Safety Laboratory (HSL). Each month a diffusion tube doped with nitrite is distributed to each participating laboratory; participants then analyse the tube and report the results to HSL. The nominal mass of nitrite on the doped tubes is different each month, and is intended to reflect the range encountered in actual monitoring. The latest results from Harwell Scientifics participation in the WASP scheme are enclosed as Annexe 3. For the purpose of diffusion tube QA/QC in the context of Local Air Quality Management, Ricardo AEA carry out an assessment of laboratory performance for each full calendar year. This was based on the following criteria, which were agreed with DEFRA and HSL:

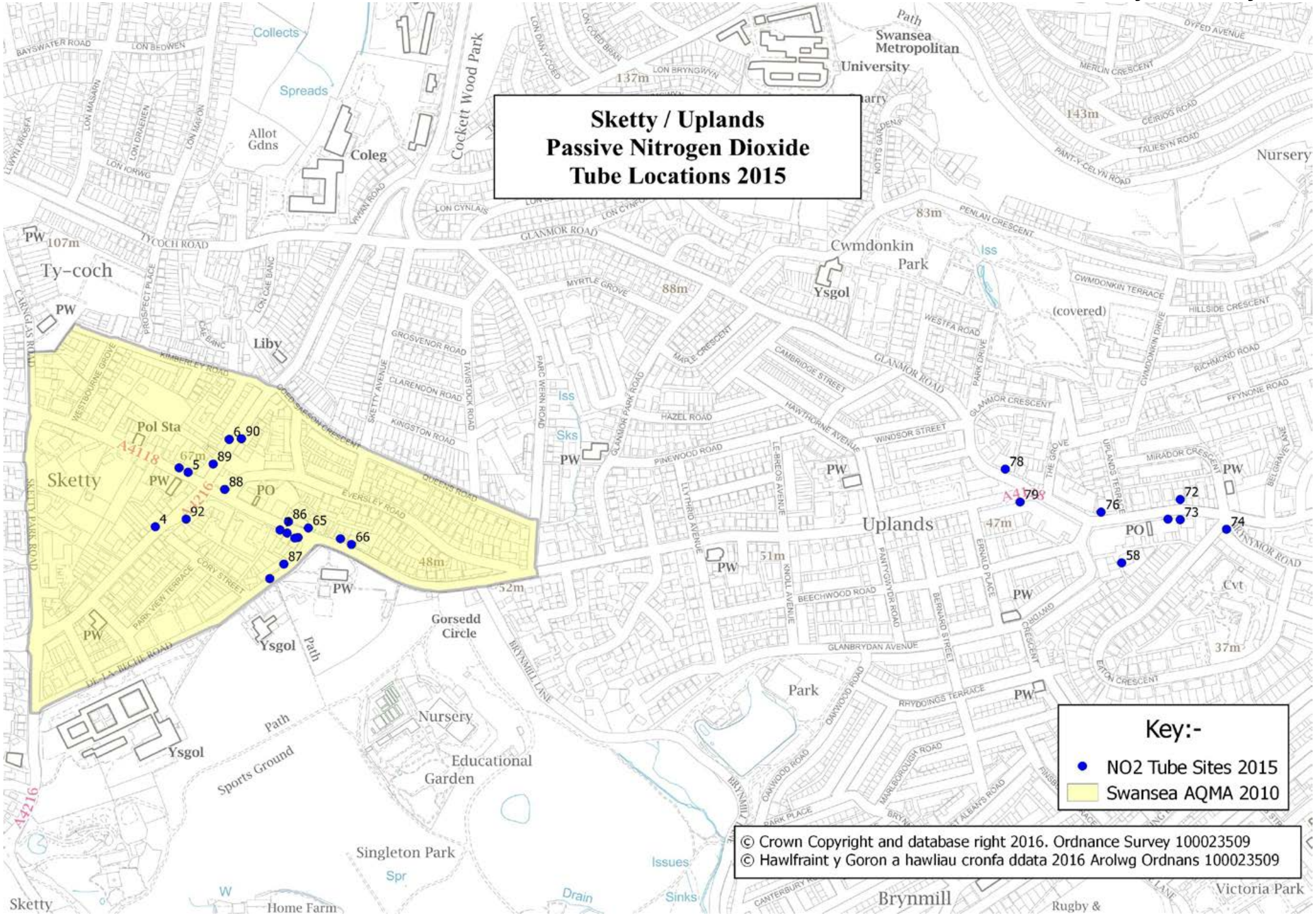
1. Participating laboratories must complete at least 10 of the 12 monthly WASP rounds.
2. The year's single worst result is ignored: this makes some limited allowance for one-off problems with analytical equipment etc.
3. Each laboratory's monthly standardised results are then combined to give a standard uncertainty for the full year, expressed as a relative standard deviation (%RSD)
4. The RSD must be within 15%Non-Automatic Monitoring



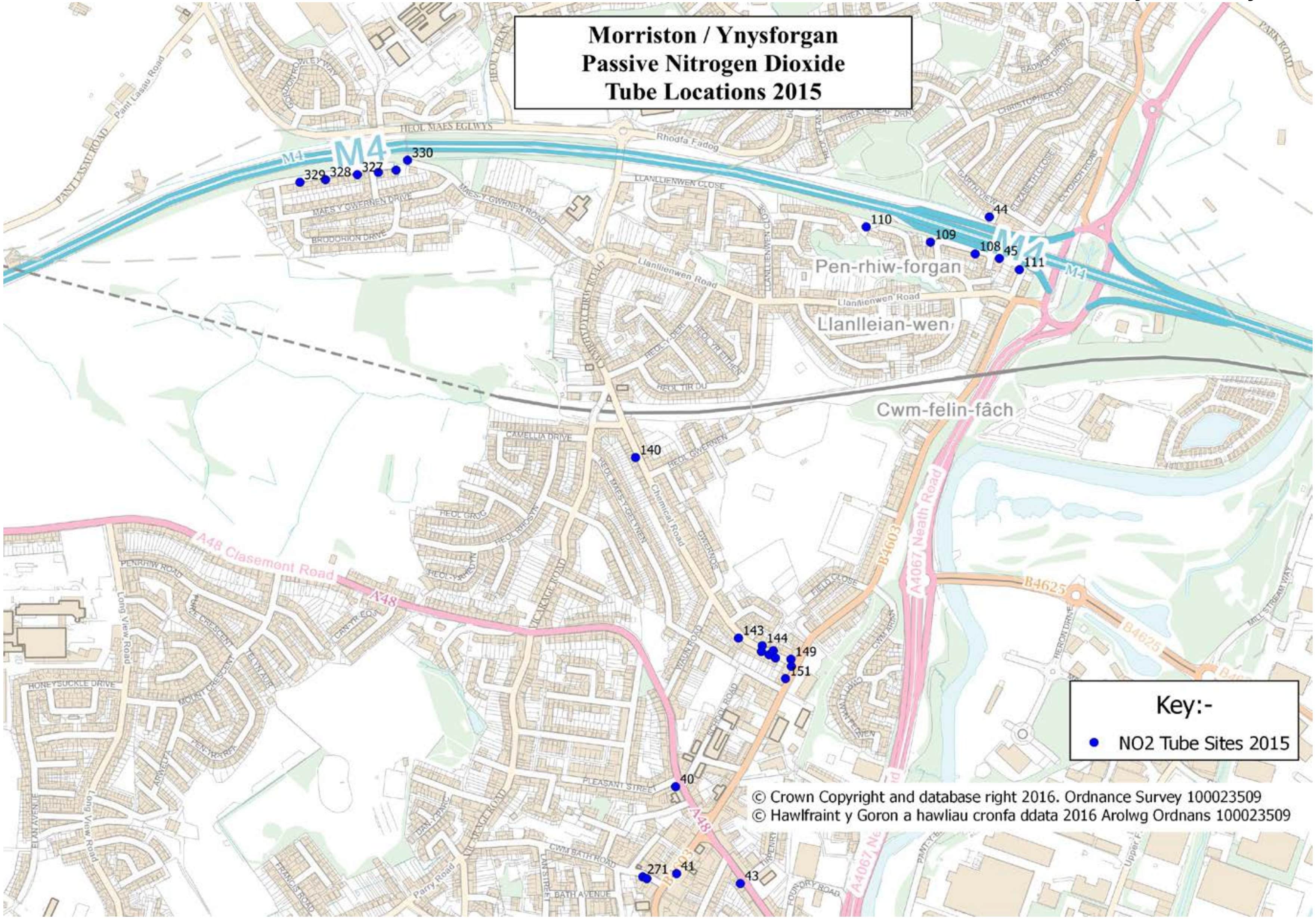
Map 16 – Location of Passive Nitrogen Dioxide Diffusion Tubes 2015



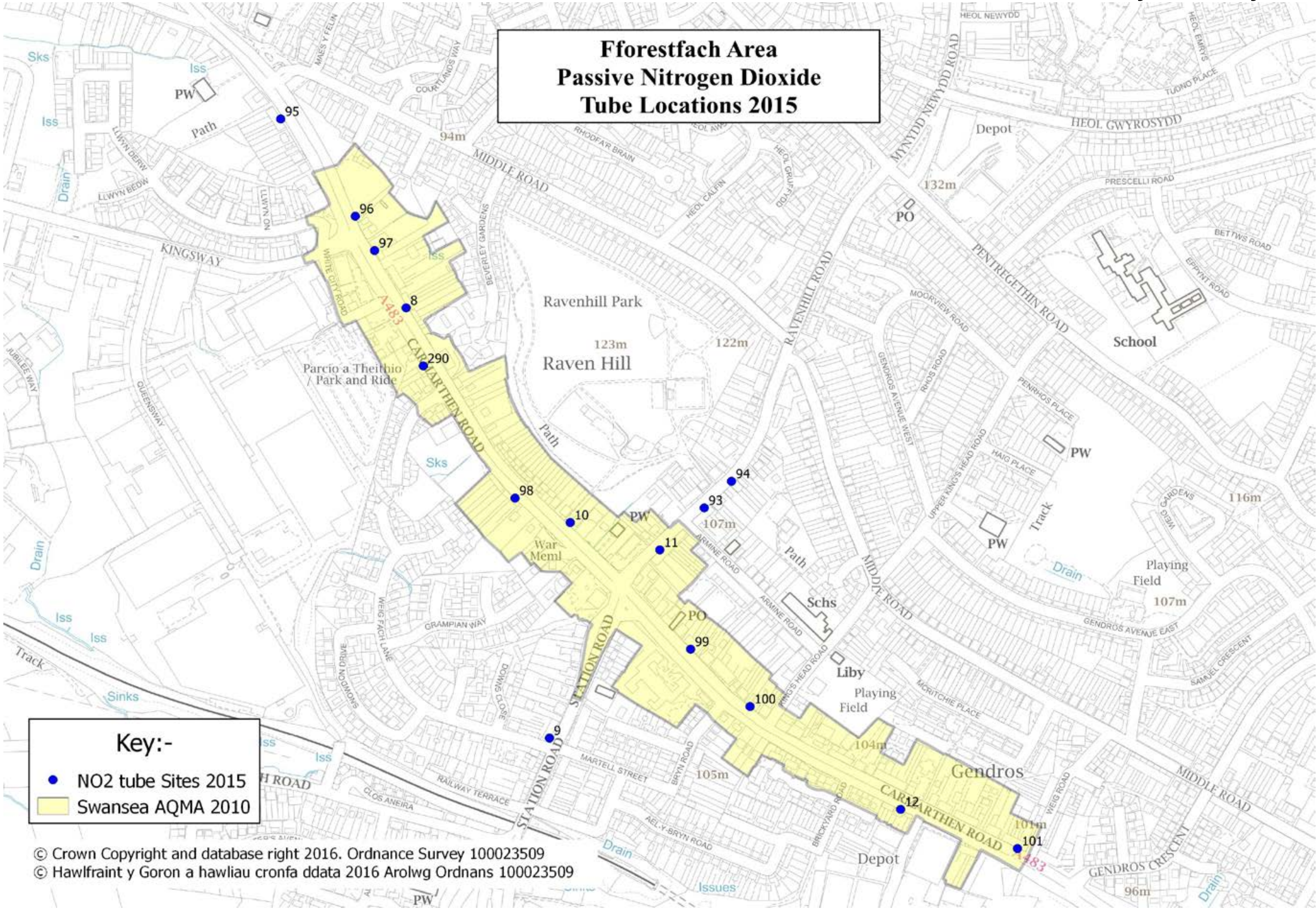
Map 17 – Location of Passive Nitrogen Dioxide Diffusion Tubes 2015 – City Centre area



Map 18 – Location of Passive Nitrogen Dioxide Diffusion Tubes 2015 – Sketty/Uplands area



Map 19 – Location of Passive Nitrogen Dioxide Diffusion Tubes 2015 - Morriston/Ynysforgan area



Map 20 – Location of Passive Nitrogen Dioxide Diffusion Tubes 2015 – Fforestfach area

2.1.19 Determination of a "Swansea" bias factor

There has been great debate surrounding the use of a locally derived bias factor when correcting diffusion tubes for bias. Indeed, previous auditor's comments have indicated that such a local derived correction factor should be obtained for Swansea. The auditor's comments have been taken on board and for the last several years tri located diffusion tubes have been located on the sample intake at each of the authority's chemiluminescent analyser sites at the Swansea Roadside AURN, Cwm Level Park and Morriston Groundhog sites. All co-location sites will operate for the foreseeable future. This co-location work is required to be repeated yearly given the advice within section 6.3.1 of the report prepared by the then AEA Energy and Environment (now Ricardo on behalf of DEFRA and the Devolved Administrations: NO_2 Diffusion Tubes for LAQM: Guidance note for Local Authorities[17].

Following on from previous auditors comments dated 9th September 2010 where it was highlighted that the bias adjustment factors from the three monitoring stations mentioned above should not have been averaged to produce a "Swansea Bias Factor" it has been decided to use the result of the co-location study undertaken at the Swansea AURN to correct passive NO_2 tubes exposed during 2015.

The ratified data has been obtained for the Swansea Roadside AURN via the UK Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector. Ricardo AEA undertakes the QA/QC work on behalf of DEFRA at the Swansea AURN site.

The bias correction to be used for diffusion tube exposure during 2015 in Swansea is therefore 0.88. A spreadsheet containing the automatic real-time data and the passive diffusion tube data used to derive the bias factor is shown within Annexe 4.

[17] http://www.airquality.co.uk/archive/reports/cat13/0604061218_Diffusion_Tube_GN_approved.pdf

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

2.2.2 Automatic Real-Time Nitrogen Dioxide Data

Measurements are undertaken with Advanced Pollution Instrumentation (API / Teledyne) real-time NO_x analysers and also by the DOAS systems at Hafod and St Thomas. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified[18]. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the annual mean.

In the case of the Swansea AURN, the QA/QC procedures undertaken by Ricardo have resulted in ratified hourly data expressed in $\mu g/m^3$ being provided. The ratified hourly means have been used to calculate the objectives for the hourly and annual means. Hourly ratified data has been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector. In the case of data from the Morriston Groundhog and Cwm Level Park sites, Ricardo also undertakes QA/QC procedures on behalf of the Welsh Air Quality Forum and Welsh Assembly. Hourly ratified data expressed in $\mu g/m^3$ has been downloaded for the sites from http://www.welshairquality.co.uk/data_and_statistics.php . These data have then all been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation. Sections 2.1.6 and section 2.1.7 refer to the data collection methodology for the Hafod and St.Thomas DOAS systems. Annual means derived for 2015 are given below within table 7 along with those for previous years 2011-2014.

[18] LAQM.TG(16) General Considerations Paragraph 7.160 page 7-41

Site ID (see table4 above)	Location	Within AQMA	Data Capture 2015 %	Annual mean (ug/m³)				
				2011	2012	2013	2014	2015
1	Swansea AURN ** (12m)	Y	98.98%	25.6 (32.38)	26.0 (30.66)	26.8 (31.15)	25.0 (30.76)	23.0 (27.43)
3	Morriston Groundhog ** (22m)	N	91.13%	21.1 (27.25)	23.4 (28.10)	23.2 (28.58)	21.1 (25.89)	20.5 (25.02)
4	Cwm Level Park ** (100m)	Y	96.08%	20.87	19.61	18.54	17.08	14.75
5	Hafod DOAS	Y	99.1%	**57.61**	**52.60**	**50.68**	**48.99**	**40.24**
6	St.Thomas DOAS	N	99.9%	40.89	38.62	39.45	35.83	33.71
13	**Station Court, High Street(1.0m)	Y	93.24%	N/A	N/A	N/A	*56.85	**50.9 (54.52)**

Table 7 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective 2011-2015

** For information purposes only. Data capture commence July 2014.*

** The distance to the nearest receptor location is given in brackets after the site name in the above table. The NO_2 annual mean at the nearest receptor location has been derived following guidance within TG.16 paragraph 7.79 page 7-29.The supporting simple calculator Excel spreadsheet (Issue 4: 25/01/11) has been downloaded from http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

The resulting calculated NO_2 annual mean at the receptor location due to fall off in concentration with distance from the road is given in bold for the year of consideration. The measured roadside concentration is given in brackets. Background 1k by 1k NO_2 concentrations (for 2015 based on Background maps base year of 2011 file name 409-no2-2015.csv) were downloaded from http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011 and overlain on a GIS background map within Quantum GIS v2.4.0 (Chugiak). The background concentration required for the calculation was obtained from the nearest 1k grid square to the monitoring station. The background concentrations shown in table 8 below were used:

Site ID (see table 4 above)	Location	Background NO_2 Concentrations (ug/m^3)				
		2011	2012	2013	2014	2015
1	Swansea AURN)	16.3	19.57	19.01	17.06	16.93
3	Morriston Groundhog	17.8	19.71	19.03	17.34	17.03
13	Station Court High Street	-	-	-	-	16.65

Table 8 – Background NO_2 concentrations 2011-2015

As the site at Cwm Level Park has an Urban Background classification, with the nearest receptor being 100m away, the annual mean presented above has not been corrected to the nearest receptor as guidance within LAQM.TG(09) (within box 2.3) indicates that the correction method within the simple calculator is setup to work at a distance of 0.1 to 50m form the kerb.

One striking observation from table 7 is that the Hafod DOAS only indicates marginal exceedance of the NO_2 annual mean objective for 2015. This annual mean result for 2015 was totally unexpected and was initially disbelieved due to the perceived likelihood of an error in its calculation. However, despite the authors initial scepticism the derived annual mean has been compiled from a data capture of 99.1% after the application of the QA/QC rules outlined in section 2.1.6 above. Passive diffusion tube site 59 Hafod Post Office (passive diffusion tube measurements are discussed later) is located directly opposite the 250m DOAS open path and has previously been seen to trend in-line with the measured DOAS concentrations. However for 2015, the bias corrected annual mean for site 59 is 47.78ug/m^3 and is comprised of 100% data capture. This observation does not reconcile the drop in measured concentrations unless the street canyon effects were continually observed along the opposite façade from the DOAS path. Regrettably, the meteorological monitoring that had been established front façade of the Hafod Post Office with 3D wind speed/direction is no longer operational. These data may have provided some insight into the validity of the above mentioned theory.

The St Thomas DOAS, marginally exceeded the annual mean objective during 2011 and then has marginally complied with the annual mean objective during 2012 and 2013 with 2014 and 2015 now showing full compliance. Improvements with the more recent annual means to that of 2010 at St Thomas are possibly due to the improvements made around Quay Parade bridges during November/December 2011. The two other roadside sites at the Swansea AURN and Morriston Groundhog both continue to see an overall decrease in measured concentrations and exhibit full compliance with the annual mean objective.

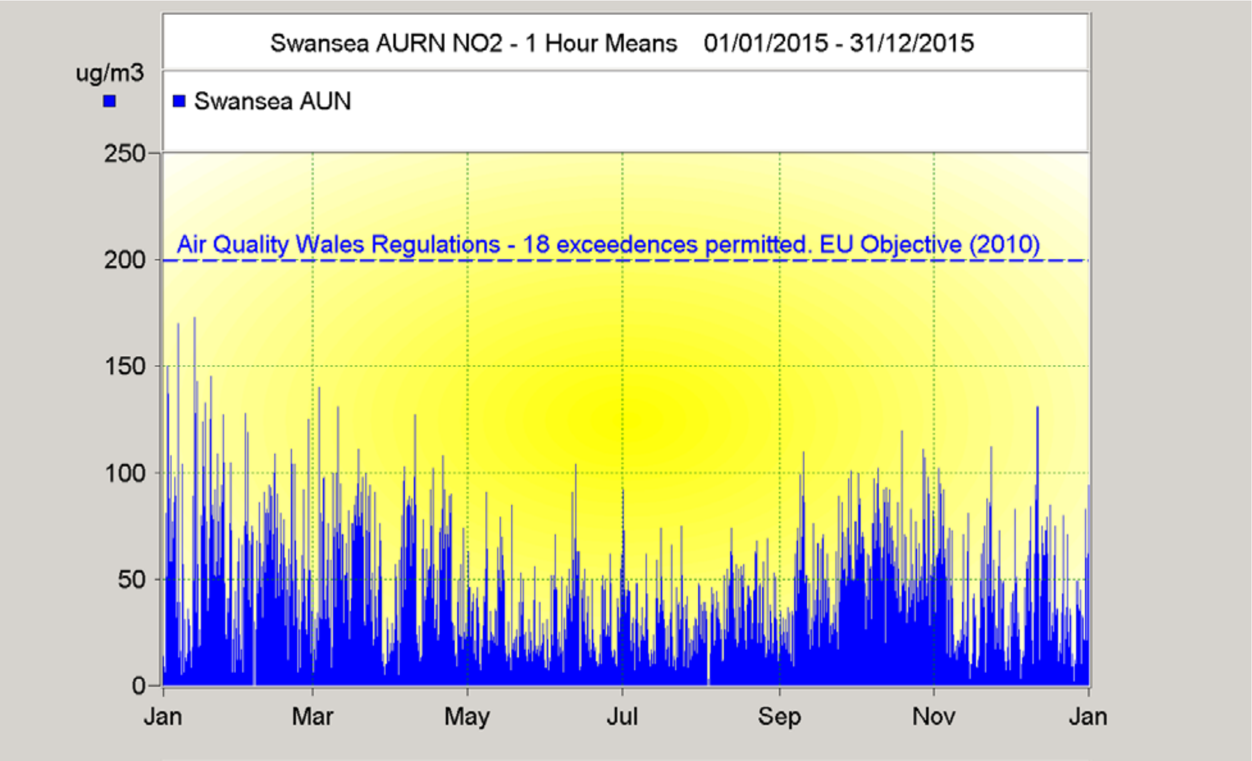
The roadside chemiluminescent NO_x monitoring undertaken during 2015 at Station Court High Street confirms the initial and limited measurements undertaken during 2014 and now confirms an exceedance of the NO_2 annual mean objective at this location. The site is located within the existing Swansea AQMA 2010. The location of the site and local influences are outlined within section 2.1.13 above. There are two ATC traffic counters which provide an insight into the composition of the traffic flow. ATC Site 22 lies to the north of the site with ATC site 57 to the south. Both sites are relevant to this location and indicate a combined HGV composition (Heavy Van/Mini bus/ L/M/HGV, Articulated lorry, and Bus) of : ATC site 22 -11.7% and ATC site 57 - 11%. Full details of the ATC monitoring undertaken can be found in section 3 below.

Table 9 below indicates assessments from all stations in respect of the number of exceedances of the 1-hour NO_2 objective. Where data capture rates are below 90% the 99.8th percentile is presented in brackets.

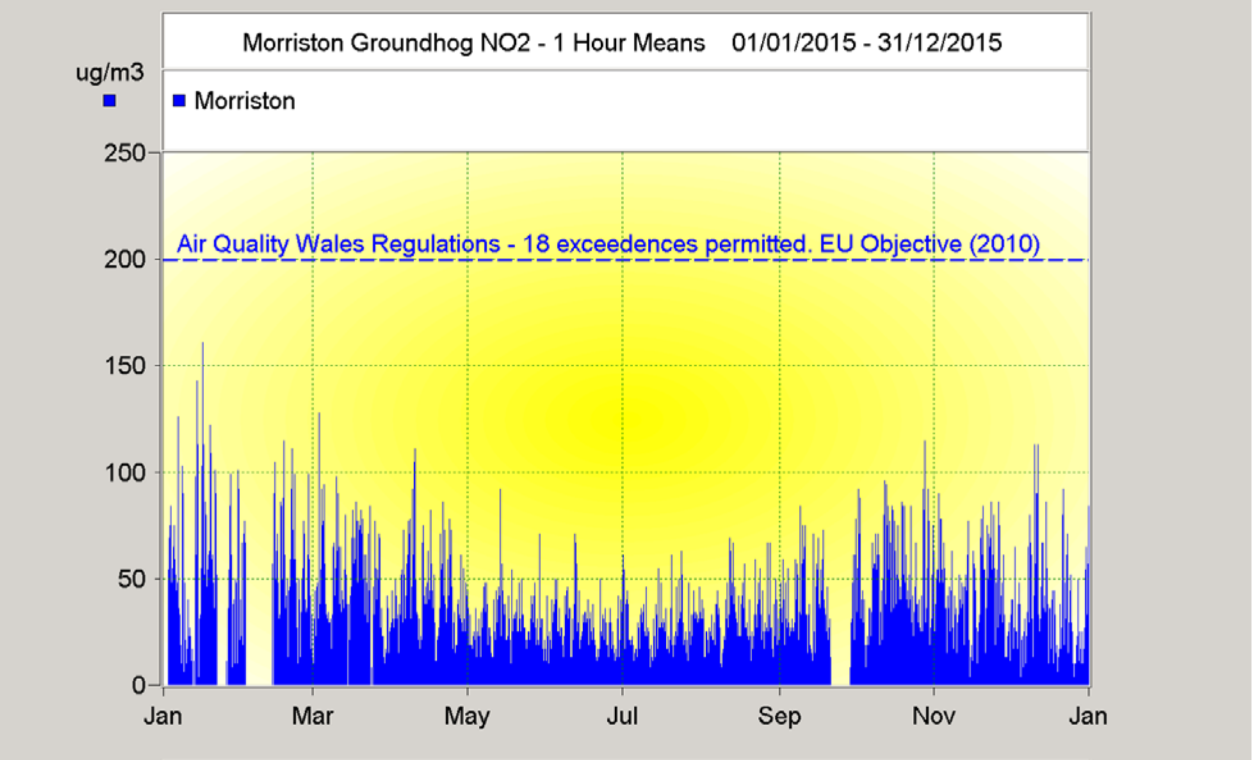
Site ID (see table 4 above)	Location	Within AQMA	Data Capture 2015 %	Number of Exceedances of hourly mean (200 $\mu g/m^3$)					
				2010	2011	2012	2013	2014	2015
1	Swansea AURN	**Y**	98.98%	0	1	0	0	0	0
3	Morriston Groundhog	**N**	91.13%	0	0	0	0	0	0
4	Cwm Level Park	**Y**	96.08%	0	0	0	0	0	0
5	Hafod DOAS	**Y**	99.1%	**20** **(203.13)**	16	5	6	1	0
6	St.Thomas DOAS	**N**	99.9%	0	0	0	0	0	0
13 *	Station Court, High Street	**Y**	93.24%	-	-	-	-	5 **(194.7)**	2

Table 9- Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective
*** Data capture rate below 90% 99.8th percentile presented in brackets*

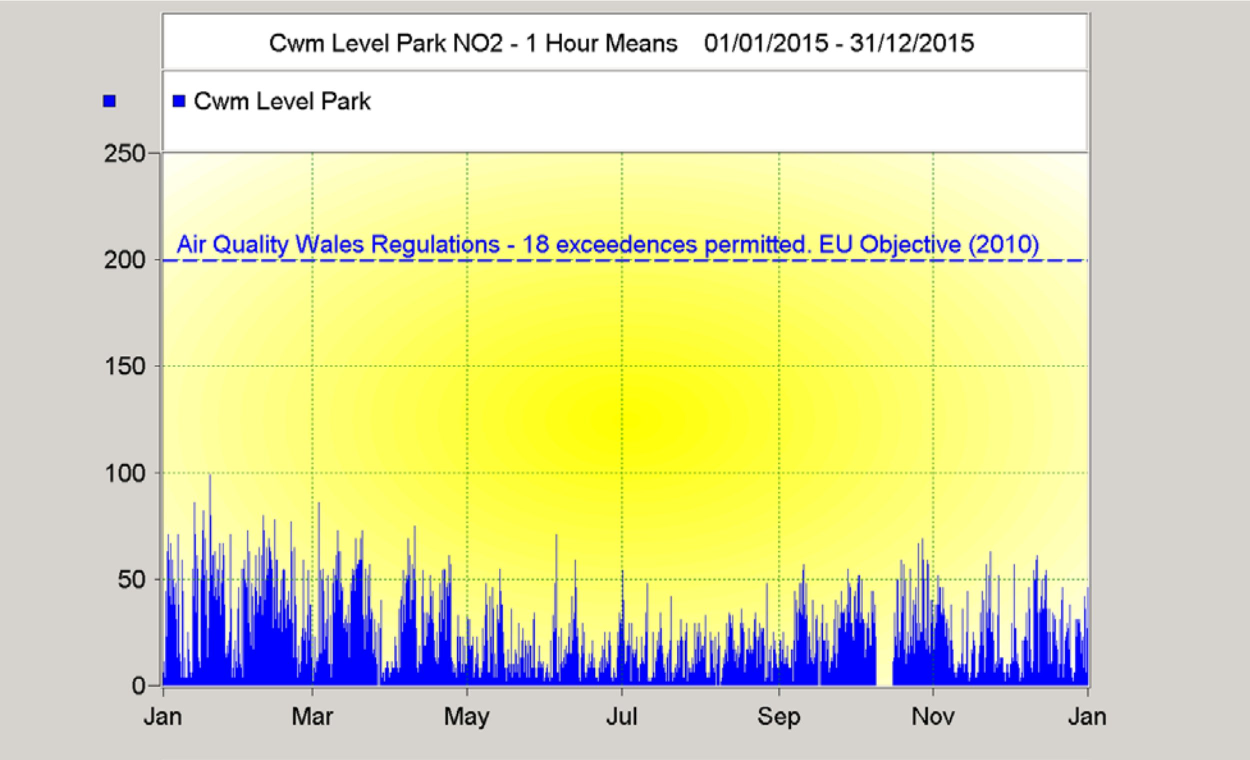
Graphs 1- 6 below show the NO_2 1-hour means for 2015 from the 6 automatic and continuous sites now within Swansea.



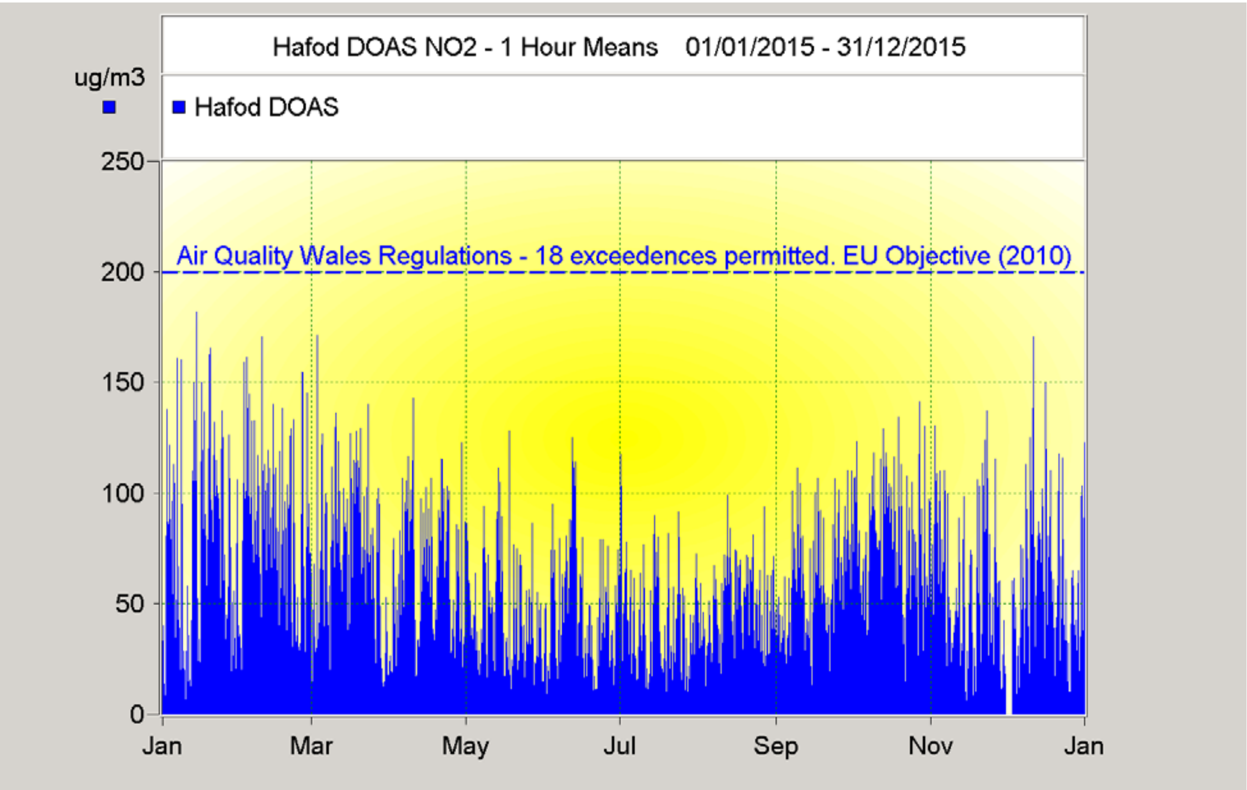
Graph 1 – NO_2 1- hour means Swansea AURN 2015



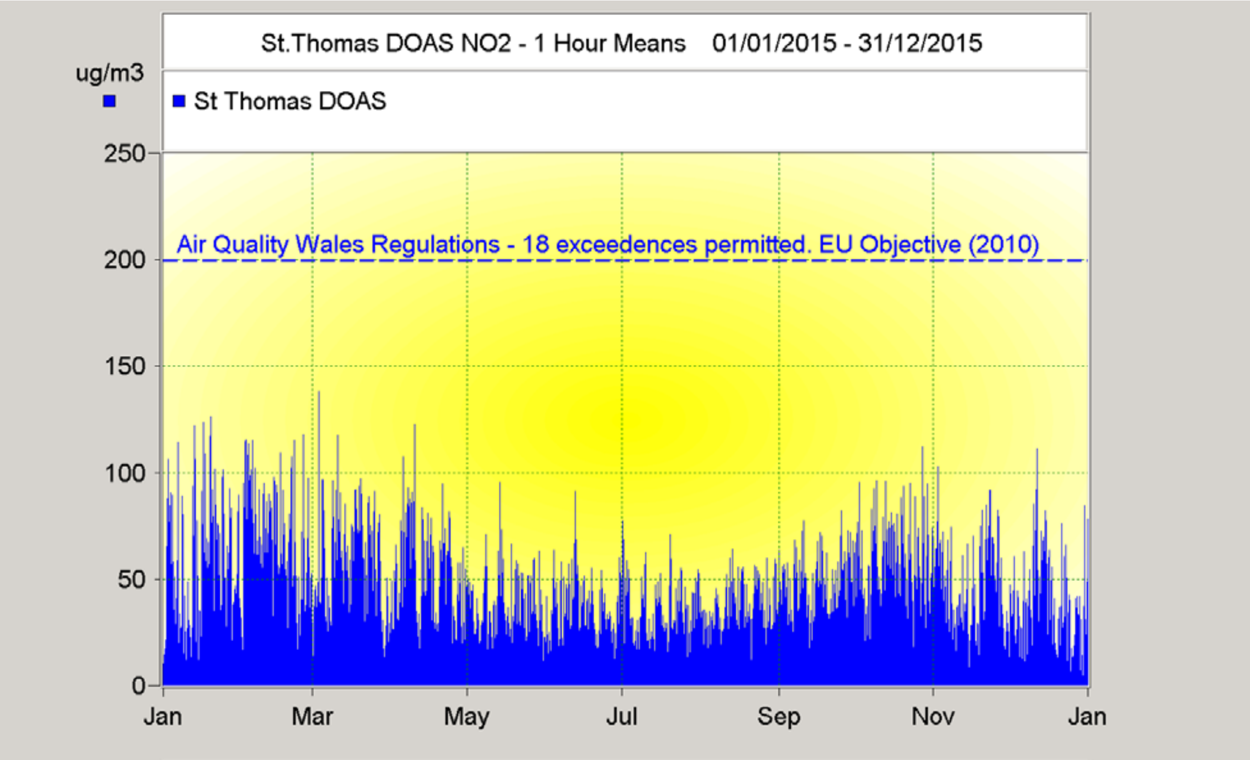
Graph 2 – NO_2 1- hour means Morriston Groundhog 2015



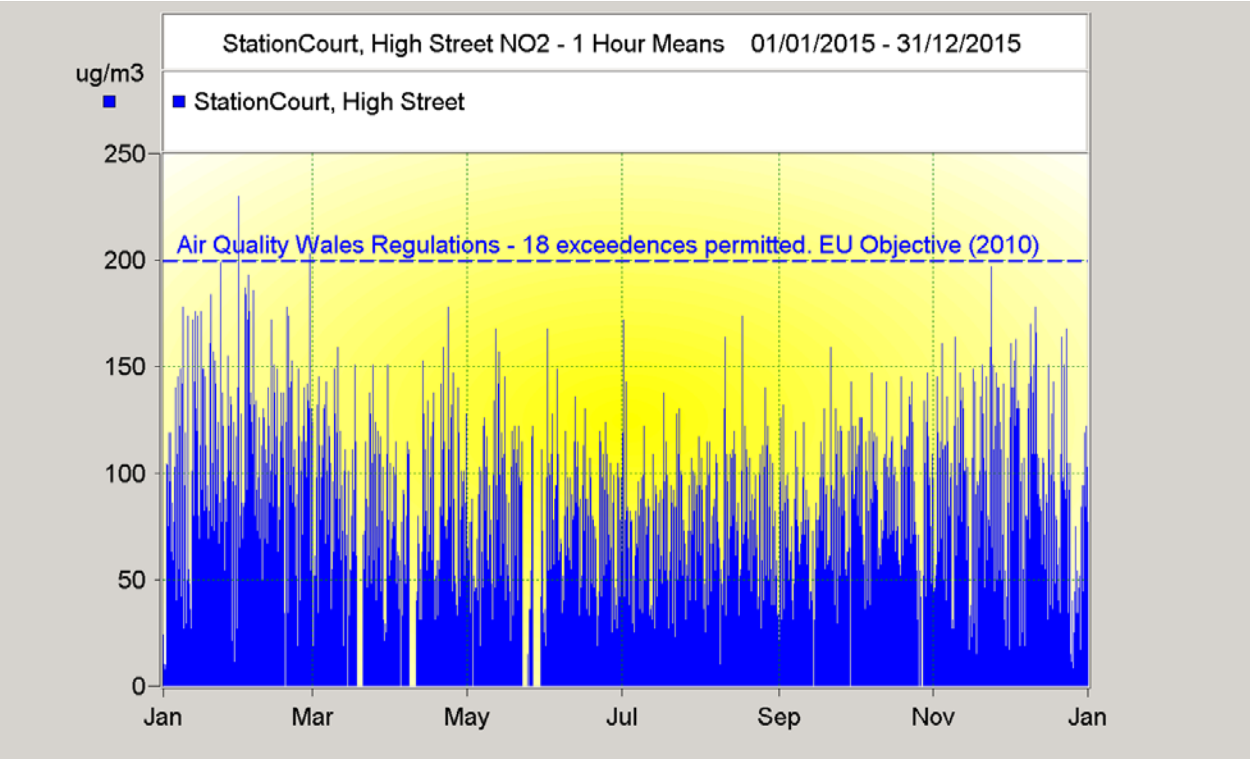
Graph 3 – NO_2 1- hour means Cwm Level Park 2015



Graph 4 – NO_2 1- hour means Hafod DOAS 2015



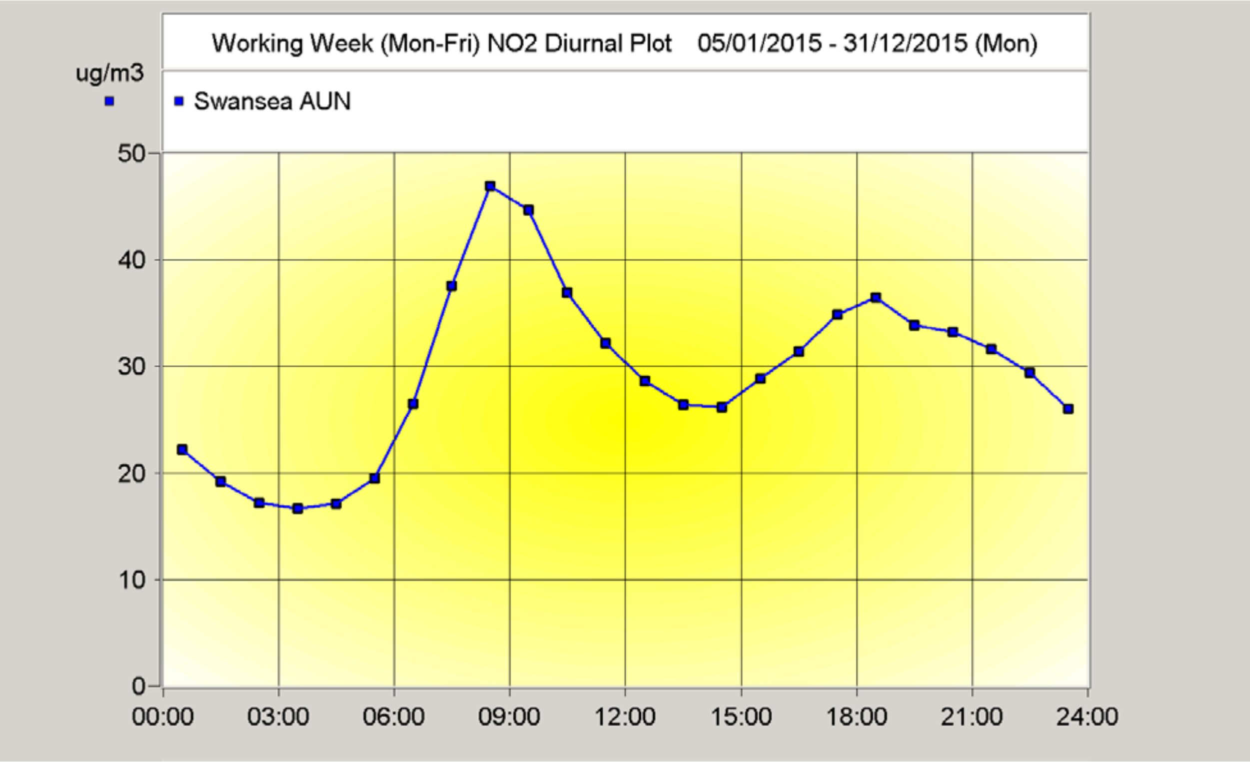
Graph 5 – NO_2 1- hour means St.Thomas DOAS 2015

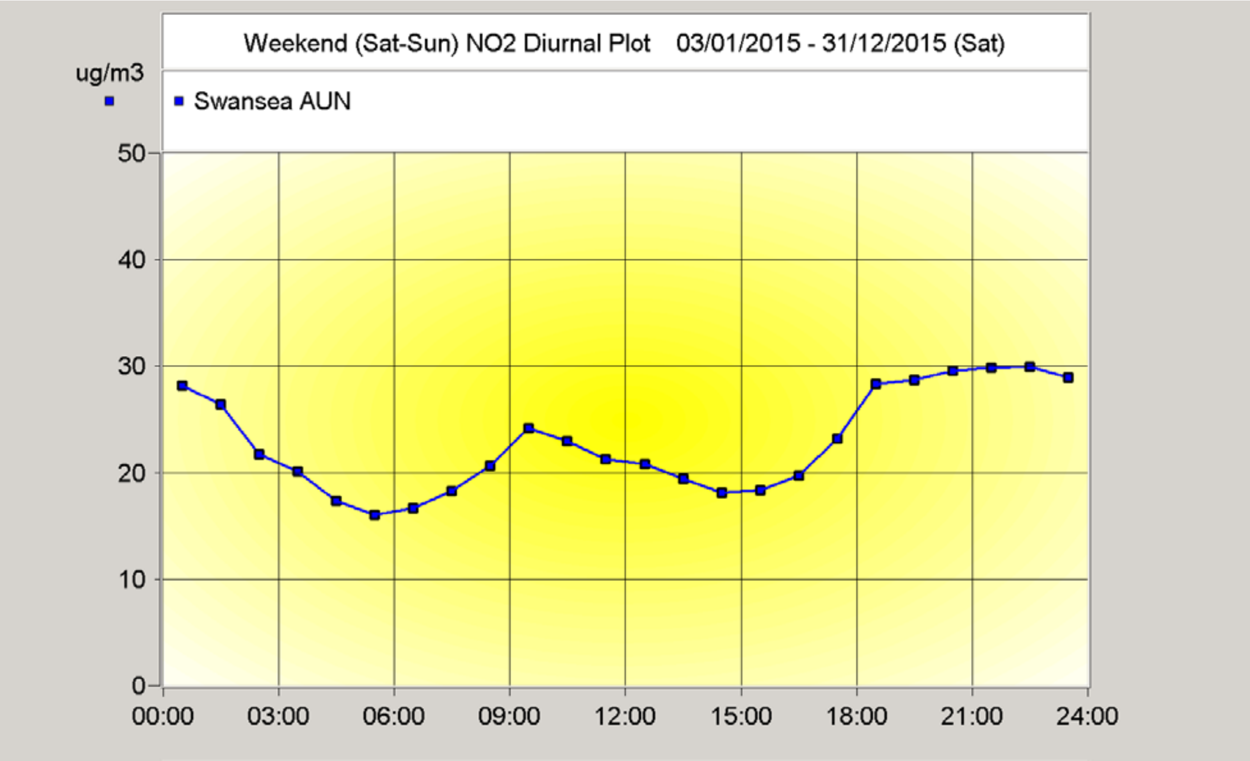


Graph 6 – NO_2 1- hour means Station Court, High Street 2015

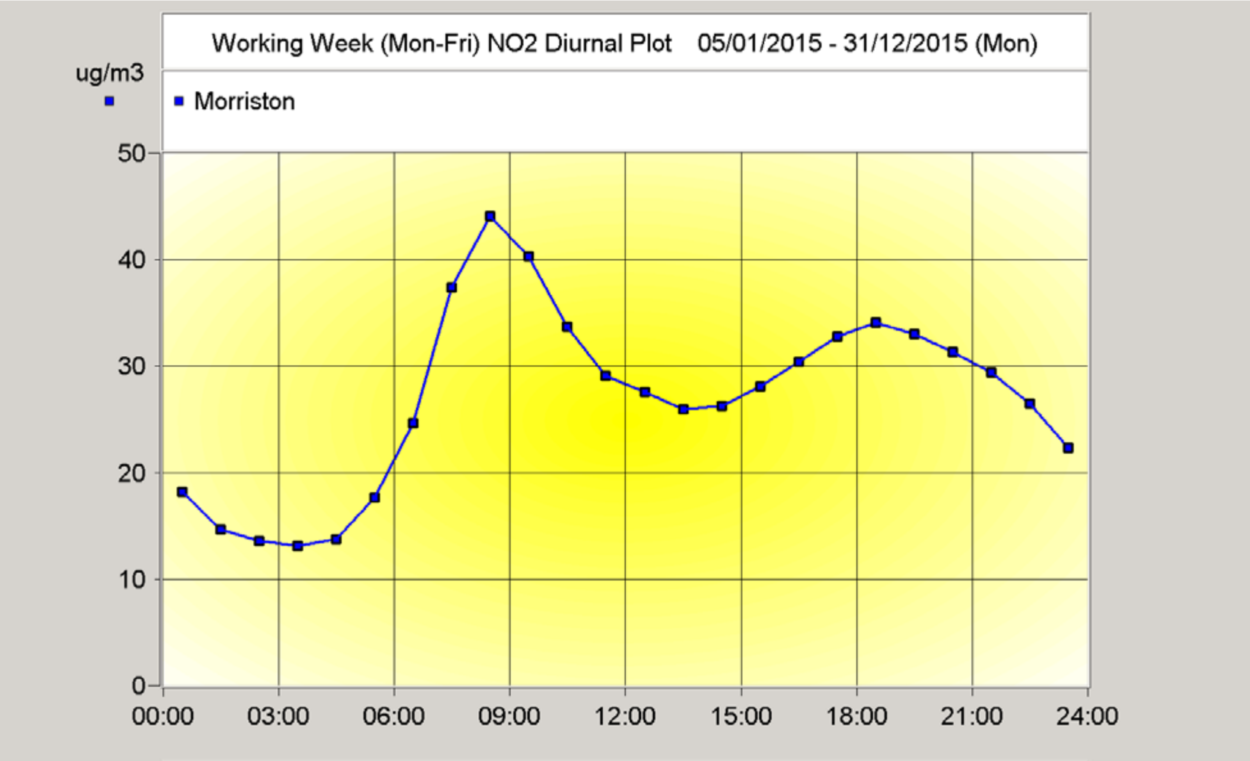
Diurnal NO_2 profiles of the working week (Mon – Fri) and the weekend (Sat – Sun) for each site are provided below within diurnal plots 1-6. Again, as would be expected, the weekday peak concentrations are seen at each site during the am period with the pm period being much smoother. The am peak is thought likely to be influenced more by the prevailing meteorological conditions during the morning period which are then dispersed before the pm period i.e. wintertime inversions. A completely different profile is obtained for the weekend period.

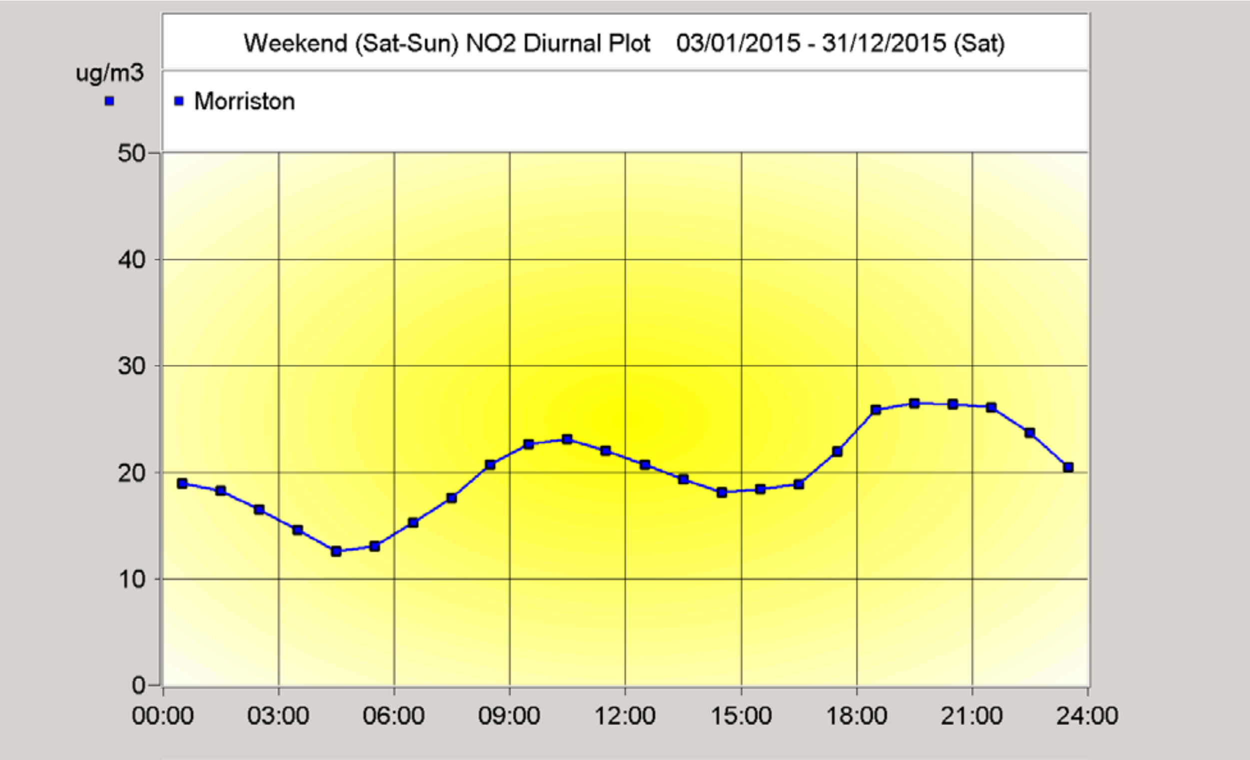
The weekday profiles raise the question whether the authority should, as part of its Air Quality Action Plan, concentrate efforts on reducing the NO_2 impact solely around the am peak traffic period of 7-10am. Thought is still being given as to what effect this may have on the overall NO_2 annual mean and 1 hour objectives and is expanded on below. The newly established site at Station Court does seem to paint a different picture with concentrations remaining high throughout the whole working day. Whatever traffic management measures are introduced into the Nowcaster forecast system being developed for such situations, to achieve widespread compliance with the objectives, will obviously require detailed and thorough planning.



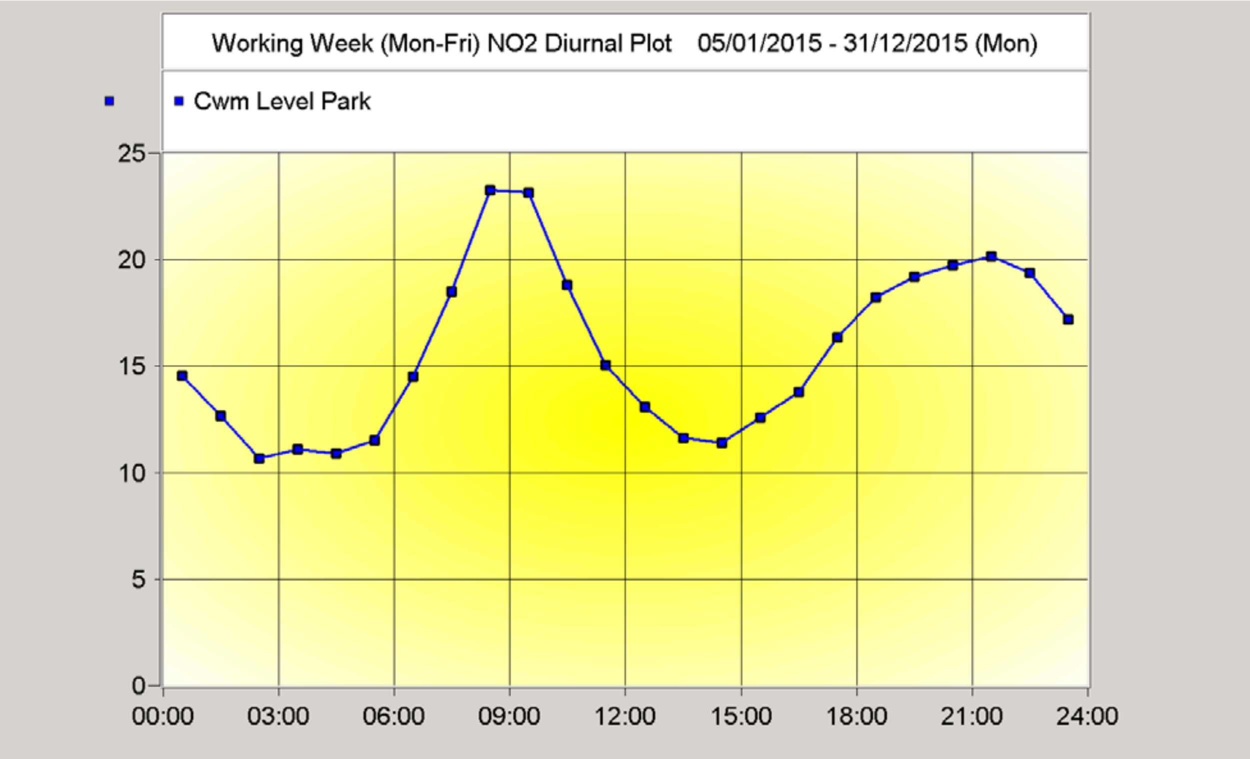


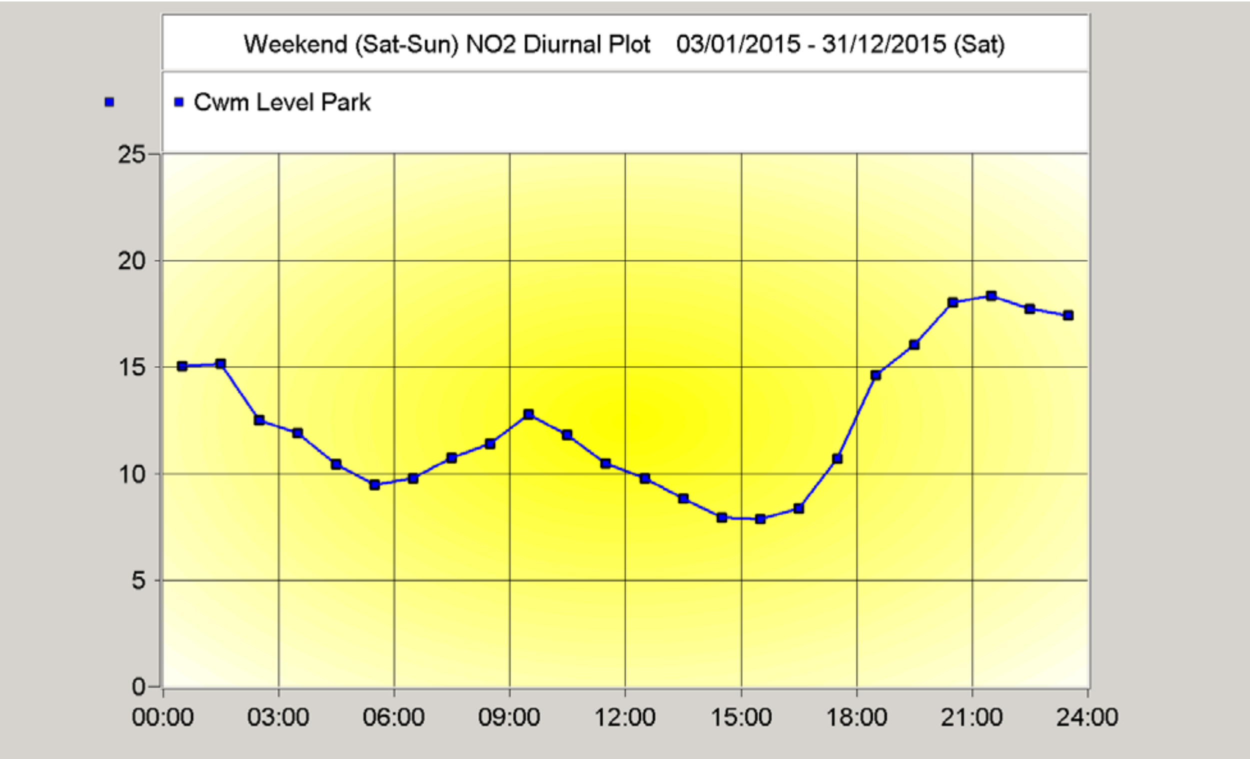
NO_2 Diurnal Profile 1 – Swansea AURN 2015(top weekday profile, bottom weekend profile)



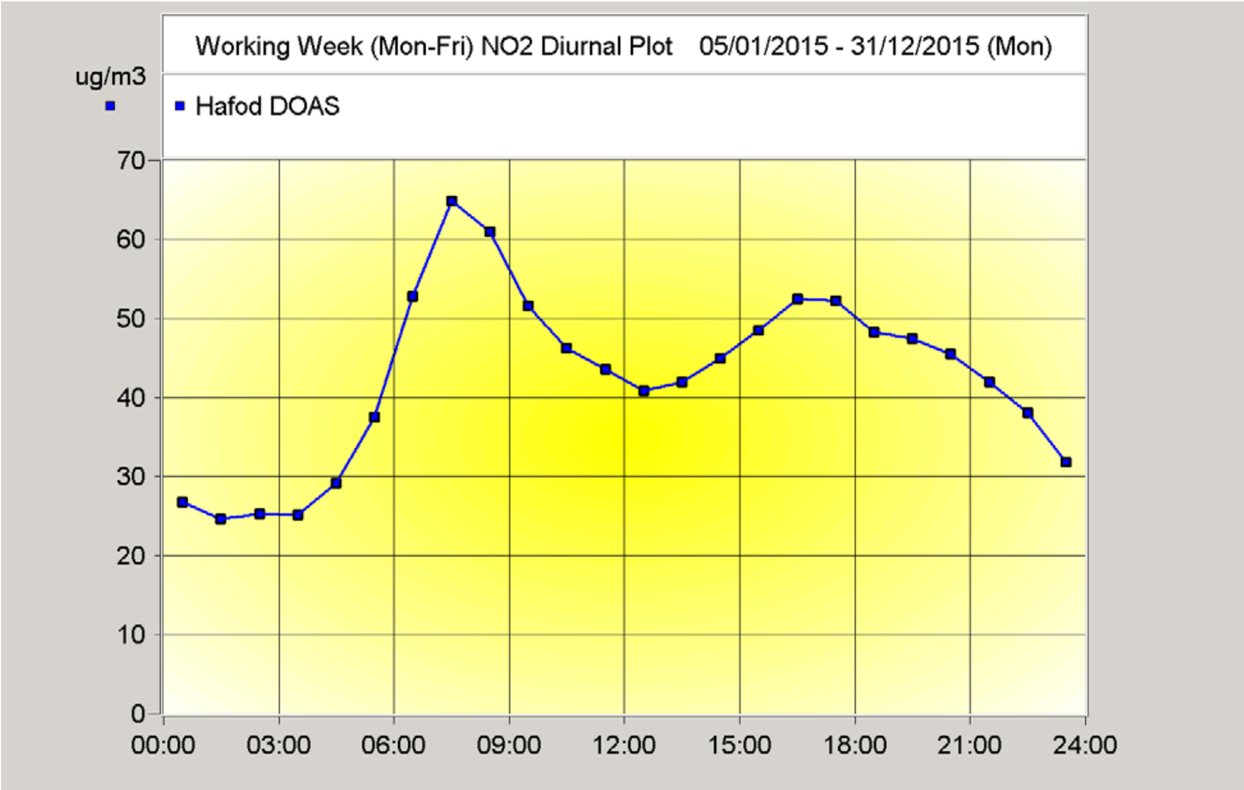


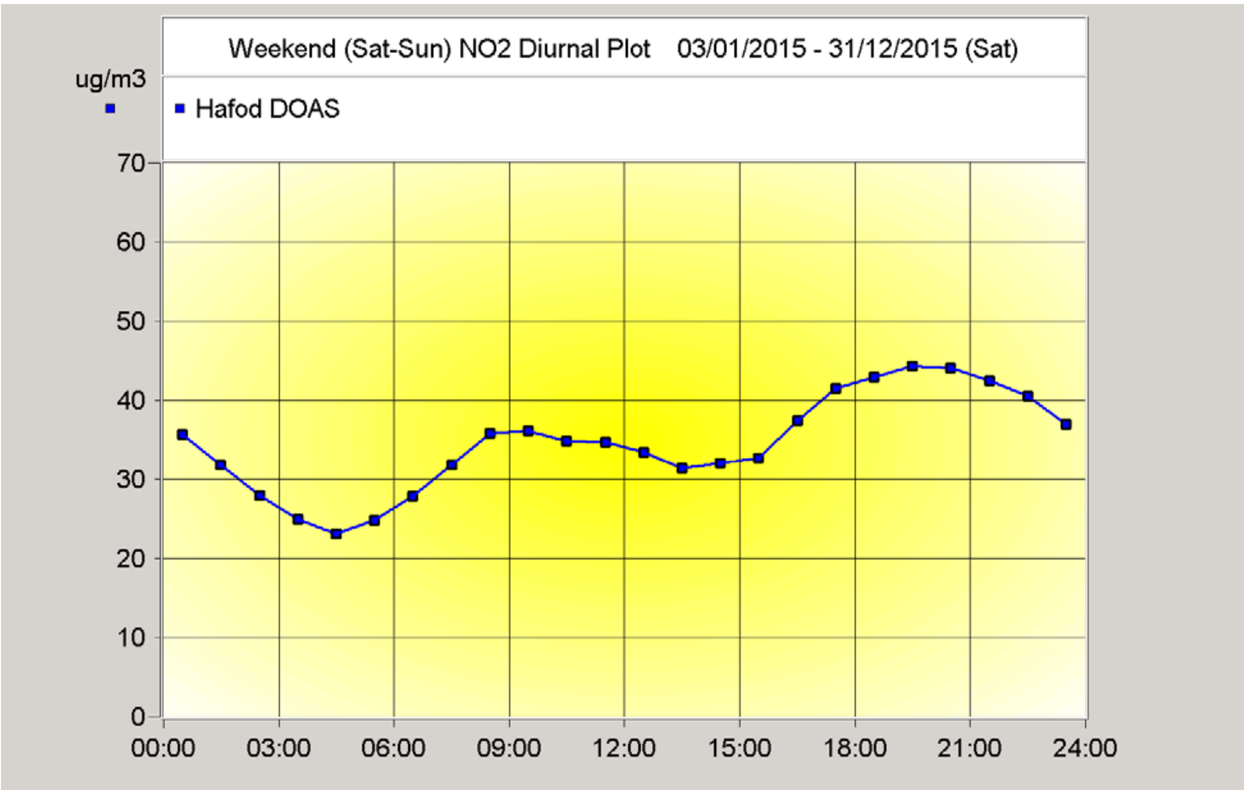
NO_2 Diurnal Profile 2 – Morriston Groundhog 2015 (top weekday profile, bottom weekend profile)



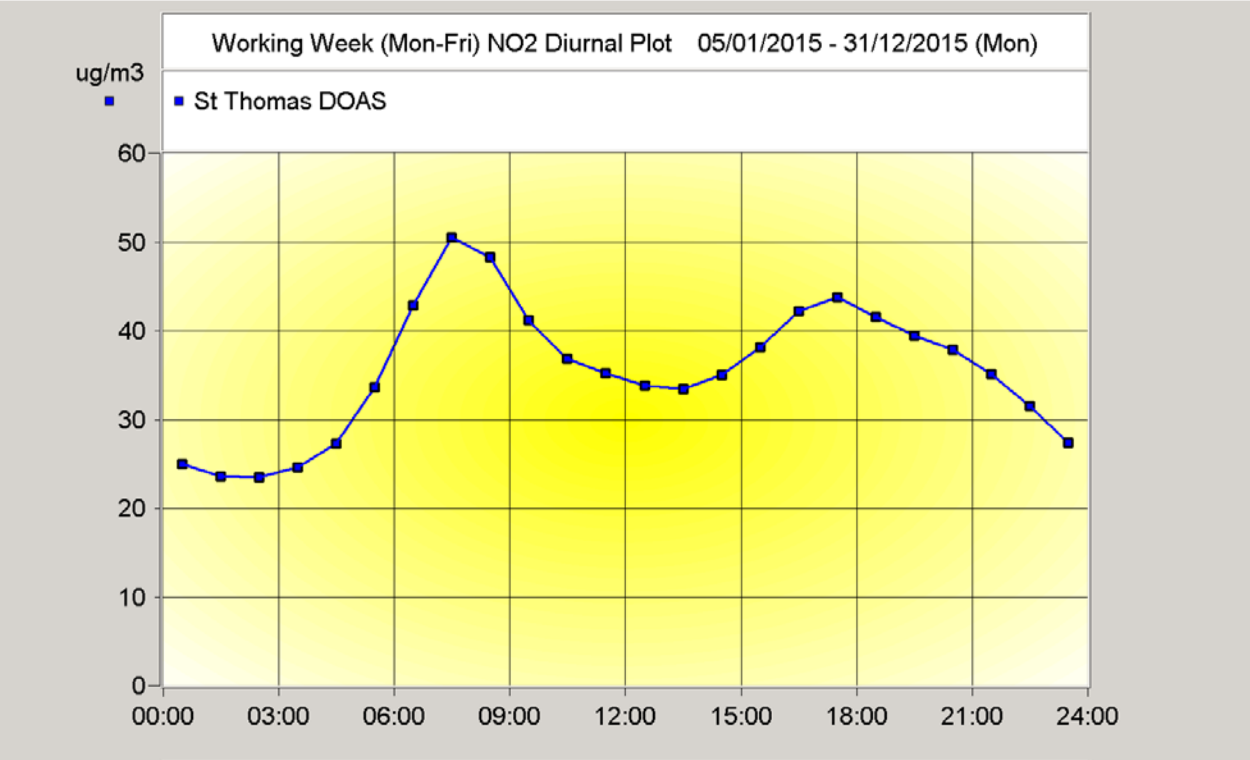


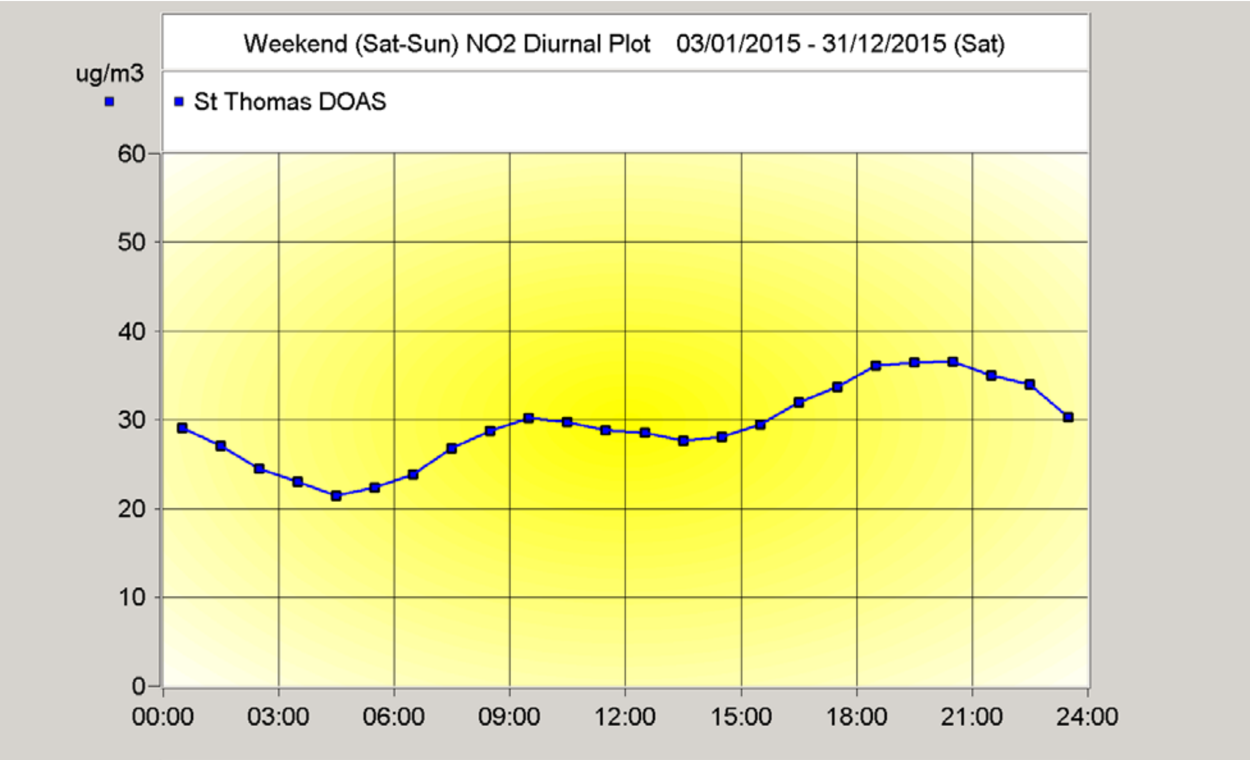
NO_2 Diurnal Profile 3 – Cwm Level Park 2015 (Urban background site) (top weekday profile, bottom weekend profile)



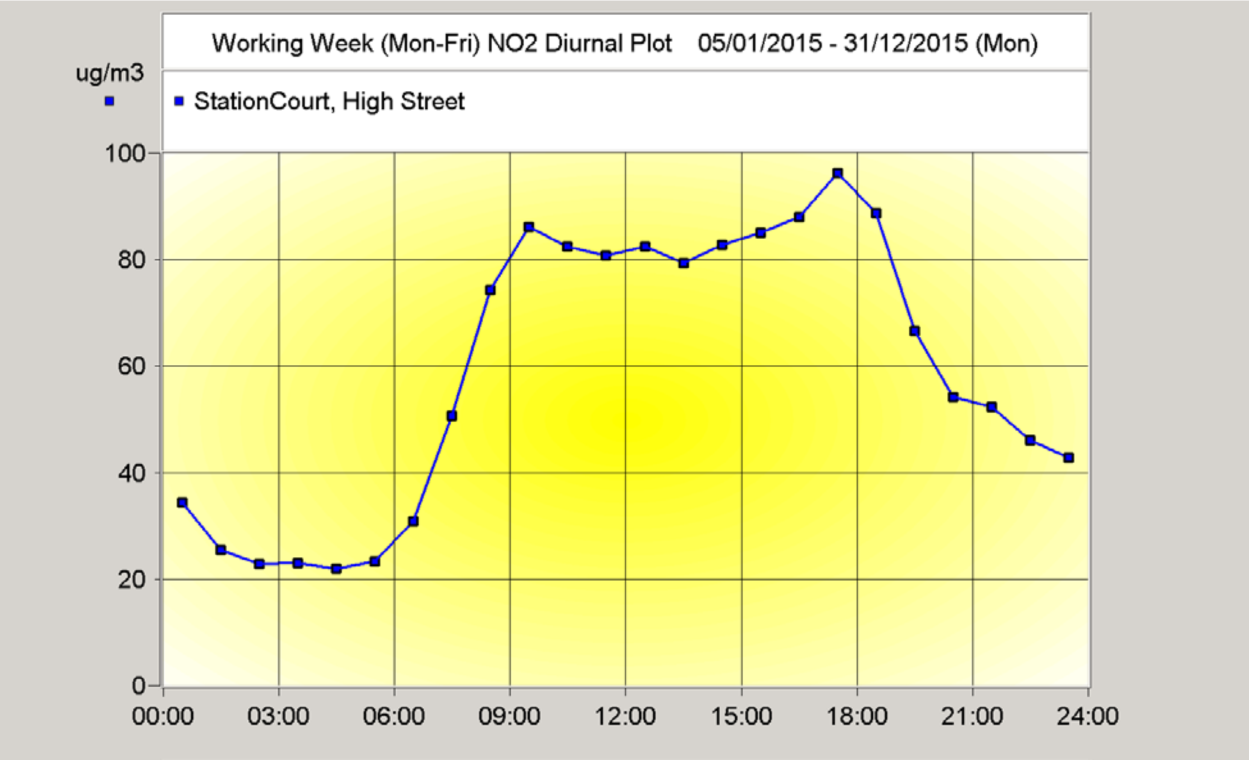


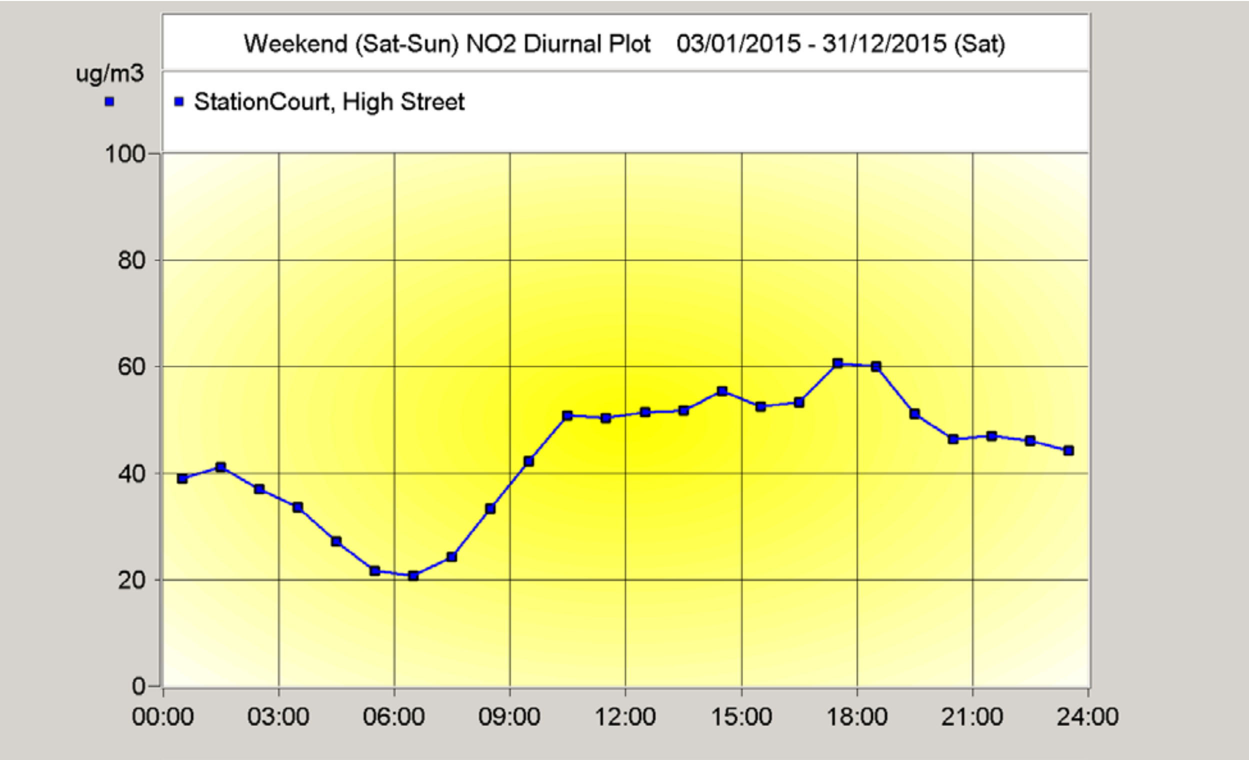
NO_2 Diurnal Profile 4 –Hafod DOAS 2015 (top weekday profile, bottom weekend profile)





NO_2 Diurnal Profile 5 – St Thomas DOAS 2015 (top weekday profile, bottom weekend profile)



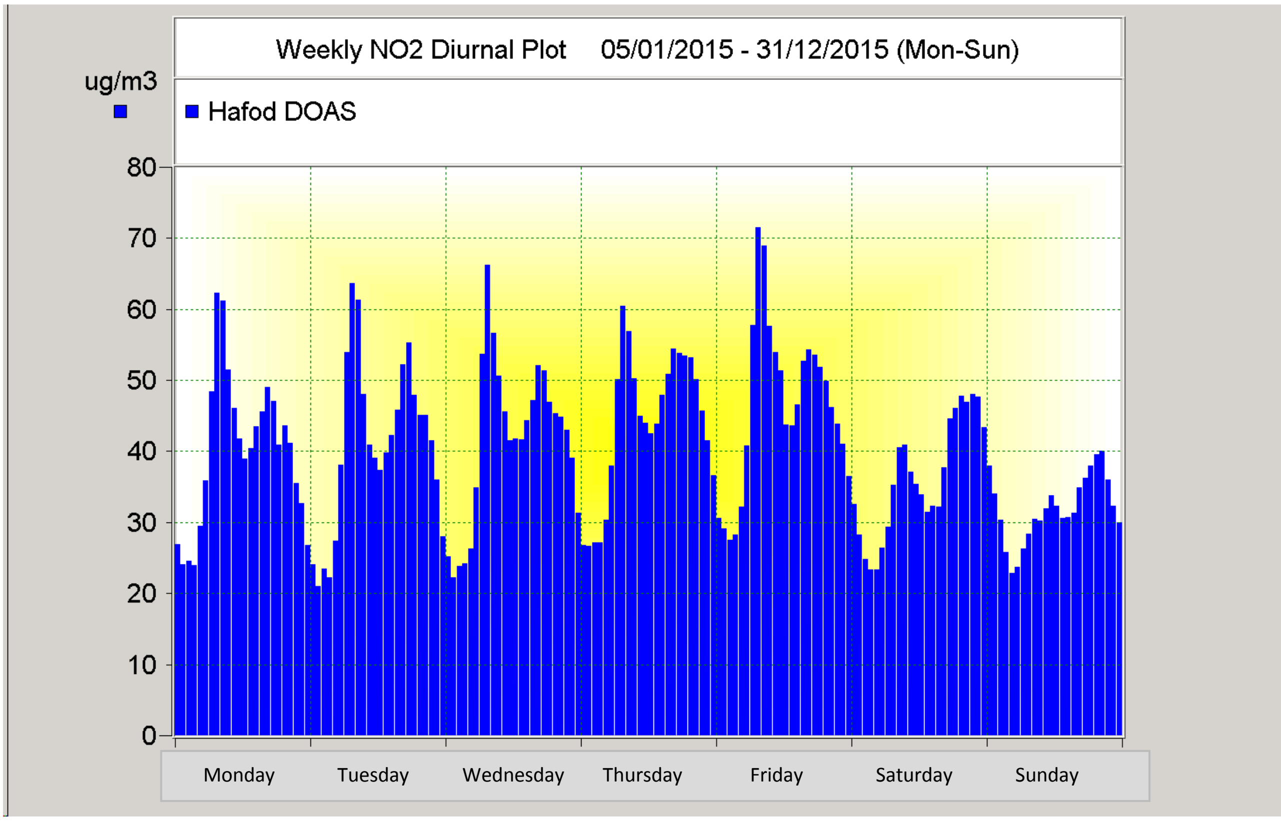


NO_2 Diurnal Profile 6 – Station Court High Street 2015 (top weekday profile, bottom weekend profile)

Of particular interest once again, are the diurnal profiles obtained at the Station Court High Street site. Concentrations remain elevated during the whole of the working period throughout the day with concentrations showing a rapid rise from around 06:00hrs, not decreasing greatly after the am rush-hour period and in fact continuing to increase following mid-day with peak concentrations not being reached until the pm rush-hour starting around 18:00hrs. This is a completely different profile to that obtained from every other site in that at all other sites, a drop in concentrations is seen after the am peak before they rise again during the pm peak. At the Station Court site, concentrations continue to increase during mid-morning and over the lunch period into early afternoon and only peak during the pm rush-hour period.

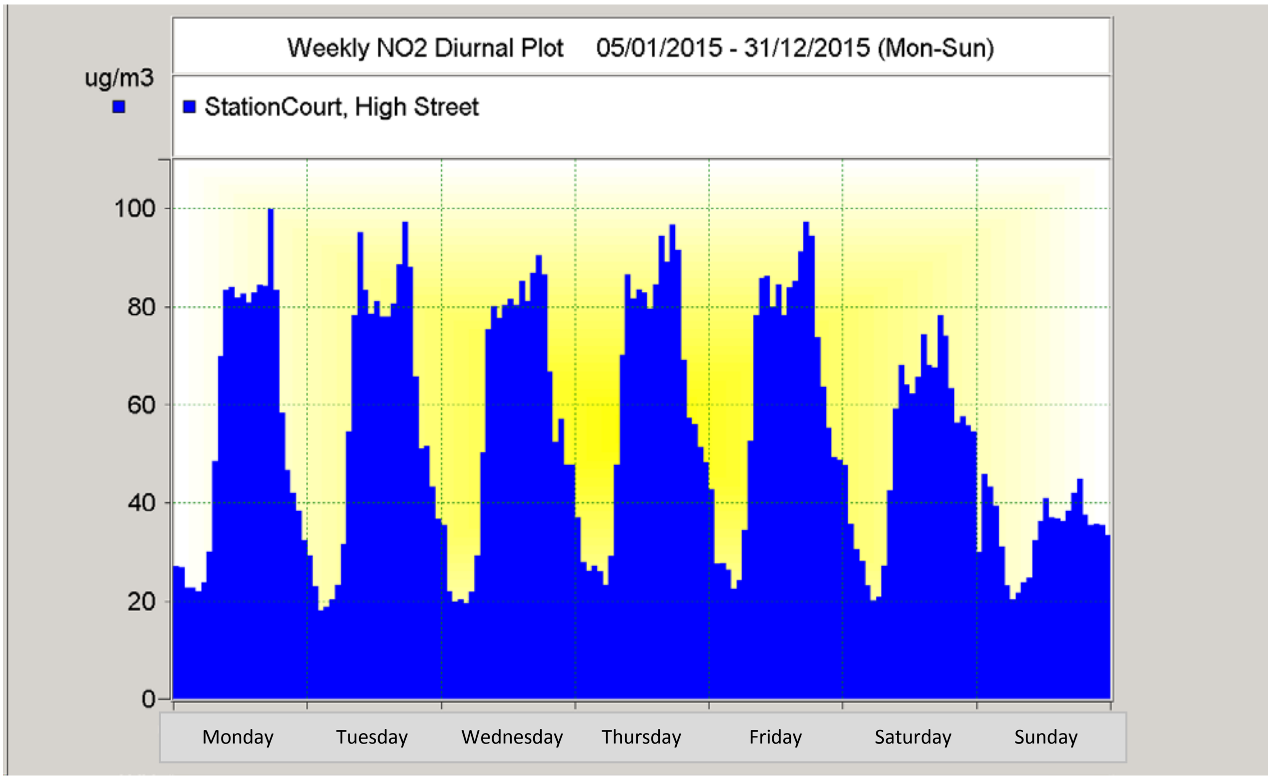
The diurnal weekday profiles obtained for the both the Hafod DOAS and Station Court sites are both interesting and concerning in that can these profiles be better explained and more importantly what practicable measures in the case of the Hafod DOAS site would reduce the impact of the morning rush hour along this street canyon. Early thoughts with the data from the Hafod DOAS were that it was envisaged that additional “source apportionment” would be required with specific emphasis on identifying the fuel being combusted and also the EURO classification and the adopted abatement technology employed within each vehicle. Obviously, the only way to accurately obtain this information would be via a static ANPR camera linked to the DVLA databases. When sufficient information had been gathered, thought would then have to be given as to how interventions could practicably be made with specific vehicle types within the fleet. However, budgetary restraints no longer permit this action to be considered further. It should be mentioned that in light of the annual mean returned for 2015 at the Hafod DOAS, no conclusions have been formed as it is unknown if the sharp downward annual mean concentration will be repeated in subsequent years. Should this be a real trend then the approach will need to be reassessed in light of the newly emerging evidence including the revocation of the areas as an AQMA.

If diurnal profiles are created for each individual working day at the Hafod DOAS, the same am peak trend is apparent, therefore, it could be argued that whatever interventions are decided upon would need to be applied for every morning of every working day of the week in order to make any difference to the concentrations being recorded. A weekly summary of the individual daily diurnal plots from the Hafod DOAS is given below as diurnal profile 7. If diurnal plot 7 is compared to the same plot from 2014 (see USA 2015 at http://www.swansea.gov.uk/media/13539/Updating-and-Screening-Assessment-2015/pdf/Swansea_USA_2015.pdf) the drop in measured concentrations is evident but the pattern in the overall profile remains.



Diurnal Profile 7 – Hafod DOAS – Weekly 2015

The weekly profile obtained at the Station Court site is shown below as Diurnal Profile 8 and presents a different challenge and scenario to that painted above for the Hafod DOAS. Visual observations confirm that congestion and a high flow of buses, together with the location of bus stops/mini roundabouts may well be contributory factors to the concentrations being seen. These high concentrations exist from early morning to early/late evening Monday to Saturday with the peak concentrations not being seen until the pm period. The only day that does not experience these conditions are Sundays.



Diurnal Profile 8 – Station Court High Street – Weekly 2015

Detailed traffic flow data for the authorities GPRS network of ATC's is presented in subsequent chapters. The nearest GPRS traffic counters to the Hafod DOAS are GRPS site 6 (located approximately 50m south of the Hafod DOAS transmitter and GPRS site 18 (located approx. 25m north of the Hafod DOAS receiver. The nearest traffic counters to the Station Court site are GPRS site 22 (located 330m to the North) and GPRS site 57 (located 350m to the South)

2.2.3 Nitrogen Dioxide Diffusion Tube Monitoring

All data presented within table 11 below has been corrected for tube bias only. No correction for tube chemistry has been applied as a result of the tri-location study carried out at the Swansea Roadside AURN chemiluminescent analyser[19]. In any event, all passive diffusion tubes are located roadside and no correction has been made using a roadside tri-location study derived bias correction to a passive diffusion tube with an urban background classification.

Sites with data capture greater than 75% i.e. those that have the minimum 9 months exposure period and which exceed the annual mean are highlighted in bold red. Those sites that are close to exceeding the annual mean (between 37-40ug/m^3) are highlighted in bold blue. **Table 11 indicates the bias corrected annual means including any correction necessary for distance to nearest receptor from the sampling location - see table 6 for distance to nearest receptor. The relevant distance correction/background concentration (where applicable) is given within table 12 for sake of completeness.**

Annualised means in accordance with LAQM.TG(16) guidance on page 7-55 to 7-56 have been calculated for sites with data capture rates below 75% as per the method outlined in Box 7.10. Chemiluminescent NO_2 data has been used from Cwm Level Park which has an Urban Background classification. Details of the original raw mean, data capture and derived annualised mean are given below within table 12a.

Box-Whisker Plots are provided for all sites within Annexe 5. Please note that RAW, uncorrected for bias data is presented within the box-whisker plots

[19] http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site Type	In AQMA?	Data Capture 2015 %	Annual Mean concentrations 2015 (ug/m3) Adjusted for tube bias and distance to receptor and annualised where appropriate **(Bias Adjustment factor 2015 = 0.88)**
4	262497	192857	Roadside	Y	100.0	27.28
5	262548	192943	Roadside	Y	91.7	29.70
6	262612	192995	Roadside	Y	100.0	26.57
7	262691	192852	Roadside	Y	100.0	**42.69**
8	262990	195820	Roadside	Y	100.0	**40.36**
9	263190	195205	Roadside		100.0	24.87
10	263219	195513	Roadside	Y	100.0	23.94
11	263344	195474	Roadside	Y	100.0	33.81
12	263680	195103	Roadside	Y	83.3	**38.39**
13	264830	193066	Roadside		100.0	25.66
14	265285	192696	Roadside		100.0	23.86
15	265334	192608	Roadside		100.0	24.30
16	265339	192534	Roadside		100.0	26.80
18	265526	195807	Roadside	Y	100.0	**42.07**
19	265597	194061	Roadside	Y	100.0	**39.14**
20	265594	194175	Roadside	Y	100.0	35.42
21	265634	195316	Roadside	Y	91.7	26.93
22	265682	195374	Roadside	Y	100.0	29.91
23	265728	195494	Roadside	Y	100.0	28.69
25	265845	195547	Roadside	Y	100.0	26.47
26	265876	194318	Roadside	Y	100.0	35.44
27	265922	194428	Roadside	Y	100.0	34.78
28	265949	194891	Roadside	Y	100.0	25.67
29	265973	195222	Roadside	Y	91.7	**48.90**
31	266153	196003	Roadside		100.0	28.42
32	266209	193867	Roadside		100.0	30.15
33	266236	193488	Roadside		100.0	29.45
34	266272	196168	Roadside		91.7	27.33
35	266314	193298	Roadside		83.3	31.35
36	266455	193300	Roadside		100.0	26.49
38	266662	193181	Roadside		91.7	32.66
40	266951	198278	Roadside		100.0	24.83
41	266953	198085	Roadside		91.7	31.89
43	267093	198063	Roadside		100.0	32.16
44	267639	199543	Roadside		100.0	26.55
45	267661	199451	Roadside		100.0	28.19
48	268011	193101	Roadside		100.0	19.59
50	268530	197419	Roadside		100.0	33.79
54	268693	197416	Roadside		91.7	31.38
55	268789	197420	Roadside		100.0	31.04
56 *	269306	198661	Roadside		100.0	22.20
58	264052	192884	Roadside		75.0	28.50
59	265918	194463	Roadside	Y	100.0	**47.78**
60	265036	192931	Roadside		100.0	29.70
61	264959	192878	Roadside		91.7	33.93
63	262675	192775	Roadside	Y	91.7	19.40
64	262719	192840	Roadside	Y	100.0	36.10
65	262735	192855	Roadside	Y	100.0	21.99
66	262802	192829	Roadside	Y	100.0	26.53

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site Type	In AQMA?	Data Capture 2015 %	Annual Mean concentrations 2015 (ug/m3) Adjusted for tube bias and distance to receptor and annualised where appropriate **(Bias Adjustment factor 2015 = 0.88)**
67	265903	193683	Roadside	Y	100.0	**37.20**
68	265573	193432	Roadside		100.0	34.87
69	265543	193450	Roadside		100.0	35.60
70	266649	195435	Roadside		91.7	25.60
71 **	266514	195485	Roadside		100.0	24.50
72	264091	192900	Roadside		100.0	22.60
73	264138	192868	Roadside		100.0	28.39
74	264163	192853	Roadside		**66.7**	22.39
75	264072	192869	Roadside		91.7	34.02
76	263968	192880	Roadside		100.0	25.80
78	263819	192948	Roadside		100.0	23.47
79	263842	192896	Roadside		91.7	26.82
83	262785	192838	Roadside	Y	100.0	25.97
84	262714	192839	Roadside	Y	100.0	33.81
85	262702	192847	Roadside	Y	100.0	35.28
86	262704	192865	Roadside	Y	100.0	23.97
87	262697	192798	Roadside	Y	100.0	18.93
88	262605	192916	Roadside	Y	100.0	28.37
89	262587	192956	Roadside	Y	91.7	20.09
90	262631	192996	Roadside	Y	100.0	30.02
91	262534	192950	Roadside	Y	100.0	27.46
92	262545	192869	Roadside	Y	91.7	23.10
93	263406	195534	Roadside		100.0	25.39
94	263444	195572	Roadside		91.7	25.66
95	262815	196090	Roadside		100.0	21.38
96	262922	195950	Roadside		100.0	25.55
97	262946	195902	Roadside	Y	100.0	31.44
98	263142	195548	Roadside	Y	91.7	33.05
99	263387	195332	Roadside	Y	100.0	28.84
100	263470	195250	Roadside	Y	100.0	23.09
101	263843	195047	Roadside	Y	100.0	23.75
102	266379	193307	Roadside		100.0	27.87
104	268538	197389	Roadside		100.0	27.13
107	268765	197420	Roadside		100.0	29.49
108	267608	199461	Roadside		100.0	27.33
109	267510	199487	Roadside		100.0	25.01
110	267369	199521	Roadside		100.0	24.67
111	267705	199426	Roadside		100.0	30.15
114	264622	192971	Roadside		91.7	27.48
115	265031	193097	Roadside		100.0	35.25
116	265192	193138	Roadside		100.0	35.63
117	265288	193211	Roadside		100.0	33.91
⊗118	265483	193385	Roadside		100.0	28.69
119	265522	193390	Roadside		100.0	32.05
120	265570	193366	Roadside		100.0	**44.76**
121	265706	193662	Roadside	Y	100.0	**47.29**
122	265694	193505	Roadside		100.0	30.16

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site Type	In AQMA?	Data Capture 2015 %	Annual Mean concentrations 2015 (ug/m3) Adjusted for tube bias and distance to receptor and annualised where appropriate **(Bias Adjustment factor 2015 = 0.88)**
123	265655	193423	Roadside		100.0	**39.54**
⊗124	265651	193253	Roadside		**66.7**	**37.73**
⊗125	265641	193162	Roadside		83.3	**37.10**
⊗126	265475	193144	Roadside		100.0	36.91
⊗127	265348	193110	Roadside		100.0	34.70
⊗128	265297	193085	Roadside		100.0	**37.00**
⊗129	265153	193098	Roadside		100.0	32.94
⊗130	265139	192912	Roadside		100.0	36.30
131	265137	192846	Roadside		100.0	**44.75**
132	265229	192753	Roadside		100.0	29.66
133	265350	192566	Roadside		100.0	23.61
⊗134	265113	192903	Roadside		100.0	**44.25**
^136	262612	192995	Roadside	Y	100.0	27.14
^137	262631	192996	Roadside	Y	100.0	29.19
140	266863	199009	Roadside		83.3	31.41
143	267089	198608	Roadside		75.0	29.65
144	267141	198591	Roadside		91.7	24.60
145	267139	198578	Roadside		100.0	29.69
146	267156	198571	Roadside		91.7	30.27
147	267165	198580	Roadside		100.0	27.35
148	267170	198564	Roadside		91.7	29.48
149	267204	198561	Roadside		100.0	24.98
150	267205	198545	Roadside		100.0	27.85
151	267192	198518	Roadside		100.0	26.69
160	269049	201744	Roadside		100.0	30.26
180	259064	197781	Roadside		91.7	29.10
182	259050	197790	Roadside		91.7	27.04
183	259036	197795	Roadside		100.0	28.49
197	258797	198701	Roadside		100.0	29.69
198	258811	198701	Roadside		100.0	32.13
206	261565	188211	Roadside		100.0	**38.05**
207	261561	188222	Roadside		100.0	32.16
208	261541	188215	Roadside		100.0	34.28
209	261534	188198	Roadside		75.0	35.21
210	261516	188207	Roadside		100.0	29.54
211	261501	188188	Roadside		91.7	30.98
212	261486	188200	Roadside		91.7	24.06
213	261490	188186	Roadside		100.0	30.81
214	261315	188193	Roadside		100.0	22.78
215	261299	188191	Roadside		100.0	22.50
216	261276	188190	Roadside		100.0	21.41
238	266902	197660	Roadside		100.0	26.66
239	266181	196022	Roadside		100.0	27.61
240	266169	195995	Roadside		100.0	29.30
241	266159	196013	Roadside		100.0	28.76
242	265655	193423	Roadside		83.3	35.68

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site Type	In AQMA?	Data Capture 2015 %	Annual Mean concentrations 2015 (ug/m3) Adjusted for tube bias and distance to receptor and annualised where appropriate **(Bias Adjustment factor 2015 = 0.88)**
243	265474	194949	Roadside		100.0	33.98
244	265466	194930	Roadside	Y	100.0	**42.71**
245	265448	194922	Roadside	Y	91.7	**39.32**
247	265394	194899	Roadside	Y	100.0	31.80
249	265326	194871	Roadside	Y	100.0	30.54
251	265263	194845	Roadside	Y	100.0	30.24
252	265226	194830	Roadside	Y	100.0	27.79
256	264995	194777	Roadside		100.0	**37.18**
271	266879	198078	Roadside		100.0	27.44
272	266888	198074	Roadside		91.7	28.29
275	265658	194856	Roadside	Y	100.0	22.20
276	265610	194871	Roadside	Y	100.0	31.91
277	265596	194875	Roadside	Y	100.0	34.17
278	265573	194882	Roadside	Y	100.0	33.12
279	265555	194926	Roadside	Y	100.0	**43.53**
280	265542	194980	Roadside	Y	100.0	**37.70**
281	265542	194872	Roadside	Y	100.0	34.50
282	265540	194840	Roadside	Y	100.0	31.00
284	265452	195899	Roadside		100.0	29.51
285	266955	197415	Roadside		100.0	30.90
286	266938	197377	Roadside		100.0	30.40
287	265715	193902	Roadside	Y	100.0	28.04
288	265698	193878	Roadside	Y	91.7	29.69
289	265702	193842	Roadside	Y	100.0	32.08
290	263014	195737	Roadside	Y	100.0	26.19
291	267952	193121	Roadside		100.0	**38.54**
295	258998	198698	Roadside		100.0	28.50
296	259054	198679	Roadside		83.3	31.10
323	266765	193224	Roadside		91.7	30.33
324	269815	197657	Roadside		100.0	25.75
325	266338	199647	Roadside		100.0	22.34
326	266299	199642	Roadside		100.0	23.30
327	266253	199637	Roadside		91.7	22.79
328	266183	199626	Roadside		100.0	24.76
329	266127	199620	Roadside		100.0	26.94
330	266363	199669	Roadside		83.3	30.57
331	265741	193545	Roadside		100.0	34.78
332	265679	193506	Roadside		83.3	**44.28**
333	265673	193477	Roadside		100.0	33.20
334	265688	193483	Roadside		100.0	29.74
335	265682	193461	Roadside		100.0	28.23
336	265664	193395	Roadside		91.7	33.97
337	265637	193335	Roadside		100.0	35.90
338	265651	193331	Roadside		100.0	32.80
339	265652	193313	Roadside		100.0	**40.39**
340	265632	193292	Roadside		100.0	**46.67**
341	265635	193224	Roadside		100.0	36.50
342	265655	193197	Roadside		83.3	30.00
343	265640	193173	Roadside		91.7	34.58
344	265658	193169	Roadside		75.0	26.40
345	265661	193140	Roadside		91.7	29.50
346	265681	193096	Roadside		100.0	34.08

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site Type	In AQMA?	Data Capture 2015 %	Annual Mean concentrations 2015 (ug/m3) Adjusted for tube bias and distance to receptor and annualised where appropriate **(Bias Adjustment factor 2015 = 0.88)**
347	265562	193518	Roadside		91.7	31.77
348	265572	193549	Roadside		91.7	35.90
349	265578	193576	Roadside		91.7	33.39
350	265577	193606	Roadside		91.7	**38.06**
351	265606	193466	Roadside		91.7	27.05
352	265602	193429	Roadside		91.7	30.95
353	265596	193389	Roadside		91.7	29.10
354	265595	193377	Roadside		91.7	29.80
355	265574	193269	Roadside		91.7	27.90
356	265471	193359	Roadside		91.7	27.50
357	265498	193162	Roadside		75.0	28.80
358	265414	193141	Roadside		**66.7**	32.50
359	265396	193111	Roadside		75.0	33.70
360	265267	192750	Roadside		75.0	30.30
361	265303	192719	Roadside		75.0	35.47
362	265271	192774	Roadside		75.0	36.53
363	265287	192797	Roadside		**58.3**	35.28
364	265301	192814	Roadside		**58.3**	34.75
365	265258	193075	Roadside		**58.3**	30.40
366	265237	193056	Roadside		75.0	31.04
367	265189	193044	Roadside		75.0	29.52
368	265143	193083	Roadside		75.0	25.80
369	260356	192927	Roadside		**58.3**	22.01
370	260394	192938	Roadside		**66.7**	20.01
371	260402	192910	Roadside		**66.7**	17.33
372	260291	192892	Roadside		**66.7**	27.73

Table 11- Nitrogen Dioxide Passive Diffusion Tube Results 2015

*** Site 56** is located on Ynysallan Road, Ynystawe to the frontage of a potential housing development site that would be 10-15m from the eastbound carriageways of the M4. Relevant exposure is given at present to the nearest existing dwelling within a separate development setback from the monitoring location.
**** Site 71** Copper Quarter 3 is on the frontage of an existing housing development site that will see dwellings fronting onto the access road to Morfa Retail Park and the Liberty Stadium. Relevant exposure is given at present to the nearest existing dwelling on the development site. The nearest potential dwelling within the development (setback from the monitoring location) will be within 10m of the monitoring location when construction is complete. These flats are due for completion during 2014/2015, thus site 71 has been corrected back by 10m (see table 12 below)
^Sites 135-137 are located at first floor level of properties in addition to exposure at 2.5 on the same dwelling to assess if concentrations change with height
⊗ City centre sites along busy roads – relevant exposure is given to either restaurants where there is a Café environment or to blocks of flats. Assessment where Café environment exists is for 1 hour NO_2 objective. Site 125 now corrected to relevant exposure to flats development above commercial premises.
*** **Site 295** High Street, Gorseinon is located on a lamppost outside a primary school playground. The intention here is worst case scenario to establish concentrations against the 1-hour objective fronting onto the school playground area
^ See table 12 below for Correction of NO_2 for distance from road

The distance to the nearest receptor location is given in brackets after the site name in table 6. The NO_2 annual mean at the nearest receptor location has been derived following use of the spreadsheet at http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html (Issue 4 dated 25/01/2011).

The spreadsheet calculator has been setup to work from 0.1 to 50m only. As can be seen from table 11, the authority is aware of, and planning for future proposed domestic housing developments, by making measurements at the current nearest possible monitoring position to those developments. Unfortunately, an indication can at present only be gained to a distance of 50m from the measurement point due to the setup of the provided spreadsheet tool. Table 6 and table 11 indicate two monitoring sites (site 56 and 71) that are utilised to provide an indicative annual mean to the **nearest existing/proposed dwelling** within the development sites. It could be argued that at present there is no relevant exposure at present in LAQM terms from these two monitoring locations but it is anticipated due to the developments underway that these receptor locations will be realised at some stage in the near future. Developments around site 71 continued apace during 2015 and receptor locations were present come the end of 2015 (some not yet occupied). Site 71 is therefore presented as corrected to the proposed nearest dwelling (10m) with site 56 being presented with a corrected annual mean as if it were 50m away.

The resulting calculated NO_2 annual mean at the receptor location due to fall off in concentration with distance from the road is given below within table 12. Background 1k by 1k NO_2 concentrations (for 2015 based on Background maps base year of 2011) were downloaded from http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011 and overlain on a GIS background map within Quantum GIS v2.4.0 (Chugiak). The background concentration required for the calculation was obtained from the nearest 1k grid square to the monitoring site. The final derived predicted annual mean concentration at the receptor location has been included within table 11 above.

Site ID	Distance of Measurement Site from Kerb	Distance of Receptor from Kerb	NO_2 Background Map Concentration (2015 dataset) ug/m^3	Measured 2015 Annual Mean ug/m^3 Corrected for bias	Predicted Annual Mean at Receptor ug/m^3
*56	2	*166	17.62	36.12	22.20
58	4	8	14.21	31.92	28.5
63	2	6	11.68	22.04	19.40
64	1	3	11.68	**43.05**	36.1
67	2	5	16.65	**42.82**	**37.2**
69	2	4	16.65	**39.31**	35.6
70	2	7	16.31	29.26	25.6
**71	2	**10	16.31	29.49	24.5
92	1	3	11.68	26.30	23.1
125	1	3	16.65	**42.89**	**37.1**
127	0.5	4	16.6	**45.27**	34.7
275	1	3	16.93	23.72	22.2
280	1	2	16.93	**41.11**	**37.7**
281	1	3	16.93	**39.52**	34.5
282	1	3	16.93	35.04	31.0
295	1	1.5	10.83	30.06	28.5
333	0.5	4	16.6	**42.91**	33.2
337	1	3.5	16.6	**42.39**	35.9
341	1.5	3	16.6	**40.08**	36.5
342	1	3.5	16.6	34.58	30
344	0.5	3	16.6	30.97	26.4
345	0.5	3	16.6	35.43	29.5
353	0.5	4.5	16.6	**37.02**	29.1
354	1	4	16.6	34.94	29.8
355	0.5	3.5	16.6	33.79	27.9
357	0.5	5	16.6	**37.2**	28.8
358	1	6.5	16.6	**42.12**	32.5
359	0.5	4	16.6	**43.57**	33.7
368	0.5	5	16.6	32.12	25.8

Table 12 – Correction of NO_2 for distance from road 2015

* Calculated as if 50m

** Calculated as10m as development due for completion during late 2016

Site ID	Data capture	Raw mean	Annualised mean	Bias Corrected
74	66.7%	23.43	25.44	22.39
124	66.7%	42.29	**42.88**	37.73
358	66.7%	40.35	**47.86**	**42.12**
363	58.3%	34.87	**40.09**	35.28
364	58.3%	39.49	**47.74**	**42.01**
365	58.3%	31.74	34.54	30.4
369	58.3%	20.43	25.01	22.01
370	66.7%	18.33	22.74	20.01
371	66.7%	15.86	19.69	17.33
372	66.7%	25.39	31.51	27.73

Table 12a – Annualised means 2015

Sites 118,120,124,125,126,127,128,129,130 and 134 were sited with the main intention of assessing concentrations against the NO_2 1-hour objective within the city centre. As discussed later, Swansea city centre had seen significant change in the road network to accommodate the Metro Service. This service has now terminated but the road infrastructure established for the service remains for present. Due to the aspirations to rejuvenate the city centre it is highly likely that the road infrastructure within the city centre will be significantly altered during the coming years. With the intention of the authority to increase the number of dwellings within the city centre to aid the regeneration of the shopping centre, additional monitoring locations continue to be established to provide the evidence required to feed into the planning process for this initiative. This additional monitoring is now reflective of the results obtained during 2015 which shows numerous failing and sites with the potential to exceed the NO_2 annual mean within the city centre area.

It is thought reasonable to access existing exposure to the 1 hour objective to the general population within the city centre area especially where this exposure can be related to existing external café area type environments. This process will provide valuable information for the limited number of dwellings that already exist within the city centre. These café environments are not set back at a distance from the kerb/road where the measurement has been made but are on the same road, at the same distance from the kerb as the measurement site, albeit at a distance either right or left from the monitoring point. Due to some siting issues, measurements were not always directly possible at the café environment.

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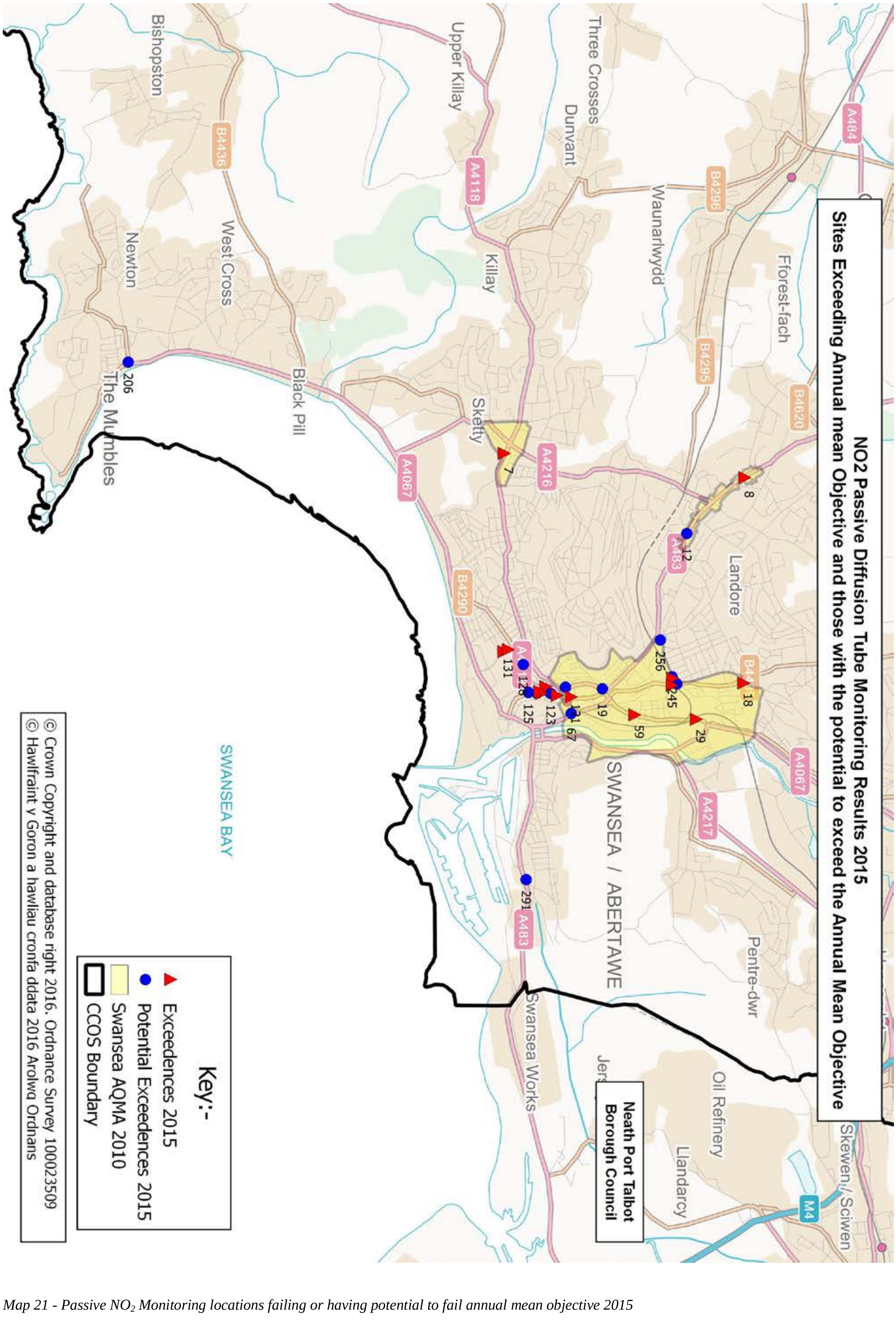
From the advice on using passive diffusion tube annual mean results[20] to assess compliance with the 1 hour objective for NO_2 it is clear from the results within table 11 above, that it is unlikely that the 1 hour objective has been exceeded at any site during 2015 as all bias corrected means are below 60ug/m^3. However, certain sites assessed as part of this process showed an exceedance of the annual mean objective. This information will be relevant to inform the preliminary discussions and task groups that are meeting to produce design briefs for interested developers.

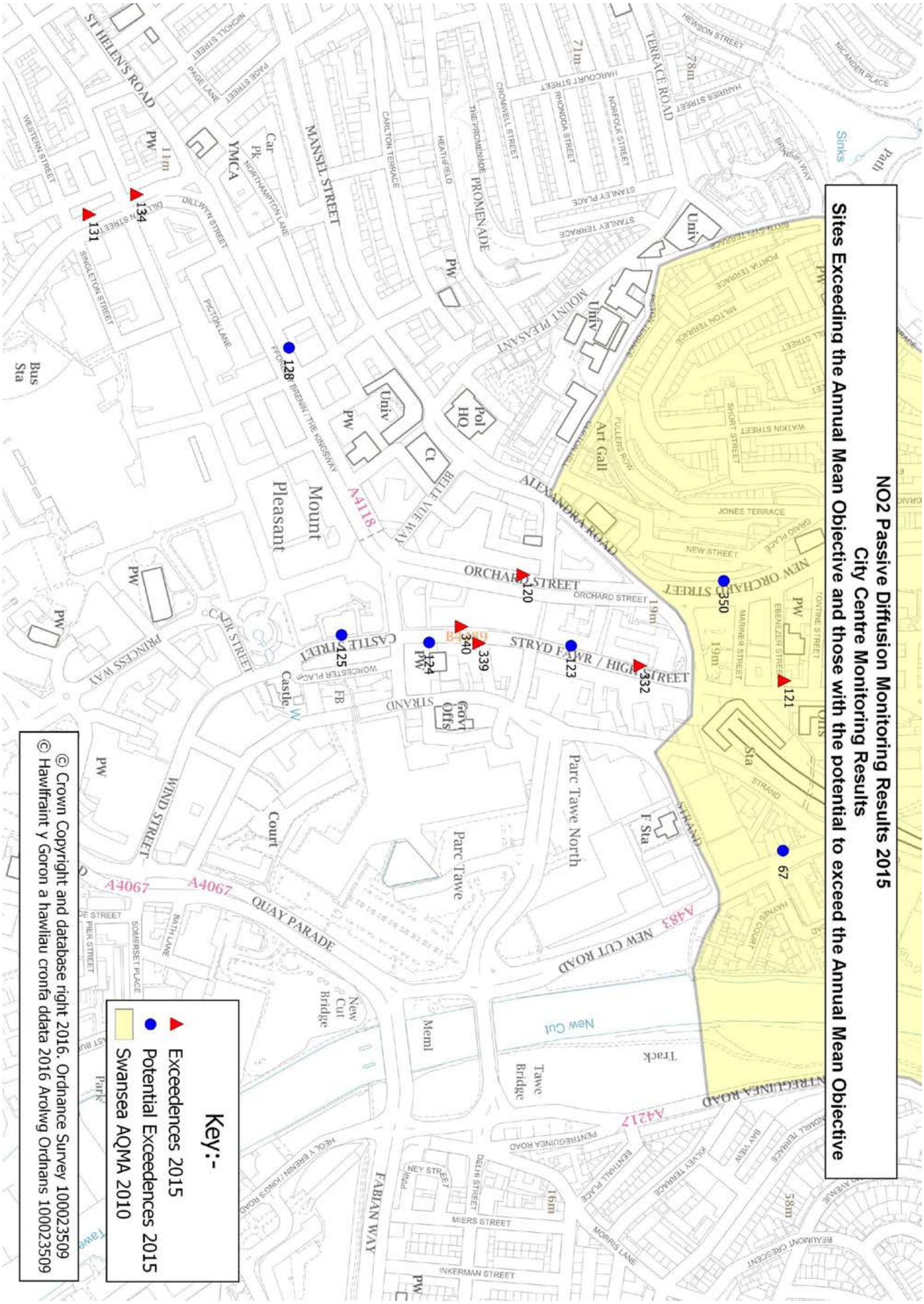
[20] http://laqm.defra.gov.uk/documents/NO2relationship_report.pdf

As discussed in previous reports, the situation within Newton Road, Mumbles continues to improve. There are now no sites exhibiting an exceedance of the annual mean. Only one site, site 206 indicates any potential exceedance of the annual mean objective during 2015. It is envisaged that the ongoing improvements will continue.

A map of those sites failing the annual mean objective and those with the potential to exceed the annual mean objective from the 2015 passive diffusion tube data is given below as map 21. The city centre is expanded within map 22 below.



Map 21 - Passive NO_2 Monitoring locations failing or having potential to fail annual mean objective 2015



Map 22 – City Centre - Passive NO_2 Monitoring locations failing or having potential to fail annual mean objective 2015

Sites that have returned the three highest bias corrected annual means are discussed below. For a greater understanding of conditions affecting the site/location a picture of the surrounding area is included.

Site 29 Morfa Terrace (B4603 Neath Road) (2015 annual bias corrected mean of 48.9ug/m^3) is located just off the Normandy roundabout, front façade of a terraced property. Photo 9 below is taken from the front façade looking north up the lower Swansea valley towards Normandy roundabout and the dual carriageway A4067

Photo 9 – Site 29 Morfa Terrace

past the Liberty stadium. The Hafod DOAS and passive diffusion tube site 59 are located approximately half a mile to the south of this location on the B4603. Considerable traffic uses the B4603 past this location into/out of the city centre in preference to the A4607 Cross Valley Link road (to the right of the Liberty Stadium) over Whiterock bridges and down to Quay Parade bridges to access the city centre locations. It is this route that the authority intends to promote further as part of the Nowcaster forecast model project in preference to the B4603 route. However, old habits die hard as despite continual delays along the B4603 through the Hafod area of the city, motorists persist with this route into/out of the city centre.

Site 59 (2015 annual bias corrected mean of 47.78ug/m^3) is located façade between the Hafod Post Office and a terraced property and as mentioned above (within sec 2.2) is directly opposite the Hafod DOAS transmitter station. The DOAS transmitter can be seen to the right of photo 10 below, fixed to the front façade of the property – site 59 is directly opposite in between the Post Office and a terraced property. The junction between Neath Road with Maliphant Street and Aberdyberthi Street are controlled via traffic control signals on each arm of the junction

These signals do hinder traffic flow down Neath Road for relatively few movements emanating from the side junctions. The annual mean returned from the real-time DOAS is 40.24µg/m^3, which, as mentioned above is surprising. In previous years these sites exhibited good correlation.

Photo 10 – Passive Diffusion Site 59

It is thought that the likelihood of a combination of conditions i.e. meteorological and/or traffic flow, leading to exceedances of the annual mean remain, and cannot be ignored, therefore monitoring will continue for the foreseeable future especially in light of the continued exceedance of the annual mean objective being seen. Traffic counters are located to the north (ATC site 18 within section 3) and to the south (ATC site 6 within section 3). The total HGV content of the flows at these sites remains fairly constant at approx. 8%.

Site 121 (2015 annual bias corrected mean of 47.29ug/m^3) is located within the existing Swansea AQMA 2010 on High Street and is shown below in photo 11. This site is situated façade at approximately 2.5m high on a block of flats opposite Swansea High Street Railway Station and outside bus stop bays. Numerous bus services operate outbound and inbound along this section of High Street. Data from the GPRS Automatic Traffic Counter (GPRS ATC site 22) located to the northern section of High Street (approx. 150 yards north of photo location) is valid for this monitoring location and indicates a bus composition of 6.4% of the flow during 2015. If the total LDV/HGV composition is taken into consideration, the figure rises to 12.1%. The traffic composition 2008-2015 is also shown below within table 13 for information. It may be coincidence that the bias corrected annual mean returned for 2014 showed an increase in concentrations over previous years that also coincided with an overall increase in both bus composition and total LDV content. However, results for 2015 have now seen a reversal of this trend.

Year	Bias Corrected Mean ug/m^3	Bus % Composition	Total % LDV
2008	79.3	8.7	16
2009	61.19	7.4	14.3
2010	52.33	6.5	13
2011	52.71	5.6	11.7
2012	50.97	5.3	10.8
2013	50.57	5.9	11.3
2014	52.71	6.4	11.7
2015	47.29	6.4	12.1

Table 13 - Site 121 Annual Bias mean corrected NO_2 Passive Diffusion Tubes 2008 - 2015

On the 7th July 2014, the authority commissioned a real-time Teledyne NO_x analyser located roadside. The site location of the Teledyne NO_x analyser is described above within section 2.1.13. The NO_2 annual mean corrected for distance to the front façade of Station Court indicate an annual mean of 50.9ug/m^3 indicating a good correlation with the passive diffusion tube measurements.

Photo 11 – Station Court, High Street Teledyne NO_x and NO_2 Passive Diffusion Tube Site 121

Annual mean trends at the monitoring locations are included below within table 14 and indicate the bias corrected annual means between 2009 and 2015.

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations ($\mu g / m^3$) Adjusted for bias						
				2009	2010	2011	2012	2013	2014	2015
4	262497	192857	Y	33.25	35.07	29.97	29.73	29.92	29.78	27.28
5	262548	192943	Y	34.22	**42.06**	33.42	34.06	34.78	32.46	29.70
6	262612	192995	Y	28.71	34.62	29.29	29.20	30.65	28.52	26.57
7	262691	192852	Y	**53.02**	**58.76**	**50.93**	**49.39**	**46.74**	**48.66**	**42.69**
8	262990	195820	Y	**44.59**	**46.81**	**41.81**	**41.80**	**44.77**	**41.76**	**40.36**
9	263190	195205		29.00	31.41	27.65	26.63	30.03	27.89	24.87
10	263219	195513	Y	26.03	29.98	25.28	23.40	25.29	24.97	23.94
11	263344	195474	Y	**37.08**	**43.92**	**37.21**	34.03	**39.45**	**37.58**	33.81
12	263680	195103	Y	**43.92**	**48.15**	**43.96**	**43.20**	**40.22**	**42.78**	**38.39**
13	264830	193066		29.90	32.83	28.03	28.99	29.30	27.78	25.66
14	265285	192696		25.23	32.66	26.99	25.57	28.69	24.30	23.86
15	265334	192608		25.73	32.76	27.33	26.69	26.91	24.45	24.30
16	265339	192534		30.73	**38.61**	30.85	30.41	31.63	28.61	26.80
18	265526	195807	Y	**47.87**	**51.23**	**49.10**	**44.74**	**47.01**	**45.85**	**42.07**
19	265597	194061	Y	**44.92**	**52.20**	**45.84**	**45.33**	**43.75**	**42.61**	**39.14**
20	265594	194175	Y	**42.42**	**45.51**	**37.41**	36.65	36.50	**37.74**	35.42
21	265634	195316	Y	32.04	33.65	30.62	30.57	30.04	27.96	26.93
22	265682	195374	Y	34.57	**37.93**	33.73	31.23	33.89	31.43	29.91
23	265728	195494	Y	33.57	36.53	33.97	33.18	30.93	28.49	28.69
25	265845	195547	Y	29.82	31.43	28.91	28.83	27.88	27.06	26.47
26	265876	194318	Y	**40.20**	**45.81**	**40.78**	**40.31**	**39.11**	**38.59**	35.44
27	265922	194428	Y	**43.14**	**45.39**	**39.95**	**37.05**	**38.03**	**39.25**	34.78
28	265949	194891	Y	30.18	33.48	30.29	30.11	28.30	28.21	25.67
29	265973	195222	Y	**52.00**	**53.38**	**53.48**	**47.60**	**43.86**	**47.36**	**48.90**
31	266153	196003		32.39	**37.79**	31.70	33.26	30.81	31.70	28.42
32	266209	193867		32.11	**38.82**	33.24	31.53	35.24	33.38	30.15
33	266236	193488		30.86	**38.09**	32.11	32.59	31.09	31.33	29.45
34	266272	196168		31.18	**39.60**	34.47	31.39	31.11	29.80	27.33
35	266314	193298		36.23	**40.67**	**40.39**	33.46	31.27	32.21	31.35
36	266455	193300		30.03	34.42	33.58	31.65	30.12	27.49	26.49
38	266662	193181		35.34	**39.05**	**37.23**	35.40	33.56	31.05	32.66
40	266951	198278		28.71	31.80	27.77	30.47	28.19	27.42	24.83
41	266953	198085		**41.59**	**41.38**	**40.54**	**38.32**	36.54	35.33	31.89
43	267093	198063		36.19	**42.60**	34.88	**38.01**	**38.62**	36.22	32.16
44	267639	199543		29.71	28.37	30.01	28.67	25.69	27.35	26.55
45	267661	199451		**37.79**	**43.87**	33.82	33.84	32.06	30.78	28.19
48	268011	193101		23.88	27.08	23.98	23.52	23.43	21.72	19.59
50	268530	197419		**37.99**	**41.14**	35.38	33.84	32.89	36.43	33.79
54	268693	197416		35.44	33.14	36.31	34.66	31.88	33.93	31.38
55	268789	197420		33.50	36.93	36.10	33.36	32.39	32.31	31.04
56 *	269306	198661		22.80	22.4	21.70	22.30	21.20	22.00	22.20
58	264052	192884		34.90	**41.7**	32.50	**37.90**	32.50	29.70	28.50
59	265918	194463	Y	**49.76**	**60.33**	**53.98**	**53.85**	**47.99**	**50.28**	**47.78**
60	265036	192931		35.30	**42.75**	**39.62**	35.74	35.71	34.21	29.70
61	264959	192878		**38.24**	**40.21**	**38.82**	**40.07**	36.45	**38.16**	33.93
63	262675	192775	Y	22.00	25.9	23.20	21.80	22.10	21.00	19.40
64	262719	192840	Y	**40.10**	**44.9**	**39.01**	**40.50**	**38.90**	**38.30**	36.10
65	262735	192855	Y	26.47	29.59	25.49	24.69	22.92	24.77	21.99
66	262802	192829	Y	30.98	36.04	30.52	31.62	29.11	26.45	26.53
67	265903	193683	Y	**39.80**	**46.3**	**39.40**	35.40	36.20	35.60	**37.20**
68	265573	193432		34.64	**41.51**	**39.26**	**39.68**	35.72	36.13	34.87

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations ($\mu g / m^3$) Adjusted for bias						
				2009	2010	2011	2012	2013	2014	2015
69	265543	193450		43.60	50.9	40.80	42.30	36.70	40.30	35.60
70	266649	195435		22.90	25.7	24.40	24.30	24.30	24.80	25.60
71 **	266514	195485		19.80	20.9	20.10	23.40	29.00	25.00	24.50
72	264091	192900		23.86	31.40	25.52	25.53	24.91	23.58	22.60
73	264138	192868		34.62	35.36	33.17	33.09	28.81	29.60	28.39
74	264163	192853		28.76	32.85	28.19	29.01	26.65	28.41	22.39
75	264072	192869		42.09	45.19	42.01	41.09	38.41	39.99	34.02
76	263968	192880		26.30	31.70	27.01	27.86	27.76	27.61	25.80
78	263819	192948		27.83	33.17	29.09	29.80	27.88	25.69	23.47
79	263842	192896		33.95	37.13	36.77	31.84	31.04	30.07	26.82
83	262785	192838	Y	28.60	35.51	30.58	30.36	30.33	27.41	25.97
84	262714	192839	Y	37.57	39.42	36.44	36.82	32.73	35.13	33.81
85	262702	192847	Y	39.58	41.89	38.05	39.19	36.24	35.62	35.28
86	262704	192865	Y	28.90	33.25	27.94	29.33	28.18	25.51	23.97
87	262697	192798	Y	21.16	23.93	22.23	22.26	22.11	20.80	18.93
88	262605	192916	Y	35.21	38.27	32.19	33.63	30.73	28.21	28.37
89	262587	192956	Y	24.17	25.99	23.12	22.37	21.26	20.12	20.09
90	262631	192996	Y	35.74	37.93	34.43	32.77	33.29	32.61	30.02
91	262534	192950	Y	30.62	37.50	32.73	30.20	30.68	29.28	27.46
92	262545	192869	Y	34.62	33.7	28.70	26.10	27.10	23.70	23.10
93	263406	195534		30.94	33.38	31.39	27.27	29.25	29.21	25.39
94	263444	195572		31.05	30.34	29.38	28.63	28.26	28.09	25.66
95	262815	196090		28.88	34.29	28.64	26.57	25.85	25.23	21.38
96	262922	195950		28.99	31.05	29.46	25.87	27.50	26.20	25.55
97	262946	195902	Y	33.84	39.95	35.00	34.78	32.92	31.62	31.44
98	263142	195548	Y	40.62	41.01	37.29	36.92	36.67	36.21	33.05
99	263387	195332	Y	29.16	37.64	30.58	30.27	31.83	32.73	28.84
100	263470	195250	Y	28.13	31.78	26.06	27.97	27.43	24.02	23.09
101	263843	195047	Y	28.27	30.97	27.26	27.17	25.34	23.31	23.75
102	266379	193307		29.99	33.13	29.54	29.66	28.70	27.96	27.87
104	268538	197389		28.41	31.70	28.55	28.24	27.86	27.70	27.13
107	268765	197420		34.27	36.16	33.53	33.99	31.01	32.23	29.49
108	267608	199461		30.10	35.76	30.58	29.46	29.75	28.72	27.33
109	267510	199487		27.06	32.44	25.12	25.85	27.14	26.43	25.01
110	267369	199521		26.18	30.46	26.34	28.57	26.66	25.75	24.67
111	267705	199426		30.63	34.62	28.70	30.38	29.40	27.15	30.15
114	264622	192971		33.19	33.92	29.99	29.07	29.70	30.07	27.48
115	265031	193097		40.48	45.67	41.44	41.89	37.57	40.40	35.25
116	265192	193138		42.87	48.73	41.92	41.49	38.43	38.73	35.63
117	265288	193211		38.32	47.27	39.71	39.32	36.61	35.30	33.91
⊗118	265483	193385		32.02	38.58	32.96	31.76	29.18	29.33	28.69
119	265522	193390		35.43	40.81	36.56	31.75	32.51	34.78	32.05
120	265570	193366		44.16	57.75	51.29	44.81	44.94	47.24	44.76
121	265706	193662	Y	61.19	52.33	52.71	50.97	50.57	52.71	47.29
122	265694	193505		37.21	47.39	37.12	34.42	32.49	34.83	30.16
123	265655	193423		51.27	51.80	50.96	48.75	46.55	47.00	39.54
⊗124	265651	193253		46.68	51.72	45.58	41.93	36.50	38.43	37.73
⊗125	265641	193162		59.48	50.5	42.10	41.80	36.20	37.90	37.10
⊗126	265475	193144		48.41	62.03	41.96	41.64	40.71	40.64	36.91
⊗127	265348	193110		37.71	61.83	56.19	48.72	45.01	44.26	34.70
⊗128	265297	193085		42.82	51.71	42.37	43.18	40.36	38.82	37.00

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations (µg / m³) Adjusted for bias						
				2009	2010	2011	2012	2013	2014	2015
⊗129	265153	193098		35.34	**40.51**	35.42	34.74	36.50	32.56	32.94
⊗130	265139	192912		**42.92**	**43.92**	**43.32**	**42.05**	**41.29**	**39.17**	36.30
131	265137	192846		**46.69**	**50.19**	**46.62**	**45.86**	**44.33**	**44.79**	**44.75**
132	265229	192753		32.39	**39.43**	36.82	34.97	33.81	27.11	29.66
133	265350	192566		27.05	33.15	30.34	21.46	26.57	25.28	23.61
⊗134	265113	192903		**45.02**	**47.74**	**49.41**	**45.67**	**44.54**	**42.65**	**44.25**
^136	262612	192995	Y	-	33.32	28.09	27.59	28.71	25.53	27.14
^137	262631	192996	Y	-	**37.13**	34.46	32.39	32.17	32.63	29.19
140	266863	199009		-	**39.36**	35.01	33.92	33.43	29.12	31.41
143	267089	198608		-	**37.32**	32.94	31.52	29.77	30.29	29.65
144	267141	198591		-	30.26	27.30	27.80	27.71	27.05	24.60
145	267139	198578		-	33.83	33.47	30.31	28.77	28.27	29.69
146	267156	198571		-	35.76	34.62	33.13	29.10	32.28	30.27
147	267165	198580		-	32.97	28.21	28.97	32.24	33.79	27.35
148	267170	198564		-	33.86	31.33	29.82	31.46	32.05	29.48
149	267204	198561		-	31.17	27.11	26.36	26.77	26.66	24.98
150	267205	198545		-	31.42	29.50	28.45	28.45	27.63	27.85
151	267192	198518		-	30.92	27.01	27.14	28.18	25.59	26.69
160	269049	201744		-	34.94	34.35	34.73	32.80	31.97	30.26
180	259064	197781		-	32.43	32.49	31.00	30.35	29.67	29.10
182	259050	197790		-	30.96	29.37	27.58	28.15	28.71	27.04
183	259036	197795		-	34.37	32.08	31.04	30.34	30.07	28.49
197	258797	198701		-	**38.71**	33.73	35.24	32.92	34.22	29.69
198	258811	198701		-	**38.49**	36.97	36.45	35.17	35.56	32.13
206	261565	188211		-	**51.37**	**47.05**	**45.60**	**41.55**	**42.50**	**38.05**
207	261561	188222		-	**45.70**	34.51	**41.17**	33.84	32.85	32.16
208	261541	188215		-	**46.18**	**37.59**	**37.48**	36.56	35.06	34.28
209	261534	188198		-	**46.87**	**44.72**	**39.40**	**41.00**	**40.72**	35.21
210	261516	188207		-	**43.61**	31.66	34.47	33.58	32.69	29.54
211	261501	188188		-	**39.49**	34.34	35.45	33.17	33.04	30.98
212	261486	188200		-	27.40	27.04	27.18	25.63	23.93	24.06
213	261490	188186		-	**40.24**	**37.79**	35.09	33.37	34.86	30.81
214	261315	188193		-	30.17	25.36	25.39	26.77	25.35	22.78
215	261299	188191		-	28.61	22.93	23.66	23.55	22.77	22.50
216	261276	188190		-	30.74	25.94	26.07	26.38	23.80	21.41
238	266902	197660		-	36.38	32.78	33.13	29.82	28.09	26.66
239	266181	196022		-	**37.70**	33.64	31.18	30.10	30.20	27.61
240	266169	195995		-	**40.14**	36.36	34.40	32.87	31.37	29.30
241	266159	196013		-	36.92	31.39	33.21	31.60	30.31	28.76
242	265655	193423		-	**45.21**	**46.01**	**44.28**	**41.47**	**40.94**	35.68
243	265474	194949		-	**41.64**	33.82	**37.40**	35.86	35.75	33.98
244	265466	194930	Y	-	**47.92**	**38.33**	**43.78**	**40.14**	**44.02**	**42.71**
245	265448	194922	Y	-	**49.14**	**41.03**	**41.93**	**39.87**	**42.03**	**39.32**
247	265394	194899	Y	-	**39.76**	35.47	29.76	32.88	35.00	31.80
249	265326	194871	Y	-	**40.58**	33.94	34.74	31.91	34.95	30.54
251	265263	194845	Y	-	**38.17**	30.76	31.94	33.95	31.52	30.24
252	265226	194830	Y	-	33.69	31.94	30.52	29.36	29.69	27.79
271	266879	198078		-	35.52	32.38	30.44	28.24	31.59	**37.18**
272	266888	198074		-	36.22	28.91	32.56	30.54	31.05	27.44
275	265658	194856	Y	-	-	26.00	25.20	24.50	22.60	22.20
276	265610	194871	Y	-	-	36.03	32.51	34.16	34.17	31.91

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations ($\mu g/m^3$) Adjusted for bias						
				2009	2010	2011	2012	2013	2014	2015
277	265596	194875	Y	-	-	**37.05**	**39.35**	34.23	36.72	34.17
278	265573	194882	Y	-	-	**39.11**	34.70	35.86	36.15	33.12
279	265555	194926	Y	-	-	**50.24**	**55.51**	**47.59**	**49.83**	**43.53**
280	265542	194980	Y	-	-	**37.90**	**40.80**	**39.60**	**41.10**	**37.70**
281	265542	194872	Y	-	-	36.00	36.70	36.50	33.40	34.50
282	265540	194840	Y	-	-	33.80	35.70	32.20	32.10	31.00
284	265452	195899		-	-	33.28	32.62	32.49	32.14	29.51
285	266955	197415		-	-	**37.51**	33.41	34.23	32.57	30.90
286	266938	197377		-	-	36.68	34.27	31.77	34.35	30.40
287	265715	193902	Y	-	-	30.76	29.72	31.87	29.53	28.04
288	265698	193878	Y	-	-	33.38	32.86	32.29	31.48	29.69
289	265702	193842	Y	-	-	**37.33**	35.86	34.15	32.95	32.08
290	263014	195737	Y	-	-	27.86	27.88	29.08	26.97	26.19
291	267952	193121		-	-	**41.79**	**45.22**	**43.73**	**39.73**	**38.54**
295	258998	198698		-	-	-	29.33	29.80	30.70	28.50
296	259054	198679		-	-	-	31.61	35.06	35.59	31.10
323	266765	193224		-	-	-	-	32.16	33.62	30.33
324	269815	197657		-	-	-	-	-	28.20	25.75
325	266338	199647		-	-	-	-	-	-	22.34
326	266299	199642		-	-	-	-	-	-	23.30
327	266253	199637		-	-	-	-	-	-	22.79
328	266183	199626		-	-	-	-	-	-	24.76
329	266127	199620		-	-	-	-	-	-	26.94
330	266363	199669		-	-	-	-	-	-	30.57
331	265741	193545		-	-	-	-	-	-	34.78
332	265679	193506		-	-	-	-	-	-	**44.28**
333	265673	193477		-	-	-	-	-	-	33.20
334	265688	193483		-	-	-	-	-	-	29.74
335	265682	193461		-	-	-	-	-	-	28.23
336	265664	193395		-	-	-	-	-	-	33.97
337	265637	193335		-	-	-	-	-	-	35.90
338	265651	193331		-	-	-	-	-	-	32.80
339	265652	193313		-	-	-	-	-	-	**40.39**
340	265632	193292		-	-	-	-	-	-	**46.67**
341	265635	193224		-	-	-	-	-	-	36.50
342	265655	193197		-	-	-	-	-	-	30.00
343	265640	193173		-	-	-	-	-	-	34.58
344	265658	193169		-	-	-	-	-	-	26.40
345	265661	193140		-	-	-	-	-	-	29.50
346	265681	193096		-	-	-	-	-	-	34.08
347	265562	193518		-	-	-	-	-	-	31.77
348	265572	193549		-	-	-	-	-	-	35.90
349	265578	193576		-	-	-	-	-	-	33.39
350	265577	193606		-	-	-	-	-	-	**38.06**
351	265606	193466		-	-	-	-	-	-	27.05
352	265602	193429		-	-	-	-	-	-	30.95
353	265596	193389		-	-	-	-	-	-	29.10
354	265595	193377		-	-	-	-	-	-	29.80
355	265574	193269		-	-	-	-	-	-	27.90
356	265471	193359		-	-	-	-	-	-	27.50
357	265498	193162		-	-	-	-	-	-	28.80

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations (μg / m³) Adjusted for bias						
				2009	2010	2011	2012	2013	2014	2015
358	265414	193141		-	-	-	-	-	-	32.50
359	265396	193111		-	-	-	-	-	-	33.70
360	265267	192750		-	-	-	-	-	-	30.30
361	265303	192719		-	-	-	-	-	-	35.47
362	265271	192774		-	-	-	-	-	-	36.53
363	265287	192797		-	-	-	-	-	-	35.28
364	265301	192814		-	-	-	-	-	-	34.75
365	265258	193075		-	-	-	-	-	-	30.40
366	265237	193056		-	-	-	-	-	-	31.04
367	265189	193044		-	-	-	-	-	-	29.52
368	265143	193083		-	-	-	-	-	-	25.80
369	260356	192927		-	-	-	-	-	-	22.01
370	260394	192938		-	-	-	-	-	-	20.01
371	260402	192910		-	-	-	-	-	-	17.33
372	260291	192892		-	-	-	-	-	-	27.73

Table 14 – NO_2 Annual Mean concentrations 2009- 2015

Continued widespread exceedances within the Hafod area continue to justify the AQMA in that area but recent improvements within the Fforestfach and Sketty areas may see the AQMA's within these areas subject to review at a future date. Only two sites within the Fforestfach AQMA are now exhibiting either exceedance or the potential to exceed the annual mean objective: Site 8 on Carmarthen Road Fforestfach returned a bias corrected annual mean of 40.36ug/m^3 with site 12 also on Carmarthen Road returning a bias corrected annual mean of 38.39ug/m^3 indicating a potential exceedance of the annual mean objective. Only one site within the Sketty AQMA is now exhibiting exceedance of the annual mean objective: Site 7 Gower Road (Sketty) returned a bias corrected annual mean of 42.69ug/m^3 with no other sites within the Sketty (or Uplands area) showing the potential to exceed the annual mean objective.

Improvements also continue to be seen within the Newton Road Mumbles area with all sites now showing compliance with the annual mean objective with the proviso that one site (site 206) exhibits the potential to exceed the annual mean objective.

It is thought worthwhile to provide a further update on site 291 (Vale of Neath Road) as within the Progress Report 2014 it was reported that the site had exceeded the annual mean objective during 2013 (43.73ug/m^3). Data from 2014 indicated marginal compliance with a bias corrected annual mean of 39.73ug/m^3 and data from 2015 also indicates marginal compliance with an annual bias corrected mean of 38.54ug/m^3. The site is located on the outbound A483 towards junction 42 of the M4, front facade of a terraced property that is within 4 meters of the A483 and close to a bus stop and is shown below to the right within photo 12.

Photo 12 – Site 291 Vale of Neath A483

It should be noted that few scheduled services stop and use the pull in lay- by style bus stop and that, at this location, the outbound flow of traffic is free flowing. There is a signal controlled junction with the Swansea Docks and the A483 entrance 200 meters westwards towards the city centre. This signal controlled junction results in queuing traffic on the opposite dual carriageway of the A483 past NO_2 tube site 48 at Bevans Row. It is curious that during 2013 free flow conditions outside site 291 resulted in an exceedance of the annual mean objective whilst queuing traffic past site 48 at Bevans Row resulted in compliance with the objective. Both sites are now indicating compliance with the annual mean objective during 2015. Some work has been undertaken on the phasing of the nearby signal controlled junction but it is too early to form any definitive conclusions if this measure has improved conditions.

In addition, the trends observed within Newton Road, Mumbles have continued during 2015 within the annual means returned for sites 206-213. During 2013-2014 sites 206 and 209 exhibited exceedances of the annual mean objective but at the same time there was clear evidence of a continued reduction in concentrations being recorded. During 2014, both sites 206 and 209 showed marginal exceedance of the annual mean objective. All other sites had shown compliance since 2011/2012. As noted within the USA 2015 it was envisaged that this reduction trend would continue and this has been shown to be the case with all sites (206-213) now showing compliance with the annual mean objective during 2015. A full discussion of the history of sites 206-213 can be found within the USA 2015 page 109-113 at http://www.swansea.gov.uk/media/13539/Updating-and-Screening-Assessment-2015/pdf/Swansea_USA_2015.pdf

2.2.4 Particulate Matter PM_{10}

Thermo PM_{10} FDMS system were installed at all 3 sites (Swansea AURN, Morfa and Morriston Groundhogs), during part of 2011 providing equivalency with the EU reference gravimetric method[21]. However, significant issues arose with the operation of the FDMS units at the Swansea AURN. Despite numerous, costly repairs, data quality and thus data capture were continually being questioned by Bureau Veritas. Following another unsuccessful repair of both the PM_{10} and $PM_{2.5}$ FDMS units at the Swansea AURN they were removed completely from site on the 16th November 2011 and replaced with Met One BAM 1020 PM_{10} and $PM_{2.5}$ units on the 28th November 2011. Data capture since the replacement has increased significantly with all particulate monitoring at the AURN site.

However due to budgetary concerns the FDMS unit remained operational at the Morriston Groundhog site despite ongoing data quality concerns and data capture concerns. However, the situation became untenable during 2014/2015 with the vast majority of data being rejected due to these data quality concerns. The decision was therefore made to remove the FDMS system at the Morriston Groundhog during late December 2015 and to replace it with a MetOne Bam1020 PM2.5 (SmartBAM).This has resulted in virtually no valid PM_{10} data for the whole of 2015 from the Morriston Groundhog. Therefore no PM10 data for the Morriston Groundhog is reported here.

The Met One Bam 1020 PM_{10} has taken part in UK equivalency trials and has been deemed to be compliant with the EU reference gravimetric method subject to the application of a 1.211 offset. Each hour, a small 14C (carbon-14) element emits a constant source of high-energy electrons (known as beta rays) through a spot of clean filter tape. These beta rays are detected and counted by a sensitive scintillation detector to determine a zero reading. The BAM-1020 automatically advances this spot of tape to the sample nozzle, where a vacuum pump then pulls a measured and controlled amount of dust-laden air (16.7l/min) through the filter tape, loading it with ambient dust. At the end of the hour this dirty spot is placed back between the beta source and the detector thereby causing an attenuation of the beta ray signal which

[21] DEFRA and devolved administrations report UK Equivalence Program for Monitoring of Particulate Matter section 5.5.2 dated 5th June 2006 at http://www.airquality.co.uk/archive/reports/cat05/0606130952_UKPMEquivalence.pdf

is used to determine the mass of the particulate matter on the filter tape and the volumetric concentration of particulate matter in ambient air.

Data collected from the BAM 1020 PM_{10} unit has an integration period of 1-hour. Hourly ratified Particulate Matter PM_{10} data for 2015 has been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector for the Swansea AURN.

These hourly data have then been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation. The calculated hourly mean mass concentration data have then been further processed by the software package Opsis Enviman Reporter. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the calculated hourly means were specified to be present.[22]

The datasets collected from the FDMS / Met One BAM PM_{10} systems are not directly comparable to the historical R&P PM_{10}TEOM datasets even given that the use of the advised interim default correction factor (1.3) was advised to estimate the EU reference gravimetric method. This correction factor has been called into dispute by various studies at diverse locations throughout the UK each deriving differing correction factors. These TEOM PM_{10} data pre 2006 have last been reported within the authorities Progress Report during May 2008. The date that the PM_{10} FDMS systems were installed / removed from the Swansea AURN site are given below within table 15 for information. Similarly, the date of provision of the BAM1020 units at the Swansea AURN and Morriston Groundhog sites are provided for information and clarity on the instrument composition of this dataset

For several years, the authority has indicated that it would undertake a basic PM_{10} screening exercise at some of the busier traffic junctions. However, this had previously proved impossible to undertake due to the unreliability of the instruments originally deployed on site. As mentioned in chapters 2.1.8 to 2.1.12 above, MetOne EBams have now been deployed at five sites during late 2012. Data for 2013-2015 are now reported here. It is important to again highlight, that the MetOne EBam has not demonstrated equivalency with the EU reference gravimetric method. However,

[22] *LAQM.TG(16) Paragraph 7.160 page 7-47*

as the intention is only to provide an ongoing screening assessment, their use is judged to be appropriate.

Site ID (see table 2 above)	Location	Within AQMA	Data Capture 2011	Data Capture 2012	Data Capture 2013 %	Data Capture 2014 %	Data Capture 2015 %	Annual mean concentrations ($\mu g/m^3$)				
								2011	2012	2013	2014	2015
1 *	Swansea AURN	Y	62.19	97.54	96.71	93.70	96.44	14.70	17.79	19.03	20.29	20.20
3 **	Morriston Groundhog	N	81.64	90.38	96.99	85.48	0	17.96	13.86	15.30	13.18	-
7 ✷	Fforestfach Cross	Y	-	-	96.71	80.00	96.44	-	-	18.03	19.02	16.25
8 ✷	Uplands Crescent	N	-	-	83.84	77.81	93.70	-	-	18.26	17.18	14.76
9 ✷	Sketty Cross	Y	-	-	55.89	98.63	96.44	-	-	19.74	18.28	18.72
10 ✷	Westway Quadrant Bus Station	N	-	-	94.79	98.36	95.07	-	-	18.91	17.27	16.62
11 ✷	SA1 Junction Port Tennant	N	-	-	95.89	99.18	95.62	-	-	17.65	14.49	11.98

Table 15 Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective
** FDMS unit installed 26th September 2006. FDMS units removed 16th November 2011. Met One BAM 1020 unit installed 28th November 2011*
*** FDMS unit installed 27th October 2006. FDMS Unit removed December 2015 and replaced with MetOneBAM 1020 PM2.5*
✷MetOne EBam

Site ID	Location	Within AQMA	Data Capture 2011 %	Data Capture 2012 %	Data Capture 2013 %	Data Capture 2014 %	Data Capture 2015 %	Number of Exceedences of 24-hour mean (50 $\mu g/m^3$)				
								2011	*2012*	*2013*	*2014*	*2015*
1	Swansea AURN	Y	62.1	97.5	96.7	93.7	96.44	5 **(29.8)**	4	2	2	2
3	Morriston Groundhog	N	81.6	90.3	96.9	85.48	0	**8 (30.3)**	0	0	1 **(19.7)**	-
7	Fforestfach Cross	Y	-	-	96.7	80.00	96.44	-	-	2	5 **(27.9)**	1
8	Uplands Crescent	N	-	-	83.8	77.81	93.70	-	-	2 ***(28.5)***	1 ***(25.2)***	1
9	Sketty Cross	Y	-	-	55.8	98.63	96.44	-	-	4 **(34.0)**	3	1
10	Westway Quadrant Bus Station	N	-	-	94.7	98.36	95.07	-	-	*4*	*4*	2
11	SA1 Junction Port Tennant	N	-	-	95.8	99.18	95.62	-	-	*4*	*2*	*0*

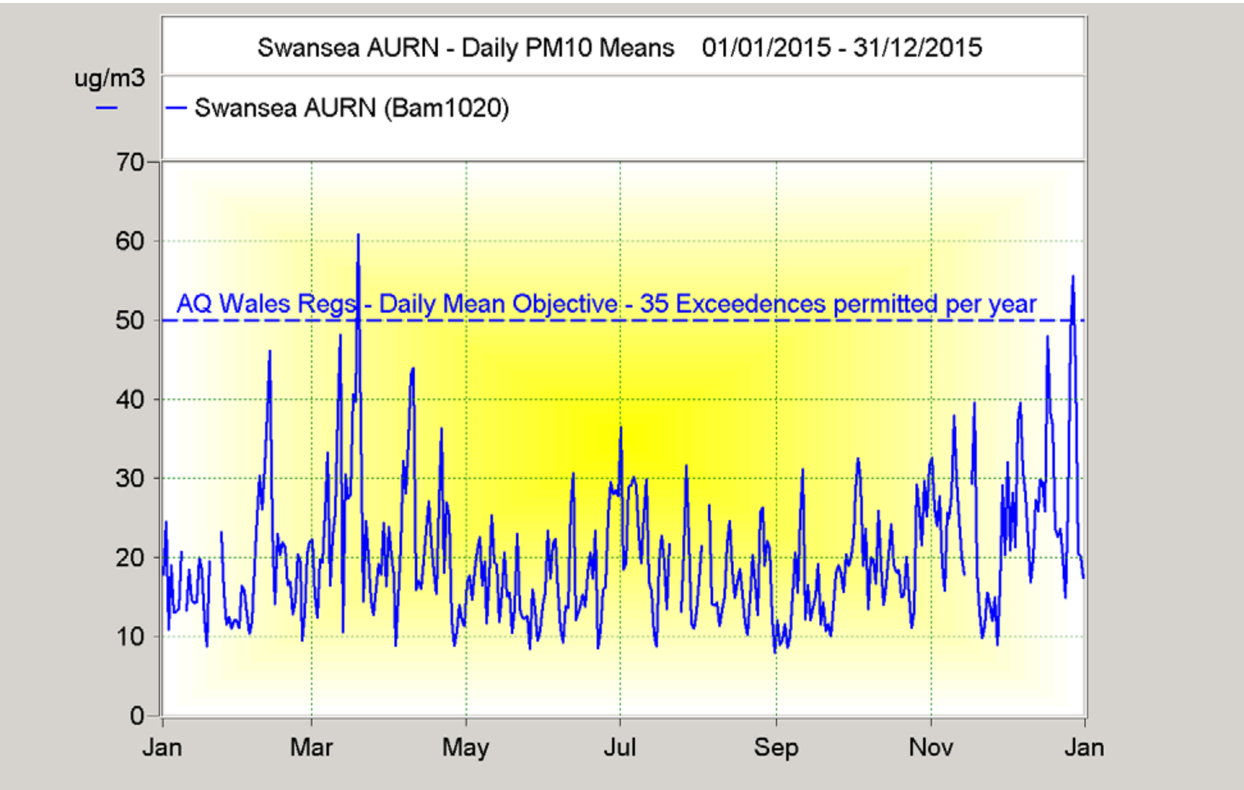
Table 16 Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

The 90th percentile's of the daily means of measurements made during 2011-2015 are presented in bold within brackets in table 16 where appropriate, as the data capture rates fall below the required 90%[23] at the Morriston Groundhog (FDMS) site and for completeness, the same approach has been taken with the low data capture

[23] LAQM TG(09) Annexe A1 – A1.157 page A1-34

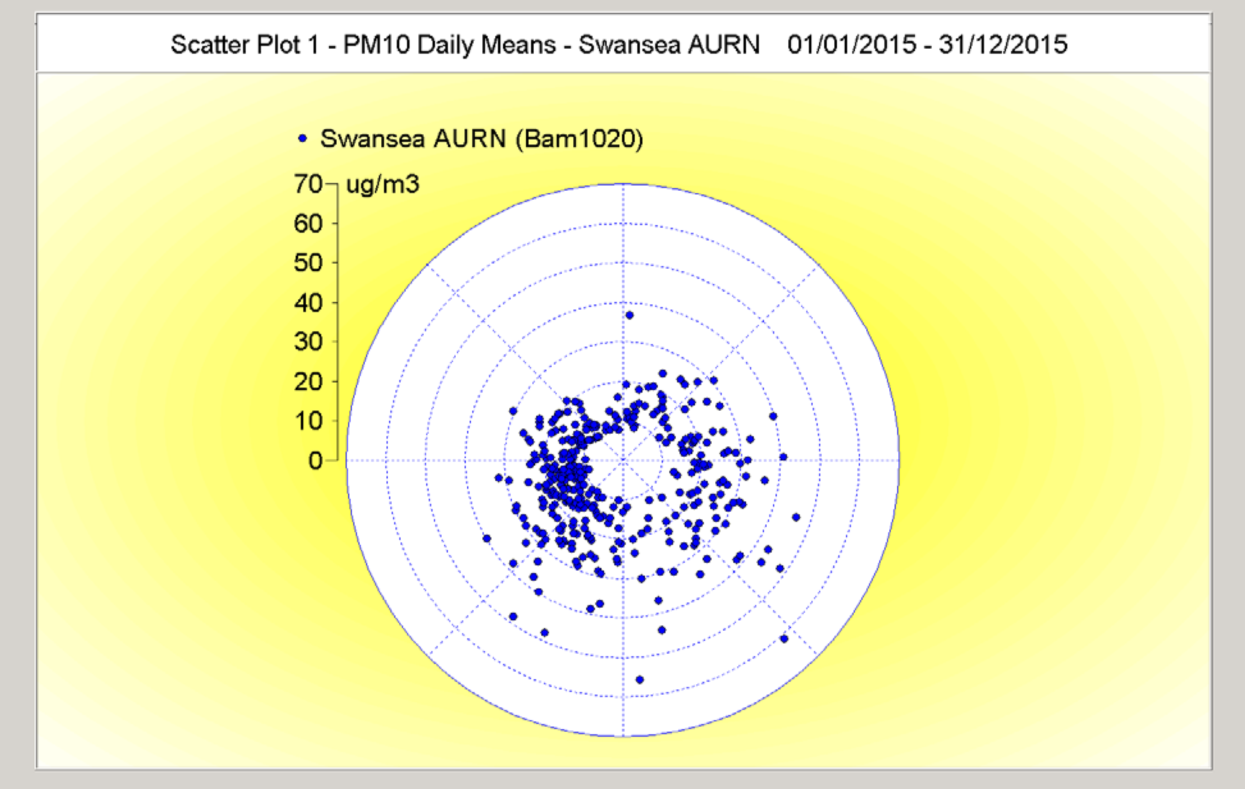
rates at the Fforestfach Cross and Uplands EBam sites. Data capture from the Uplands Crescent site was compromised due to yet another external sensor problem and pump flow issues with the main circuit/logic board failing at the Fforestfach Cross EBam site during 2014. **However, LAQM.TG(16) amends this required data capture rate to 85% with the requirement that the 90.4th percentile be presented should data capture for the year fall below the required 85%[24]. This new approach has now been adopted from 2015 but as the data capture rates are all above 85%, the 90.4% percentile has not been presented / calculated for 2015.**

Graphs 7 -13 below indicate the monitoring undertaken during 2015 with scatter plot 1 summarising the period of measurement for the Swansea AURN and Morriston Groundhog sites



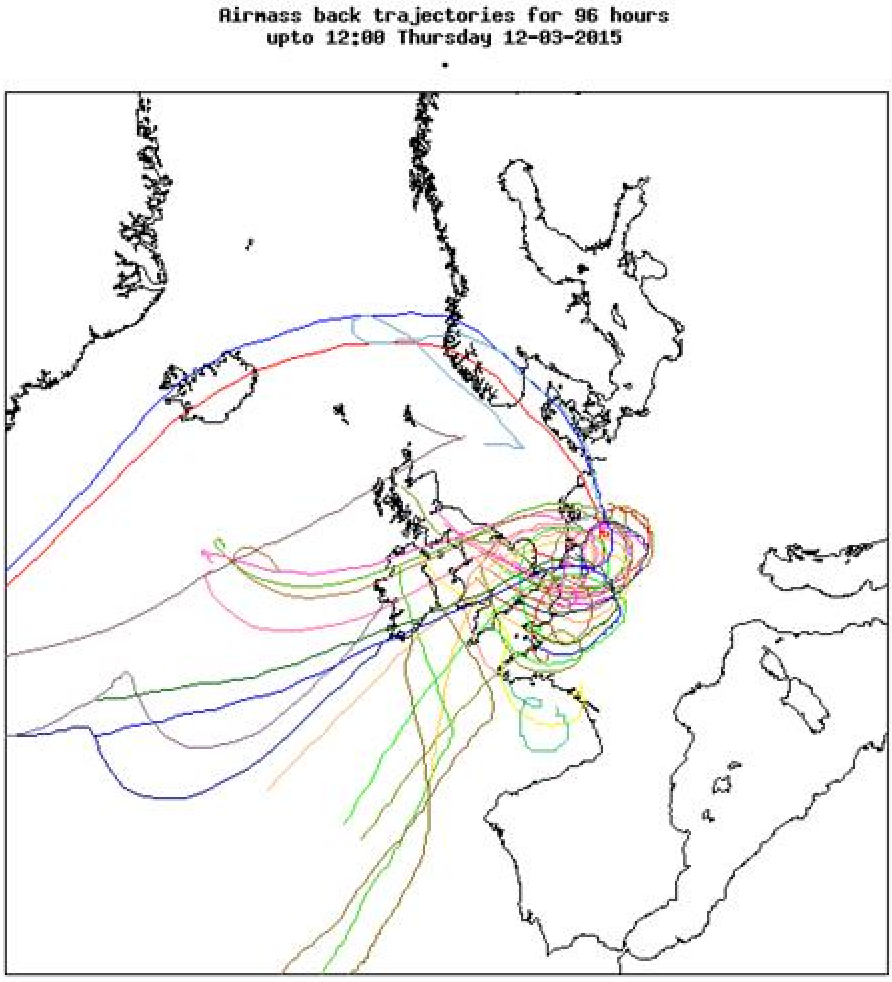
Graph 7 – Swansea AURN 24-hour PM_{10} concentrations 2015

[24] LAQM.TG(16) General Considerations paragraph 7.163 page 7-48

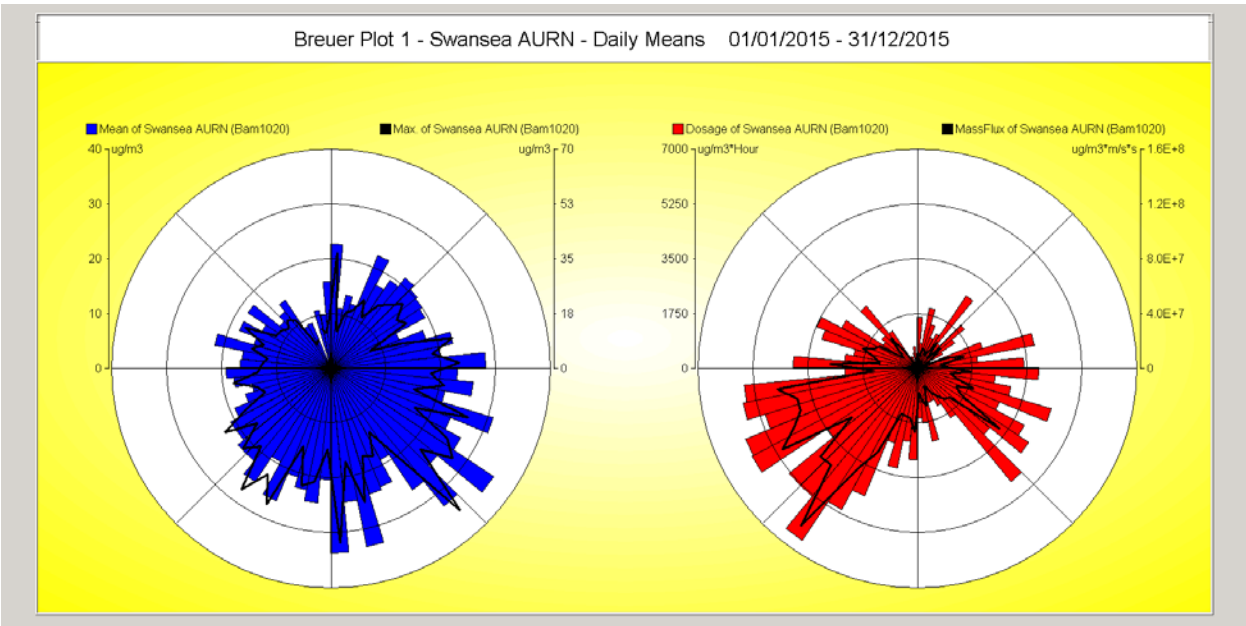


Scatter Plot 1 - PM_{10} Daily Means 2015

It is noted that maximum daily concentrations from the Swansea AURN and all EBam sites all occurred on the same day the 19th March 2015. Maximum daily concentrations ranged from 60.86ug/m^3 at the Swansea AURN to 70.48ug/m^3 at the Fforestfach EBam site. For several days either site of date, back trajectory plots indicated that the air mass was of European origin and was affecting the whole of southern UK. The extent of the episode did not appear to extend into North Wales with back trajectory plot 1 below provided by Ricardo AEA confirming the air mass source. The episode faded away during the 20th and 21st March 2015.



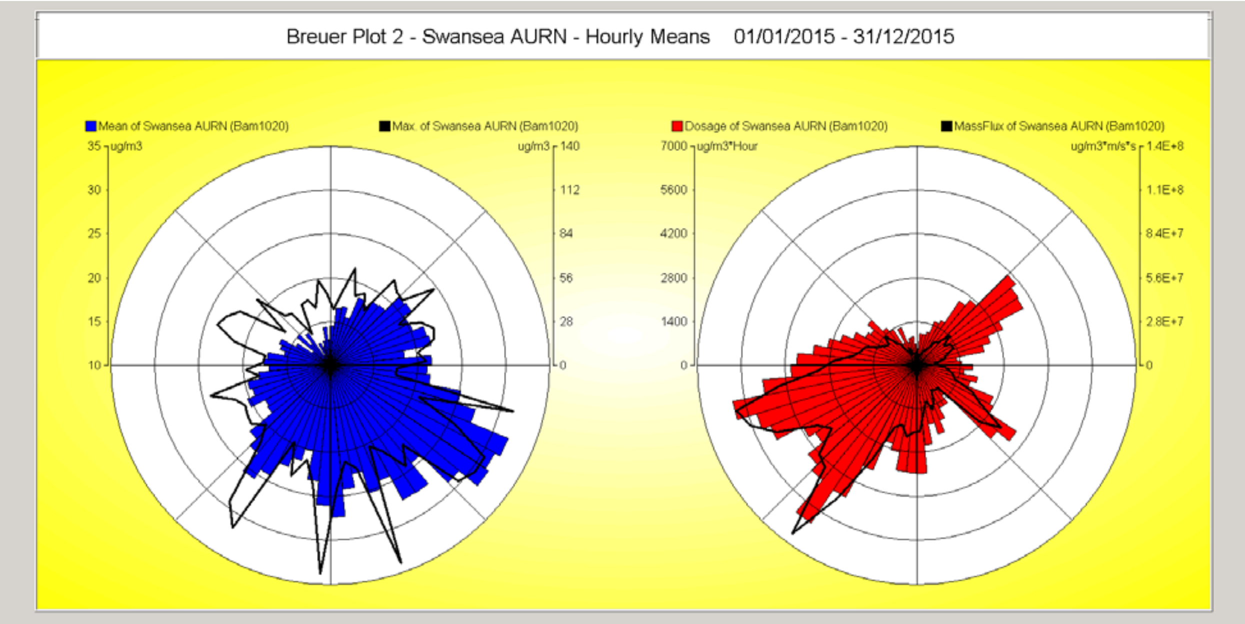
Back trajectory plot 1 – up to 12th march 2015



Breuer Plot 1 – Swansea AURN – PM_{10} Daily Means 2015

Dosage is taken to be the accumulated time multiplied with the average value of PM_{10}. This is useful for calculations of likely exposure at these locations. Mass Flux is also indicated and is taken to be: Flux - the wind speed multiplied with the operand distributed over the wind direction. All data that has valid integrated data for all three positions are included in this calculation. (Note: The average distributed wind speed and the average distributed parameter [PM_{10}] are not used to calculate the result). The result is presented in the multiplied units of the wind speed and the parameter (PM_{10}). Mass flux is the same as flux, but the result is multiplied with the accumulated integration time. This gives the mass transport in different directions.

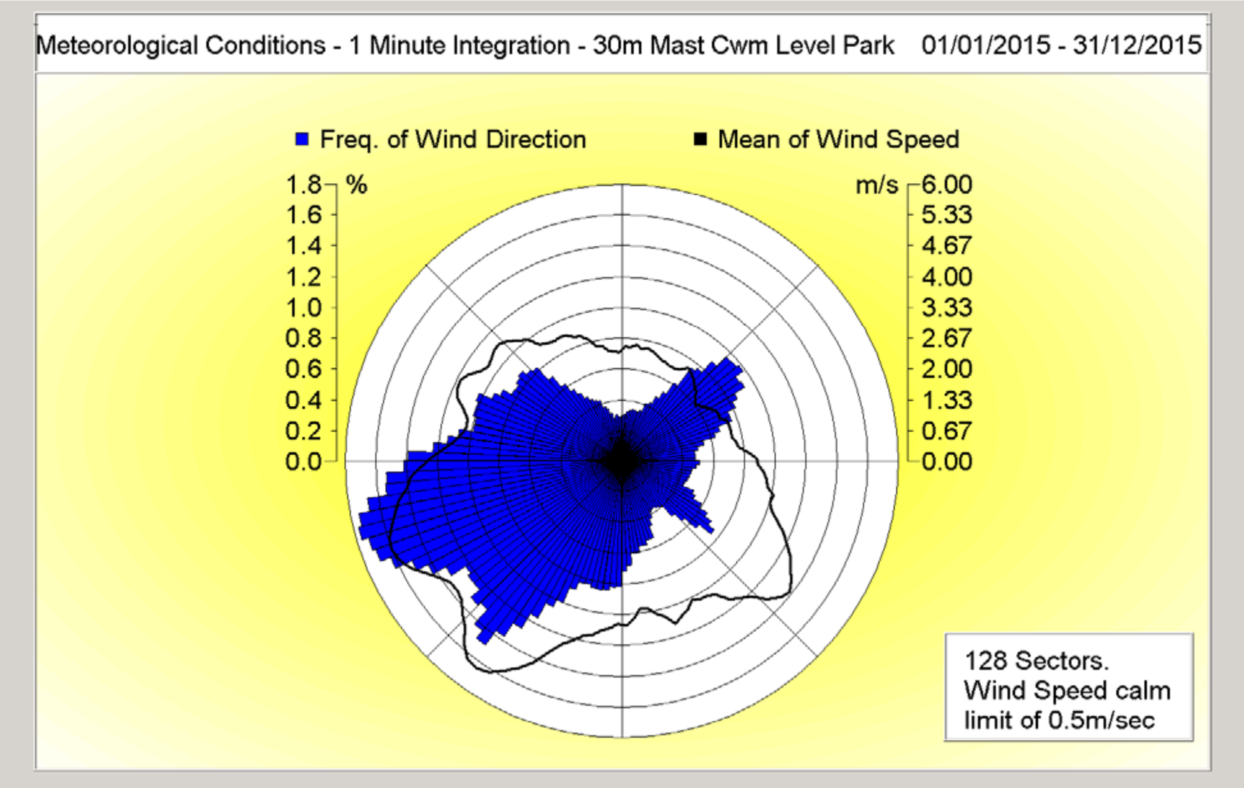
Breuer Plot 2 below presents the hourly mean concentrations at the Swansea AURN



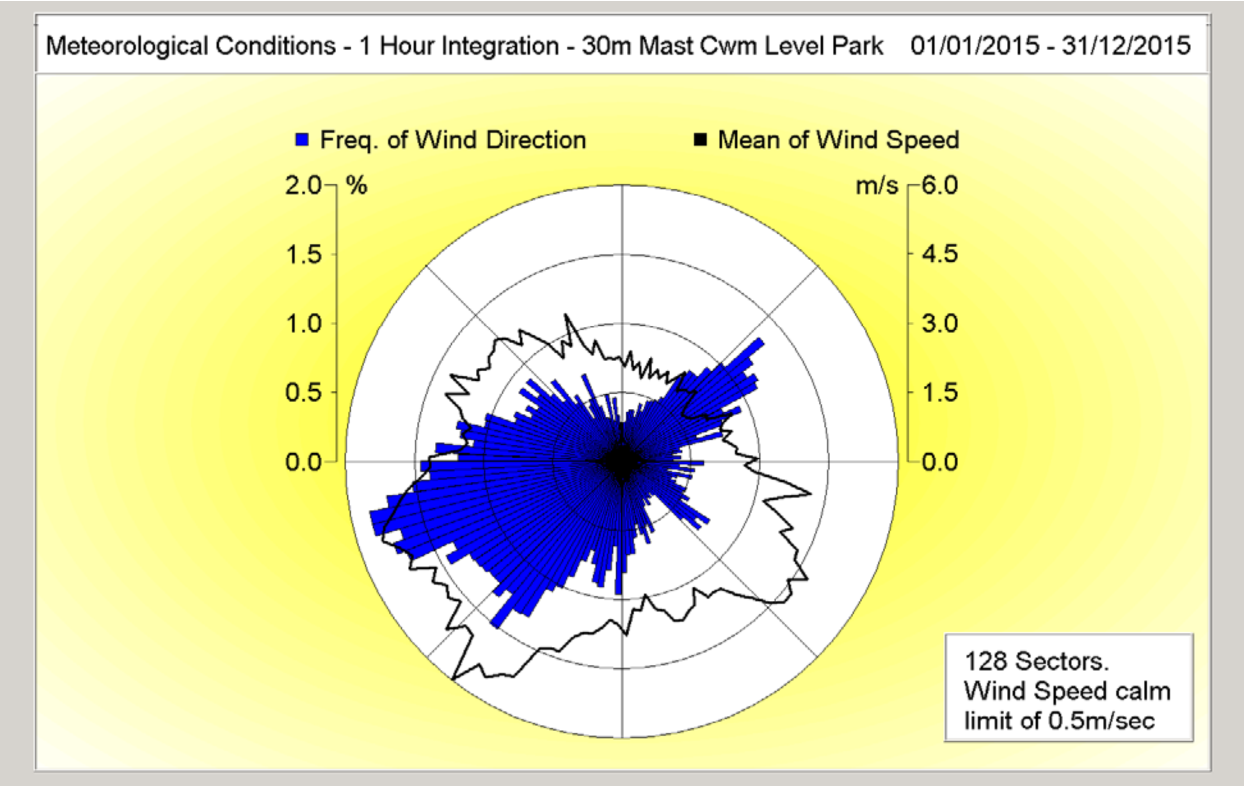
Breuer Plot 2 - Swansea AURN – PM_{10} Hourly Means 2015

As has been reported in previous years, Breuer Plot 2 once again clearly indicates that mean hourly concentrations are dominated by sources to the south-east. However, maximum hourly concentrations are far more diverse. It is thought that these maximum hourly concentrations along with dosage and mass flux probably reflect more local sources/influences during 2015 as has been seen during previous years.

Breuer Plots 3 and 4 below indicate meteorological conditions observed at the 30m Meteorological Mast at Cwm Level Park during 2015. Data is presented at 1 minute integration within Breuer Plot 3 and at 1 hour integration within Breuer Plot 4. This site is within the lower Swansea Valley and is highly representative of conditions throughout Swansea.



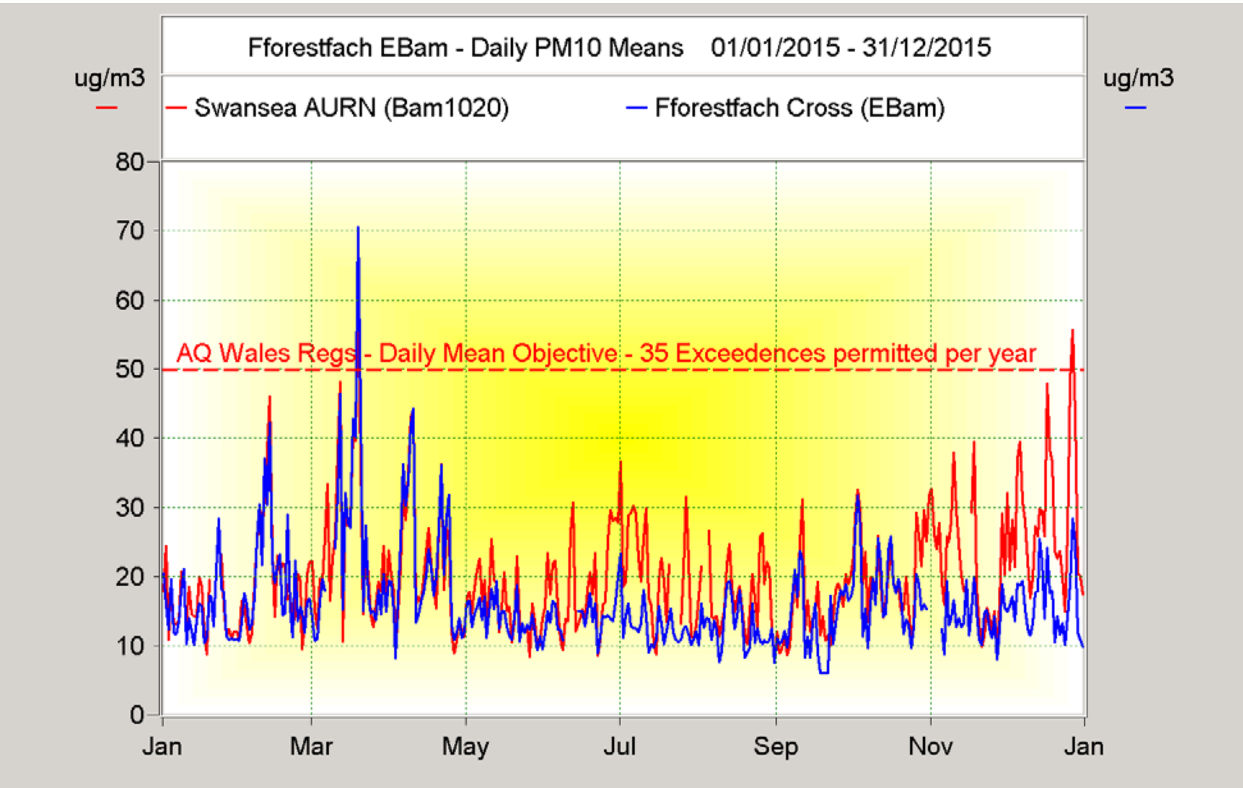
Breuer Plot 3 - Meteorological Conditions 2015 – 1 Minute Integration Cwm Level Park



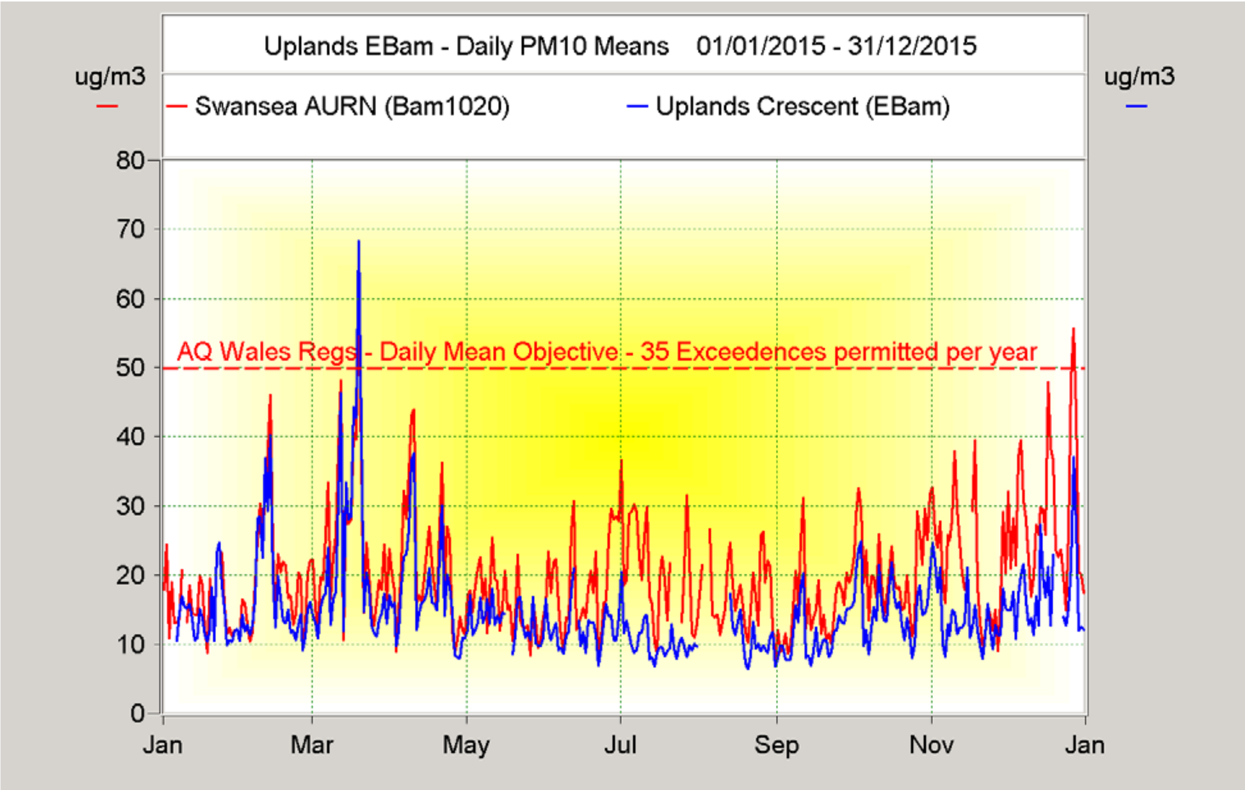
Breuer Plot 4 - Meteorological Conditions 2015 – 1 Minute Integration Cwm Level Park

From Breuer Plots 3 and 4 above, it can be seen that 2015 can be considered meteorology as a typical or "normal" year with the wind direction being from a predominantly south-westerly / westerly direction. However, there is, once again, during winter months, significant periods of north-easterly winds. These periods of north-easterly winds have become prevalent during recent years are fairly indicative of the harsher winter conditions seen within the UK over the last couple of years.

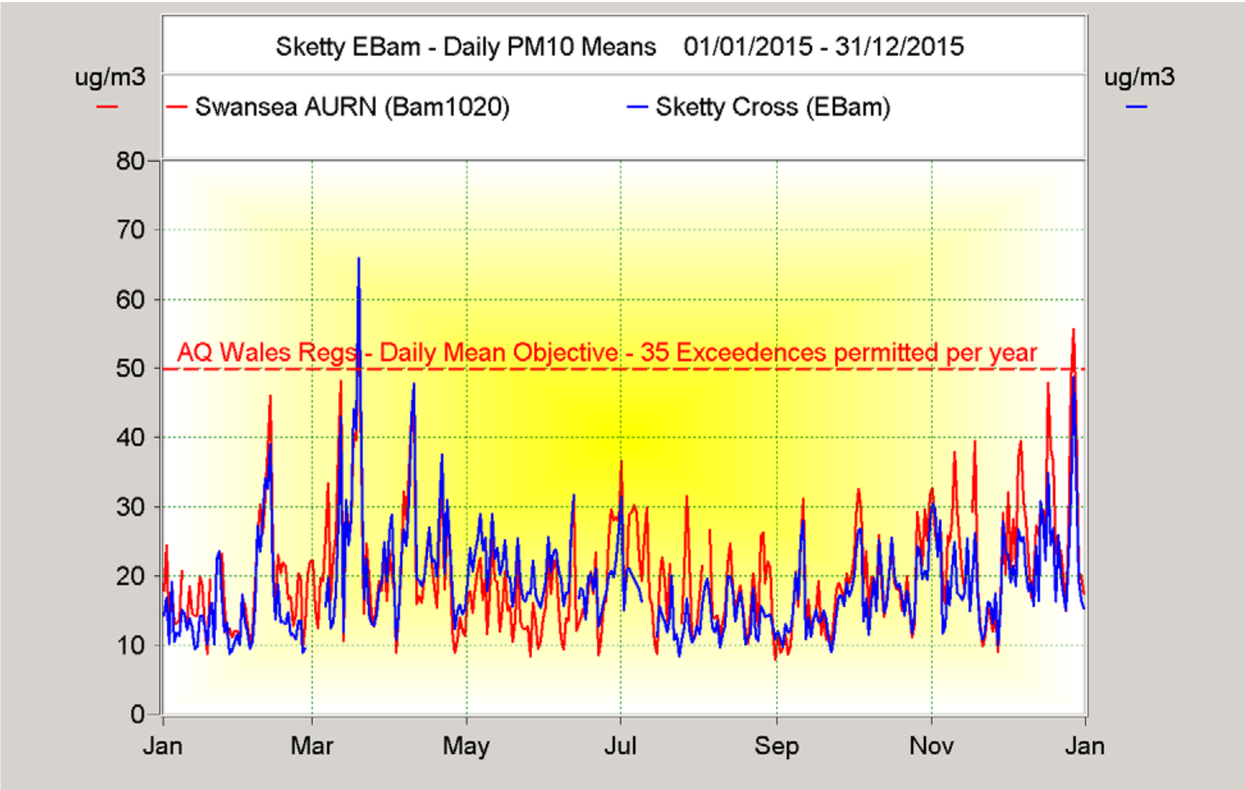
Graphs 8 – 12 below represent the indicative monitoring undertaken at the five EBam locations. For comparativeness sake, the Swansea AURN Bam1020 EU reference equivalent monitoring is plotted against each site.



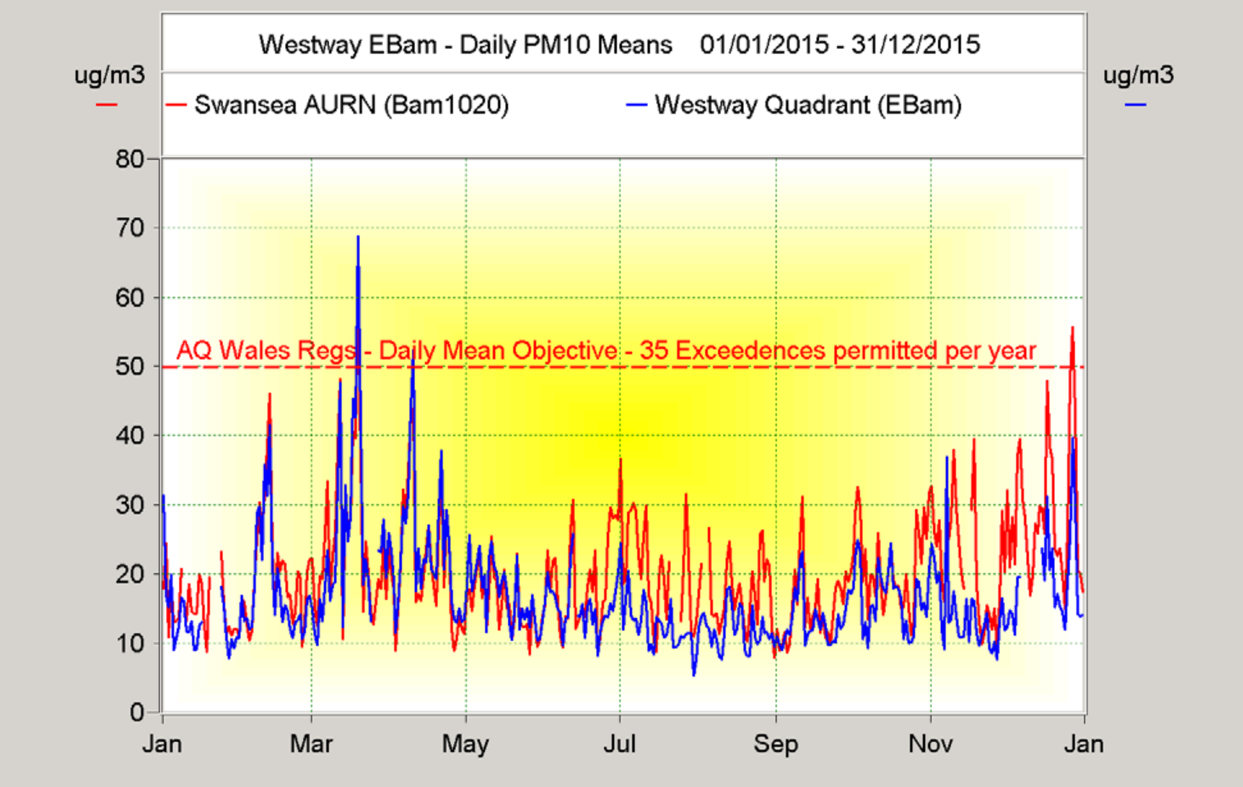
Graph 8 – Fforestfach Cross EBam 24-hour PM_{10} concentrations 2015



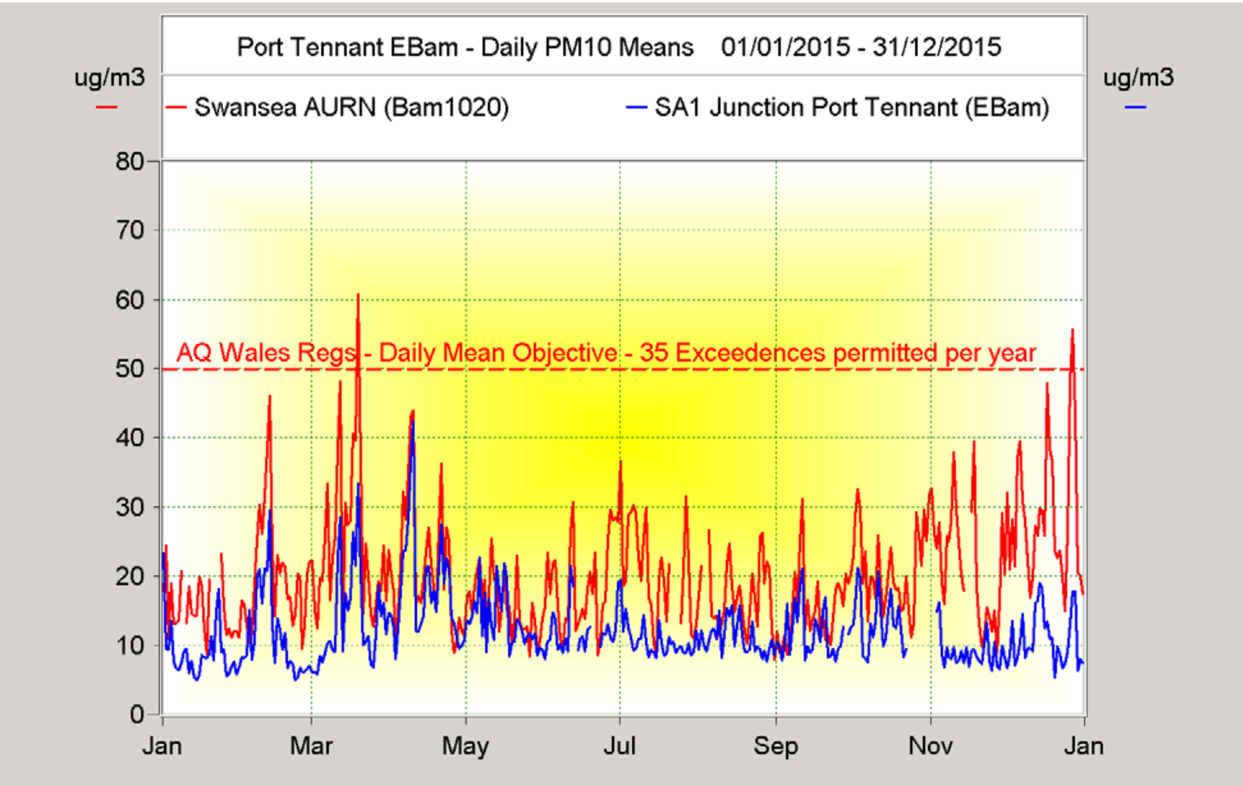
Graph 9 – Uplands EBam 24-hour PM_{10} concentrations 2015



Graph 10 – Sketty Cross EBam 24-hour PM_{10} concentrations 2015

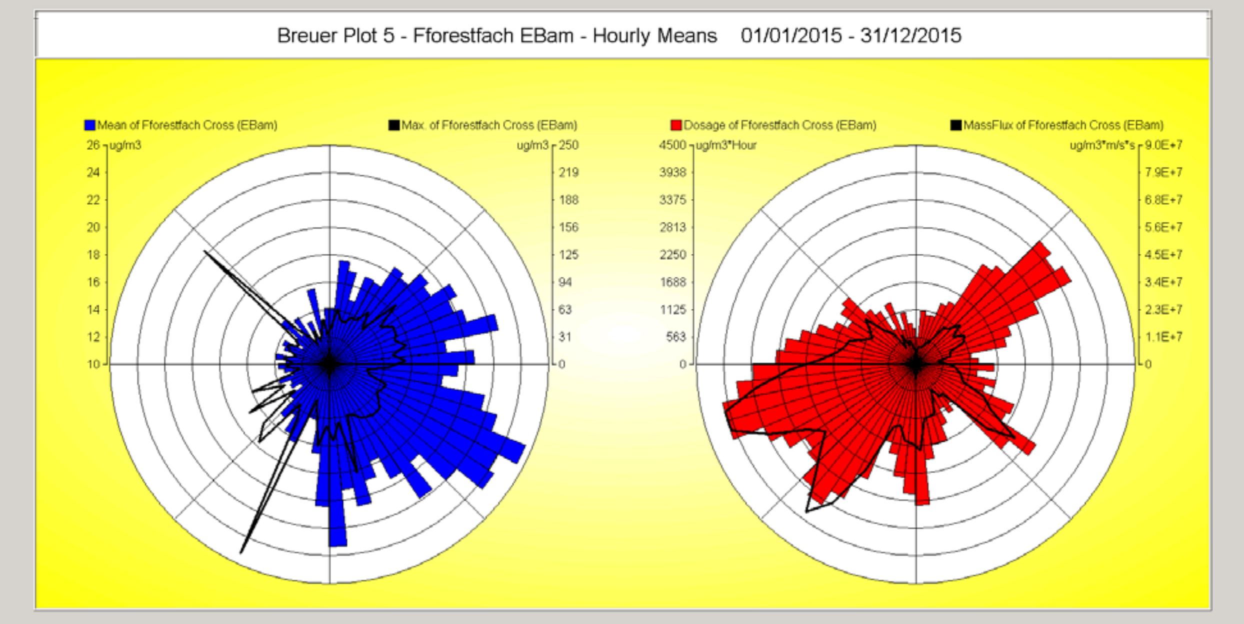


Graph 11 – Westway EBam 24-hour PM_{10} concentrations 2015

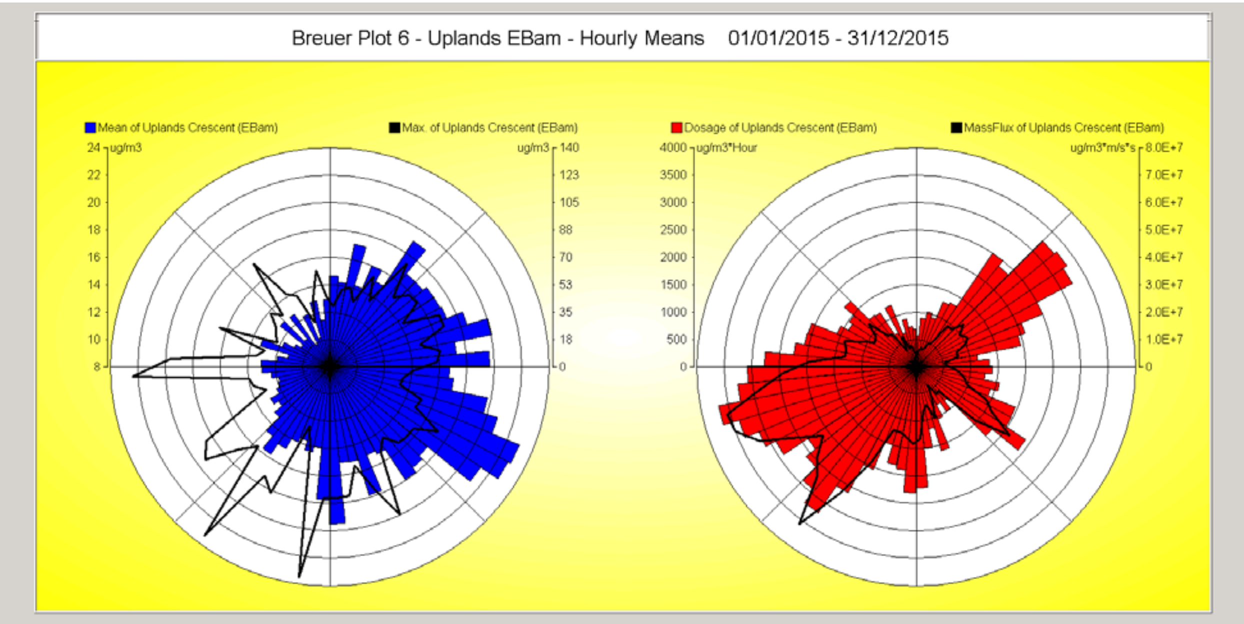


Graph 12 – Port Tennant EBam 24-hour PM_{10} concentrations 2015

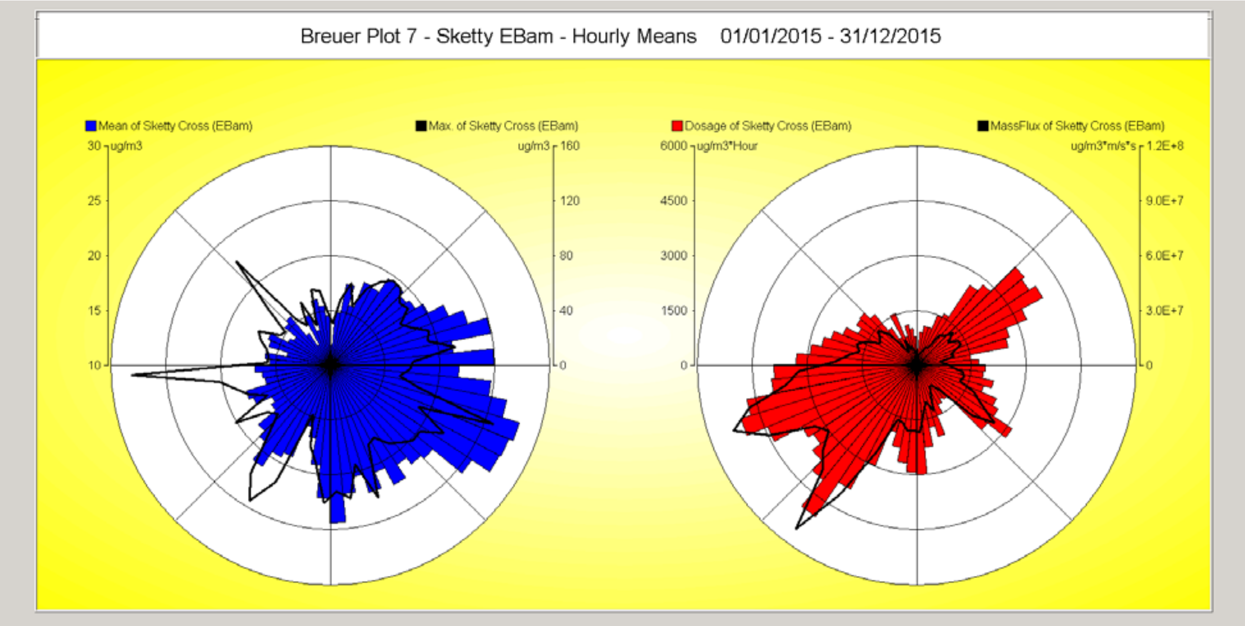
For completeness, hourly Breuer Plots from the hourly means returned from the EBam monitoring during 2015 are presented below as Breuer Plots 5-9



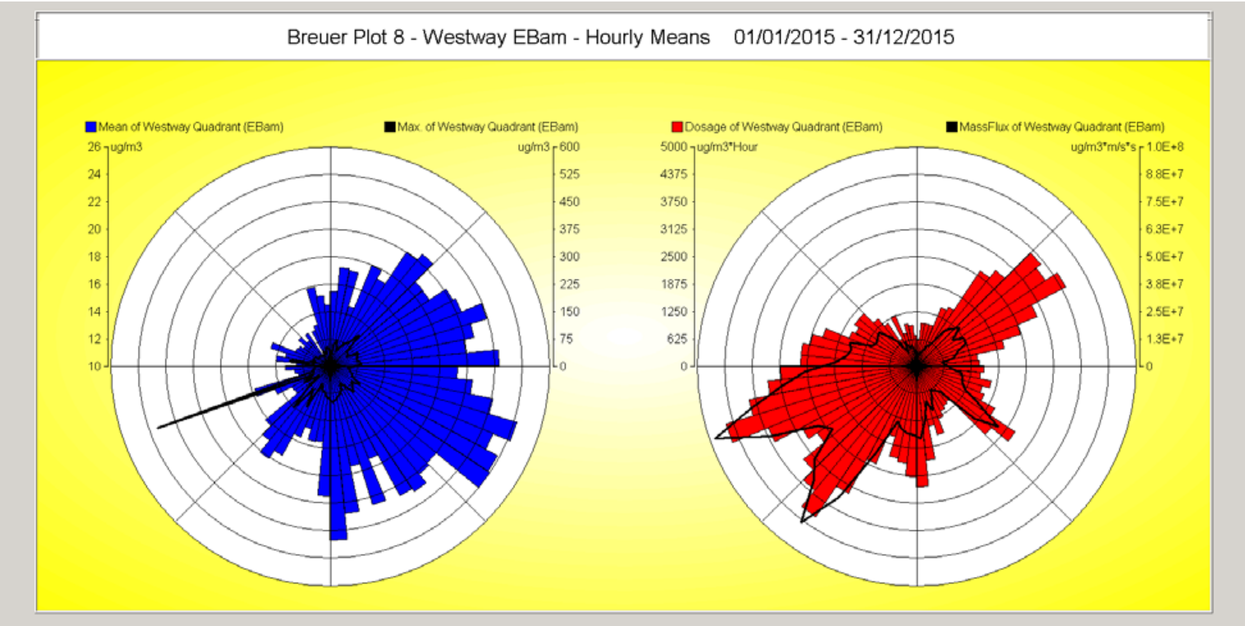
Breuer Plot 5 – Fforestfach Cross EBam - PM$_{10}$ Hourly means 2015



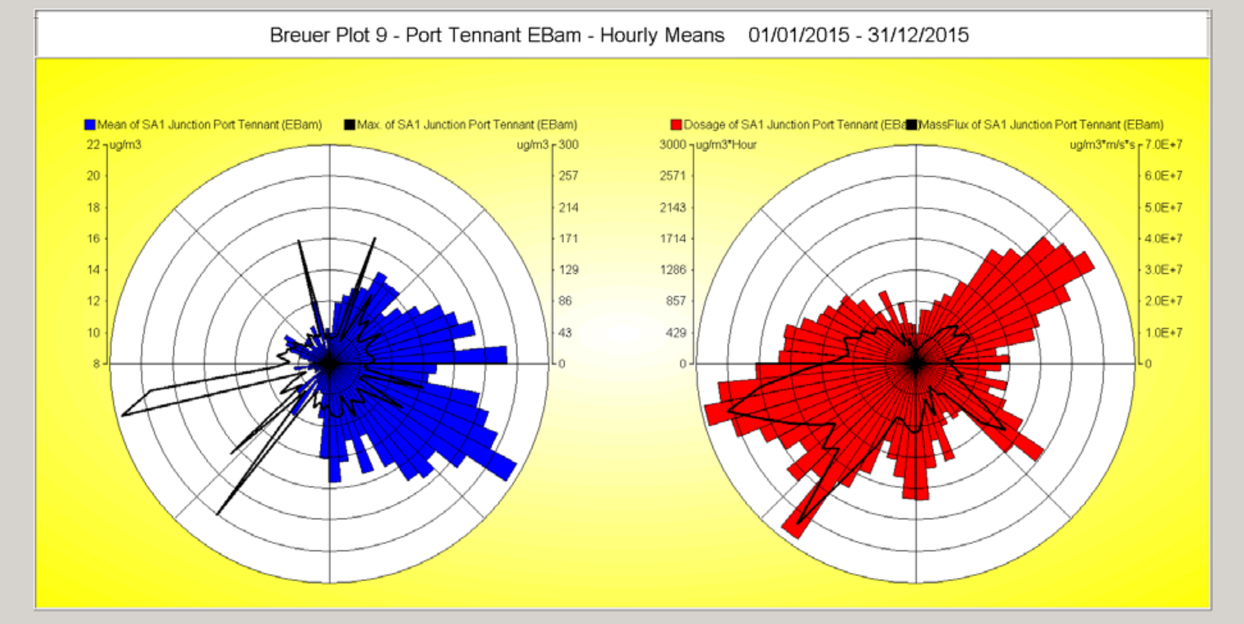
Breuer Plot 6 –Uplands EBam - PM$_{10}$ Hourly means 2015



Breuer Plot 7 –Sketty EBam - PM_{10} Hourly means 2015



Breuer Plot 8 –Westway EBam - PM_{10} Hourly means 2015



Breuer Plot 9 –Westway EBam - PM_{10} Hourly means 2015

There is a striking similarity to the hourly Breuer Plots produced for the Swansea AURN (Breuer Plot 2) to Breuer Plots 5-9 above. This has also been observed in past reporting. This would seem to point to the fact that all EBam locations, despite being located around busy junctions and/or busy, congested streets, that the dominant easterly source remains constant with local conditions having little or no effect on concentrations recorded. It will be interesting to see if this trend continues.

As can be seen from tables 15 and 16 above, **no exceedances of the annual mean objective** were seen at any of the monitoring stations. Similarly, **no breach of the 35 permitted exceedances of the 24 hour objective** was seen, **nor, where data capture was below 90% did the 90th percentile** (given in brackets after the number of exceedances) **exceed 50ug/m^3 for previous years 2011-2014. For 2015 data capture rates were above the 85% now required under LAQM.TG(16).**

2.2.5 Sulphur Dioxide

There were major alterations to the authority's network of SO_2 analysers during 2010. These changes have been reported within the reports previously submitted but are repeated within this report for clarity. Due to budget restrictions and with the knowledge that SO_2 concentrations have remained low for several years with no exceedance of any of the objectives, the decision was made to switch off the Advanced Pollution Instrumentation (API) real-time SO_2 analysers at the Swansea AURN, Morfa and Morriston Groundhog stations.

SO_2 is now only monitored at one location within Swansea - the St.Thomas DOAS (see sec 2.1.7 above). St.Thomas is ideally placed for this monitoring, being in close proximity to Swansea Docks with the Tata Steelworks to the south-east across Swansea Bay. This has been the traditional dominant source of SO_2 seen within Swansea since measurement of SO_2 commenced during the late 1970's.

The derived 5-minute means have been compiled into 15-minute averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified[25]. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate both the hourly and 24-hour objectives. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the ratified hourly means were specified to be present[26]

The data capture rates are presented within table 17 and, where applicable, the percentile value corresponding to the objective exceedance value is given should the data capture rate fall below 85%[27]. Under LAQM.TG(09) data capture requirement was 90%

Graphs 13-15 are presented below, representing time series measurements made during 2015 with the accompanying Breuer plot 10 providing an insight into the more likely source direction.

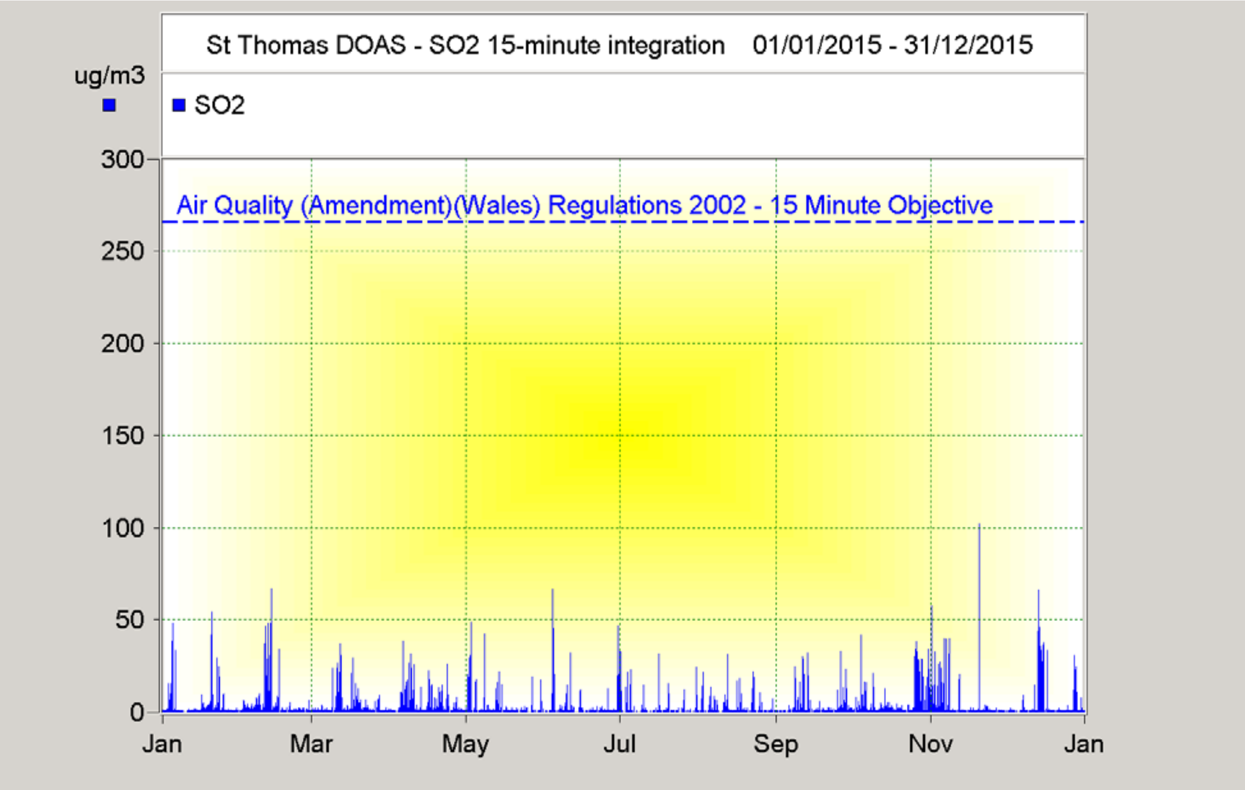
[25] LAQM.TG(16) SO2 monitoring – paragraph 7.204 pages 7-61 – 7-62
[26] LAQM.TG(16) SO2 monitoring – paragraph 7.204 pages 7-61 – 7-62
[27] LAQM TG(16) SO2 monitoring – paragraph 7.204 pages 7-61 – 7-62

St.Thomas DOAS 2015	Max 15-Min Mean $\mu g/m^3$ ($266\mu g/m^3$)	Max 1-hour Mean $\mu g/m^3$ ($350\mu g/m^3$)	Max 24-Hour Mean $\mu g/m^3$ ($125\mu g/m^3$)
Data Capture %	85.32%	87.63	**84.93**
Concentration	102.14	54	15.60
Exceedances	0	0	N/a (see %ile)
Date of Max	20/11/2015	20/11/2015	26/10/2015
Time of Max	09:15	09:00	-
2015 Percentiles	15 Minute	1 Hour	24-Hour
99.9th Percentile	N/a	-	-
99.7th Percentile	-	N/a	-
99.2nd Percentile	-	-	13.44

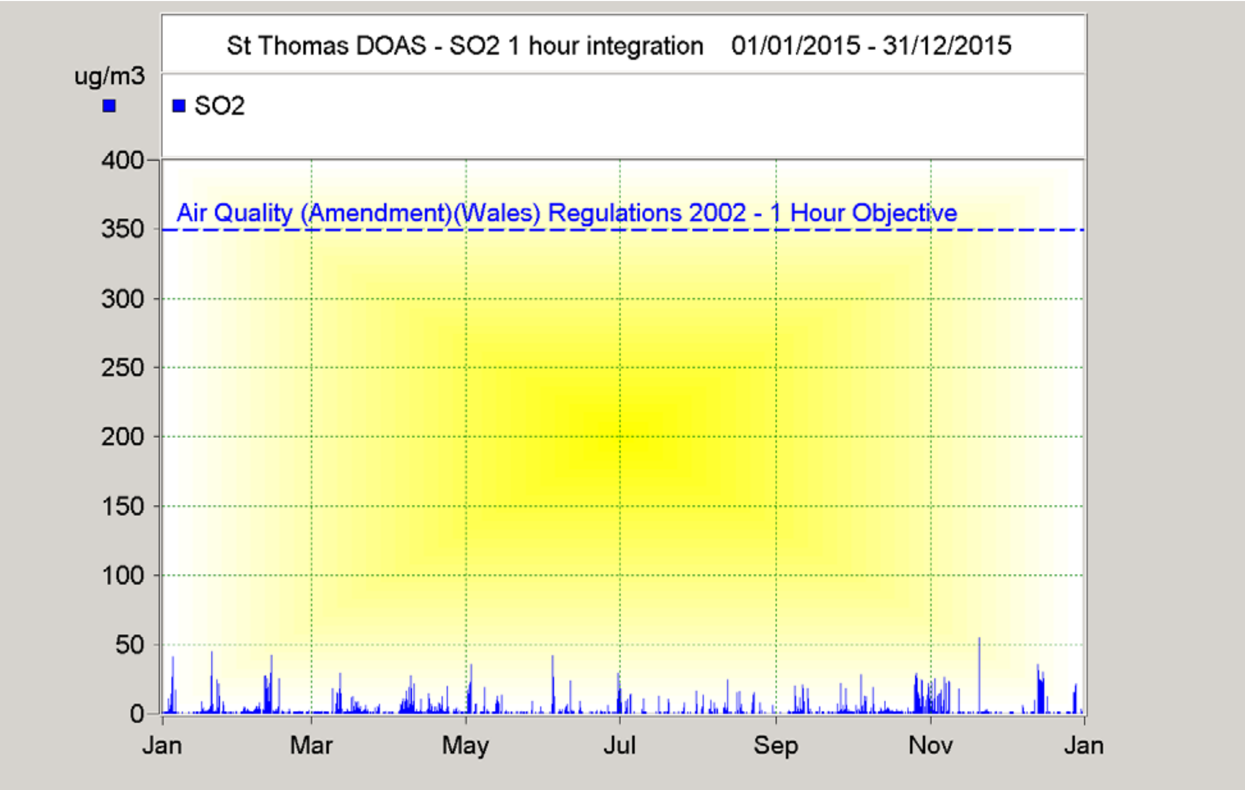
Table 17- SO_2 Concentrations 2015 St.Thomas DOAS

Looking at the data capture rates for 2015 within table 17 above, it could mistakenly be taken that there were operational issues with the equipment at the site. However, this impression would be incorrect. The reason for the quoted data capture rates is due to the QA/QC formulae used (see section 2.1.7 above). The SO_2 concentrations being measured during certain periods were very close to zero and therefore the detection limit and thus the measurement period has a standard deviation greater than twice the measured SO_2 concentration for that measurement period. Due to the standard deviation being greater than twice the measured concentration the period is rejected within the QA/QC rules due to the inherent uncertainty of the measurement.

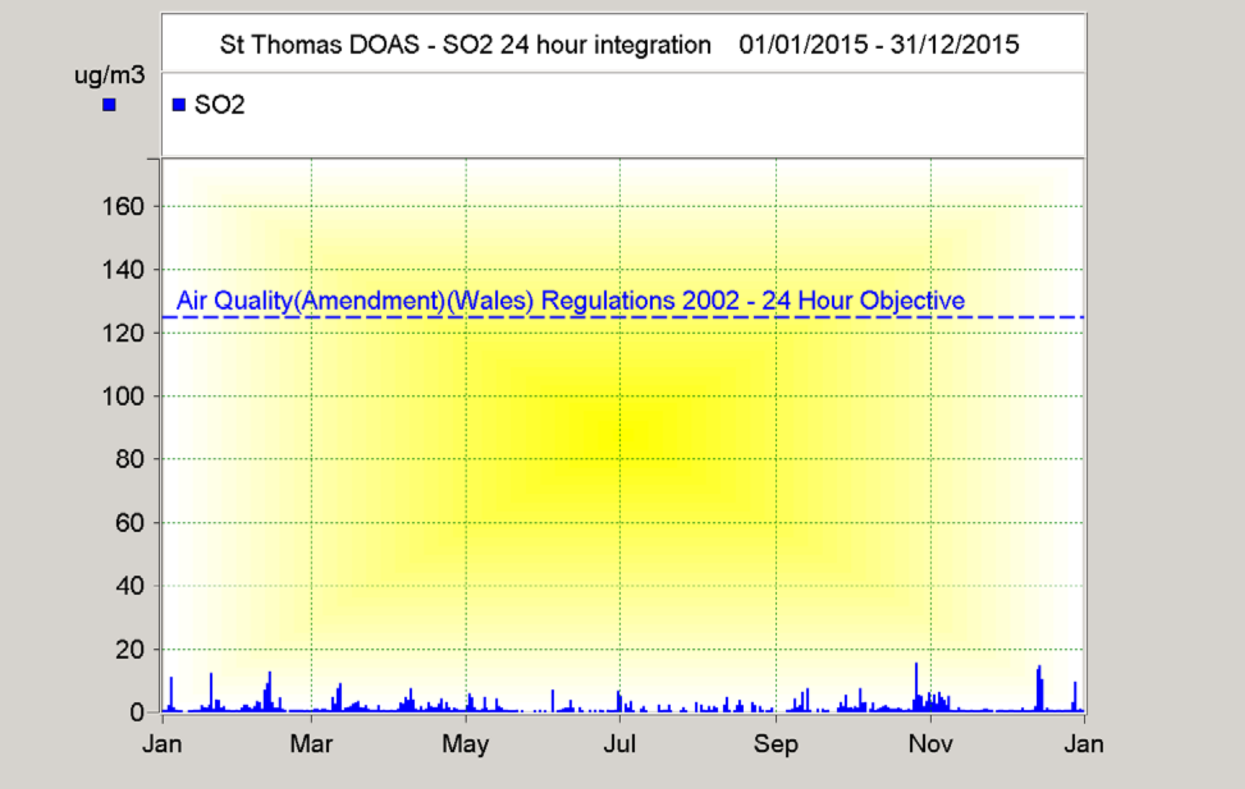
In saying the above, it should be noted that the data capture rates for 2015 are much improved from previous years. The only averaging period that did not achieve the newly required 85% data capture rate under LAQM.TG(16) is the 24 hour mean. The 2015 data capture rate for this averaging period fell just short of the 85% required and accordingly, the 99.2nd percentile is presented above within table 17.



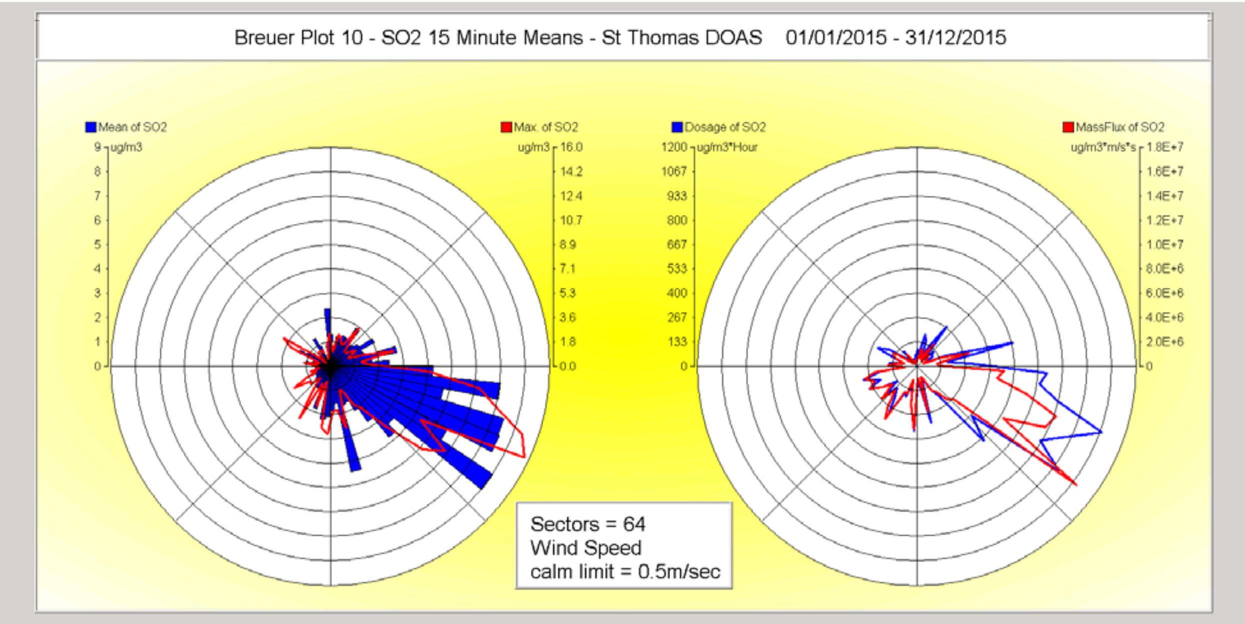
Graph 13 – 15-minute SO_2 means – St Thomas DOAS 2015



Graph 14 – 1-Hour SO_2 means – St Thomas DOAS 2015

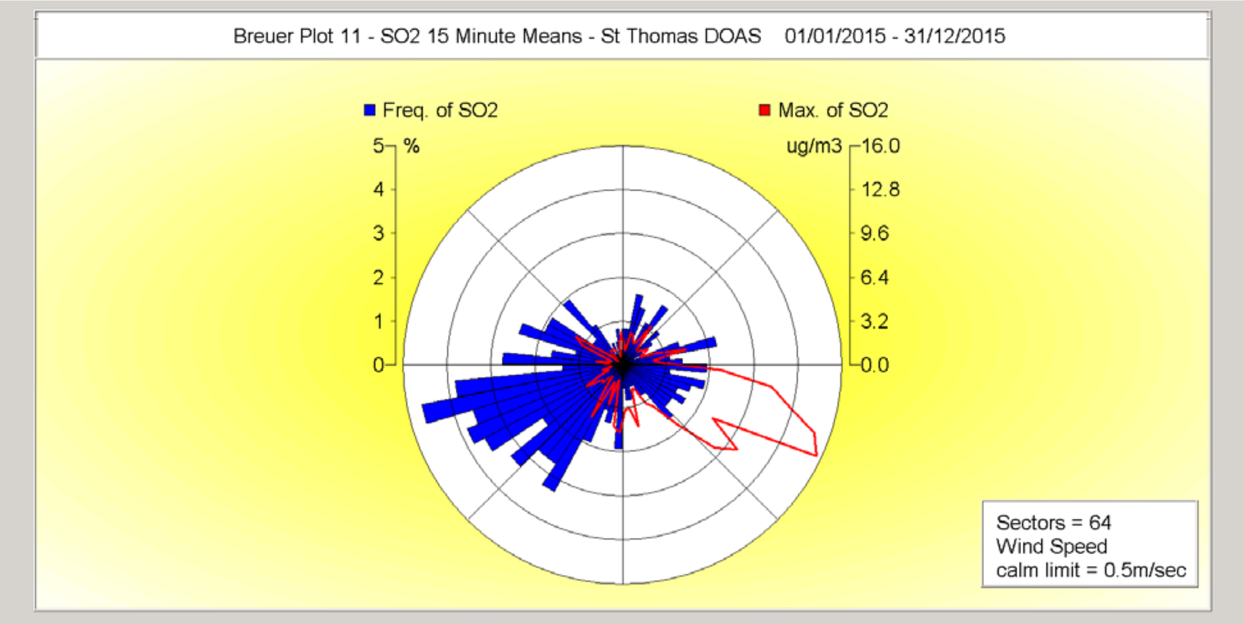


Graph 15 – 24-Hour SO_2 means – St Thomas DOAS 2015



Breuer Plot 10 – St.Thomas DOAS 15-minute SO_2 concentrations 2015

From Breuer Plot 10 it is evident that whilst low SO_2 concentrations are seen in Swansea, it is clear that the south-easterly direction still dominates (as has been seen during previous years) as the source of the measured concentrations. Interestingly, if the mean of SO_2 is replaced with the frequency of SO_2 as can be seen within Breuer Plot 11 below, it can be seen that whilst the highest means and maximums emanate from a south-easterly direction, the rate of frequency of SO2 is dominant from a south-westerly direction. However, the concentrations despite the frequency are inconsequential to the periods where south-easterly winds bring the maximum concentrations over the monitoring station.



Breuer Plot 11 – Frequency and Mean SO_2 Plot – St Thomas DOAS 2015

Quay Parade bridges/A483 and the city centre are to the west of the ST Thomas DOAS. The St Thomas DOAS station is approximately half a mile from the docks area, (in a more south-south easterly direction) so it would seem likely that the docks activities contribute to the frequency and maximum concentrations seen from that direction. Whilst there may be more local influences, it should be noted that there is heavy industry located to the south east of Swansea Bay in the form of the Tata Steelworks at Port Talbot. This has been the traditional dominant source of SO_2 seen within Swansea since measurement of SO_2 commenced during the late 1970's. From 2015 data this remains the case and is reinforced by examination of the dosage and Mass Flux plots within Breuer Plot 10. Dosage is taken to be the accumulated time multiplied with the average value of SO_2. This is useful for calculations of likely exposure at these locations. Mass Flux is also indicated and is taken to be: Flux - the wind speed multiplied with the operand distributed over the wind direction. All data that has valid integrated data for all three positions are included in this calculation. (Note: The average distributed wind speed and the average distributed parameter [SO_2] are not used to calculate the result). The result is presented in the multiplied units of the wind speed and the parameter (SO_2). Mass flux is the same as flux, but the result is multiplied with the accumulated integration time. This gives the mass transport in different directions.

2.2.6 Benzene

Benzene is measured in real-time at two roadside sites in Swansea with Opsis DOAS instruments. Sections 2.1.6 and 2.1.7 above outline the systems in operation at the Hafod (along Neath Road) and at St.Thomas (Pentreguinea Road) sites.

Annual means for benzene and the underlying data capture for 2011-2015 are provided below within table 18.

Site ID	Location	Within AQMA	Data Capt. 2011 %	Data Capt. 2012 %	Data Capt. 2013 %	Data Capt. 2014 %	Data Capt. 2015 %	Annual mean concentrations (µg/m³)				
								2011	2012	2013	2014	2015
5	Hafod DOAS	Y	75%	74%	73%	70%	73%	3.10	2.66	2.23	2.01	2.33
6	St.Thomas DOAS	N	81%	76%	73%	74%	70%	3.09	2.55	2.30	2.56	2.20

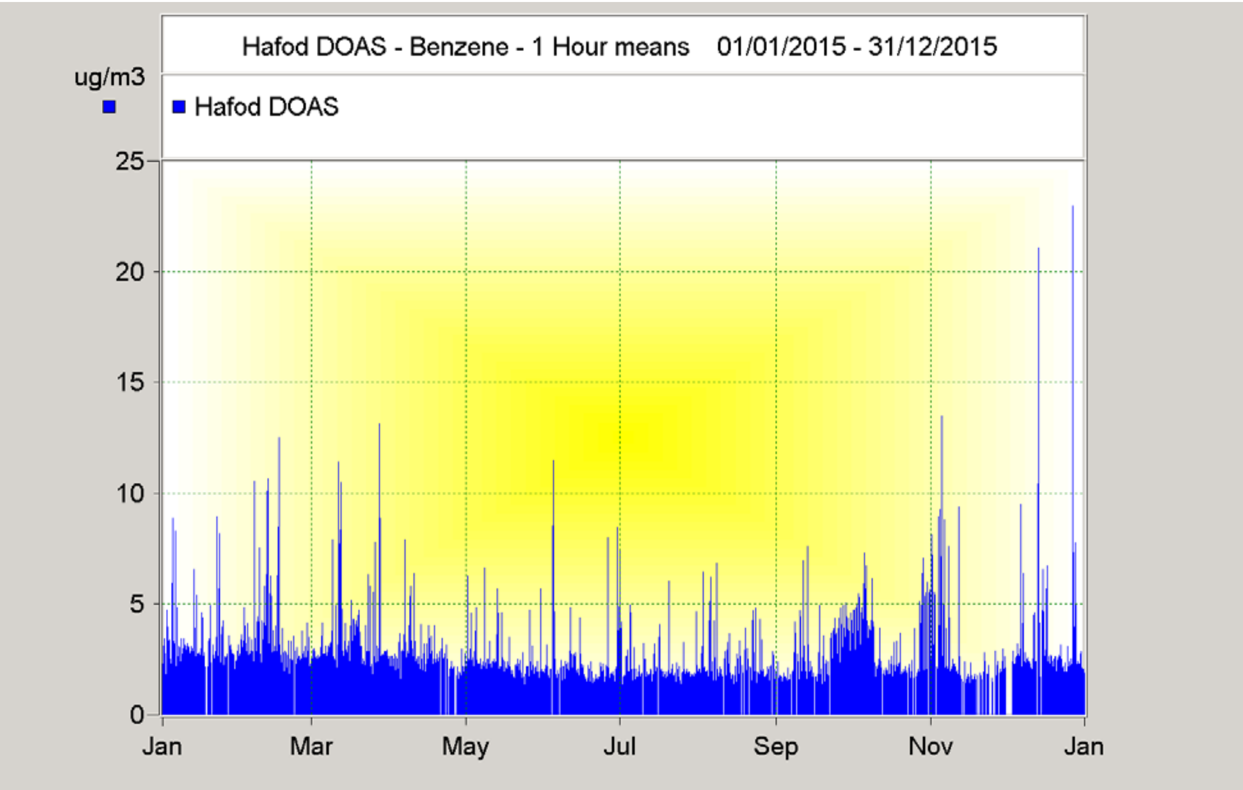
Table 18 Benzene annual means 2011-2015

Significant data has been lost at these sites in previous years due to operational issues and also building renovation works in the case of the Hafod site. Analysis of the data for 2015 has once again produced data capture rates below the assumed / recommended 85% required for other pollutants within LAQM.TG(16). No mention is made within LAQM.TG(16) of a specific required annual data capture rate for benzene[28]. However, this poor data capture rate can partly be explained by the validation rules outlined within sections 2.1.6 – 2.1.7 together with some periods of measurement cycles being close to the "limit of detection" resulting in a high standard deviation of the measurement and thus rejection if the standard deviation is more than the concentration measured.

Graphs 16 and 17 below illustrate some high hourly "spikes" of benzene throughout the year for short periods of time at both sites, and importantly around the same time, indicating a likelihood of the same source. However, these spikes during 2015 are much reduced from hourly spikes seen in recent years. Breuer Plots 12 and 13 provide additional information as to the source direction of measured concentrations.

[28] LAQM.TG(16) Benzene and 1,3 Butadiene Monitoring paragraph 7.215 page 7-65 to 7-66

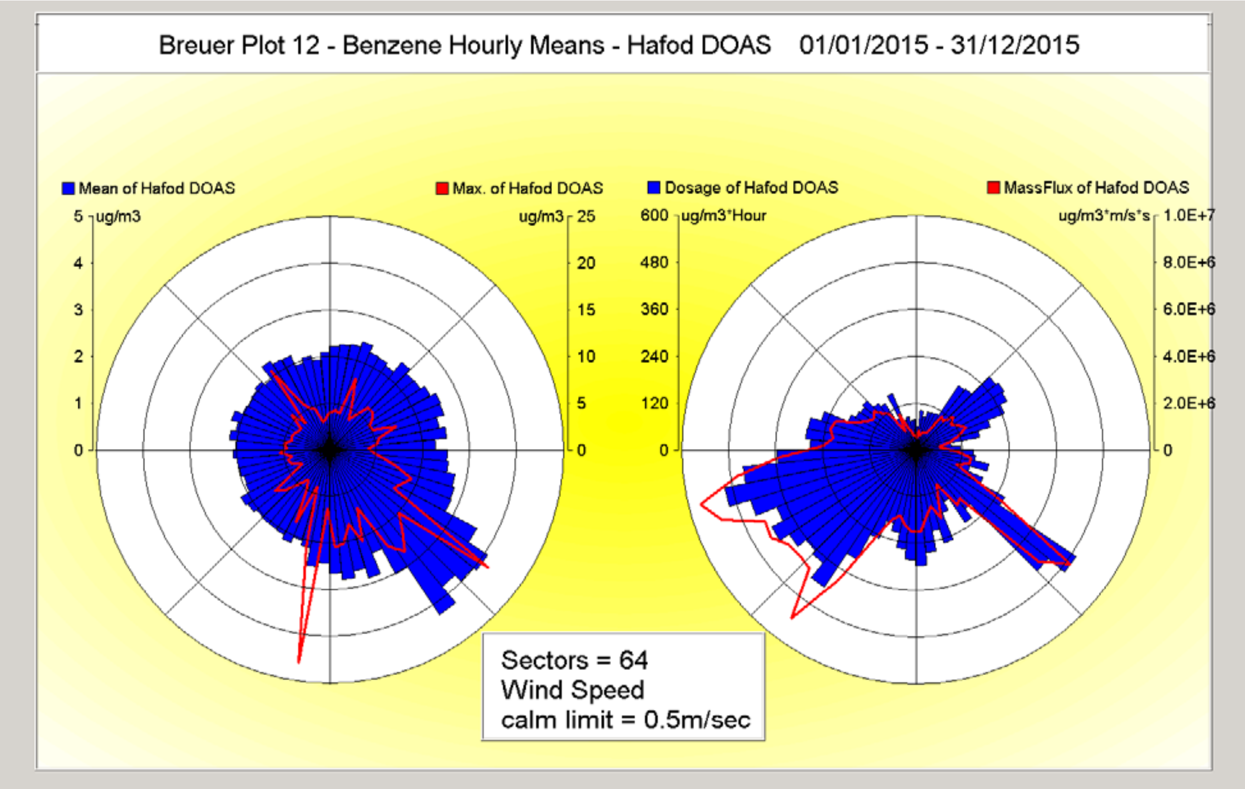
Both sites show an overall reduction trend over the last 5 years. Concentrations continue to remain below the annual mean objective level of 5µg/m^3. An influence on the annual mean concentrations during 2011 (and numerous exceptionally high hourly spikes) is thought to have been the tyre flock fire at a disused factory unit at Fforestfach which lasted for several weeks. No such incidents occurred during 2015 that could account for the numerous hourly spikes.



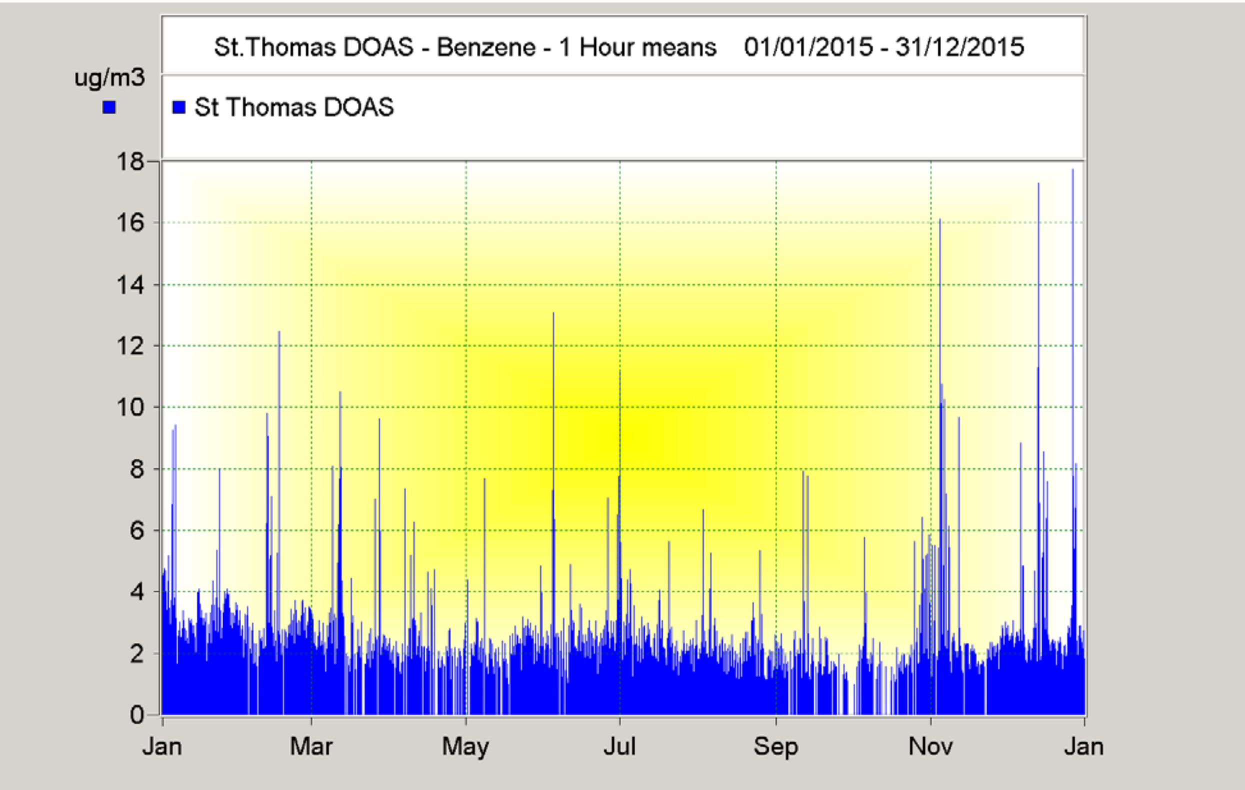
Graph 16 – Hafod DOAS Benzene 1-hour means 2015

Interestingly, both of the larger hourly “spikes” within graph 16 from the Hafod DOAS above are also seen at the same time within chart 17 below at the St Thomas DOAS. This would imply a common source.

Breuer Plot 12 below is fairly conclusive as to the dominant prevailing source of benzene being to the south-east, with the maximum concentrations being seen from a more southerly/south-westerly origin. This would suggest that these sources are the Tata Steelworks at Port Talbot and Swansea docks respectively.



Breuer Plot 12 Hafod DOAS Benzene hourly concentrations 2015



Graph 17 – St.Thomas DOAS Benzene 1-hour means 2015

Breuer Plot 13 below from St Thomas indicates and confirms the primary source of mean and maximum hourly concentrations are likely to be from the source(s) mentioned above i.e.: the heavy industry located to the south-east of Swansea Bay at Tata Steelworks and Swansea docks to the south of the monitoring site. The spike from the north-east direction is unidentified at the moment but is though likely to emanate from processes within the Morriston Enterprise Park.

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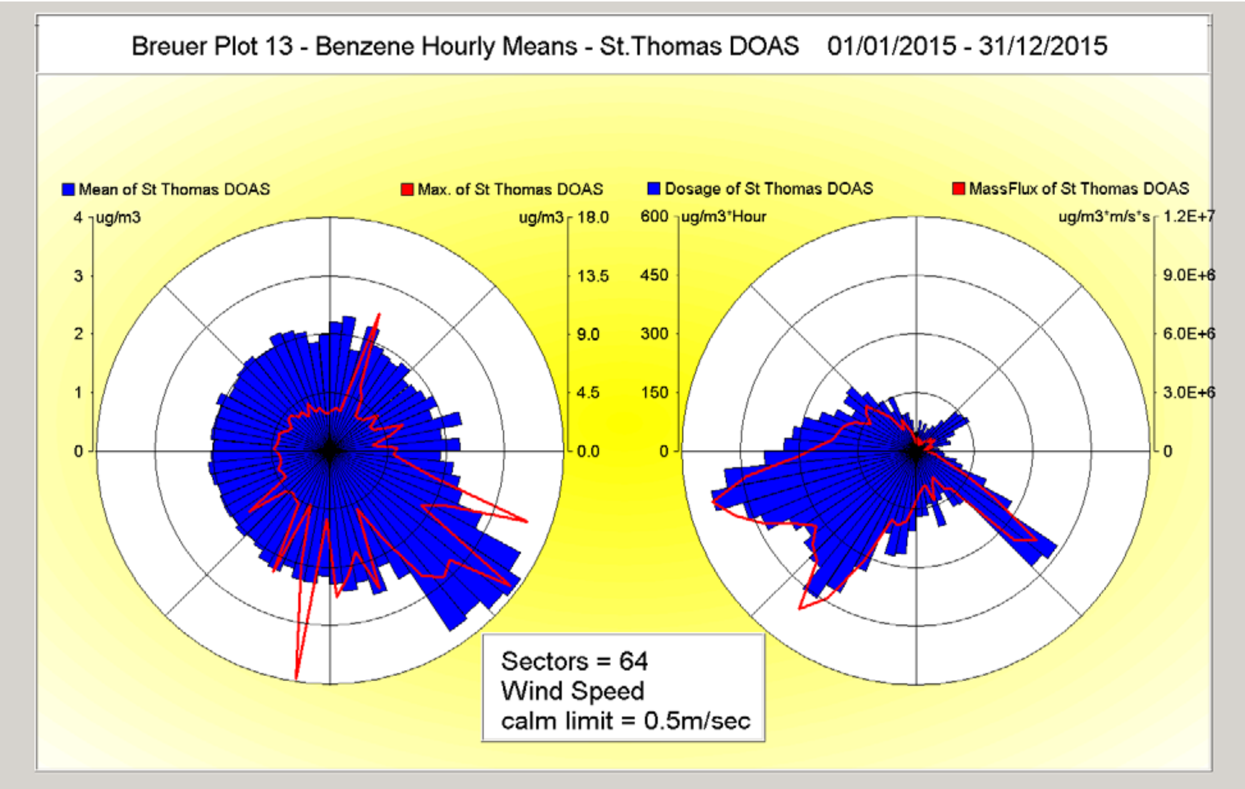


Breuer Plot 13 St Thomas DOAS Benzene hourly concentrations 2015

From table 18 above it can be seen that no annual mean exceeds 5ug/m^3 at either site and compliance is, therefore, being achieved at both sites.

2.3 Other pollutants monitored

The authority has previously monitored additional pollutants (carbon monoxide and ozone) at the majority of the automatic sites. However, due to the financial restraints that the authority is now operating under, all carbon monoxide monitoring has ceased at the Swansea AURN, and Morriston Groundhog sites, resulting in no roadside carbon monoxide monitoring being undertaken within Swansea since 2009. Ozone monitoring ceased at the Swansea AURN site on the 27th November 2008 with the analyser being transferred to the Cwm Level Park monitoring site following the reorganisation of the UK Network. Ozone continues to be measured at the Morriston Groundhog and the Hafod and St Thomas DOAS sites. Lastly, $PM_{2.5}$ was measured at the Swansea AURN Roadside station by way of the Thermo TEOM FDMS system (co-located with Thermo TEOM FDMS PM_{10}) until November 2011 when due to continued operational issues the FDMS systems were replaced with Met One Bam 1020 PM_{10} and $PM_{2.5}$ units. As mentioned above within section 2.2.4 the authority replaced the FDMS PM_{10} unit at the Morriston Groundhog site with a MetOne Bam1020 $PM_{2.5}$ monitor due to the ongoing poor data capture rates being obtained from the FDMS units. The Bam1020 $PM_{2.5}$ went live at Morriston during late December 2015 so no meaningful data is available for presentation within this reporting cycle.

In addition, the authority participate in the UK Heavy Metals Monitoring Network with The Department of the Environment, Transport and the Regions (DETR) monitoring study to determine ambient concentrations of lead, cadmium, arsenic, mercury and nickel in the vicinity of a wide-variety of industrial processes. The City and County of Swansea were requested to participate in this study from its inception during 1999/2000 due to the nickel refinery at Vale Europe being located within the authority's area at Clydach. Further details and information can be found within section 2.1.10. The analysed parameters are: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Magnesium (Mn), Nickel (Ni), Lead (Pb), Platinum (Pt), Vanadium (V), Zinc (Zn) and Mercury (Hg).

2.3.1 Ozone

Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2015. The long term objective for ozone mentioned within the Air Quality Strategy 2007 (vol 2)[29] (chapter 1 section 1.3.5 page 62) was for the 8-hour means not to exceed 100μg/m^3 on more than 10 occasions with a compliance date of 31st December 2005. LAQM.TG(16) makes no reference to ozone monitoring so the approach adopted within previous reporting cycles is adopted within this report. In addition the LAQM Interim Policy Guidance for Wales (March 2016) also makes no specific reference to ozone monitoring.

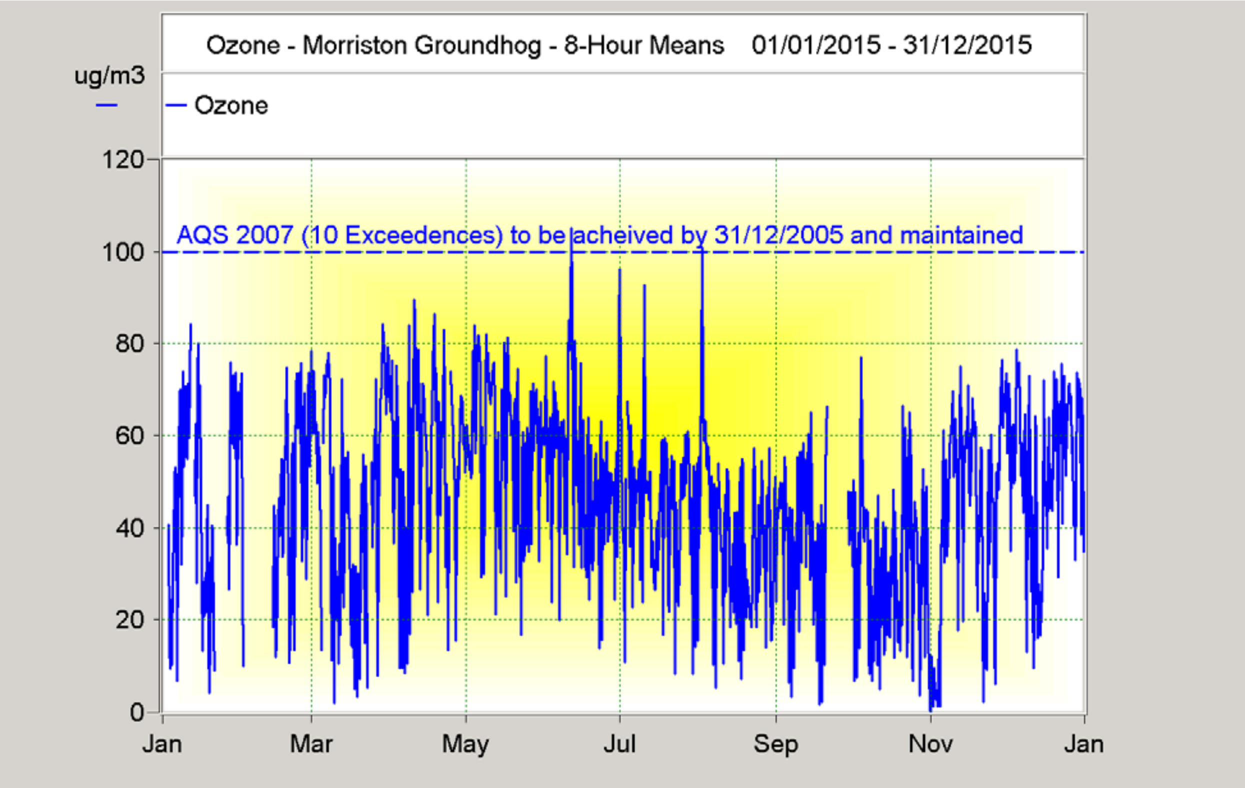
Measurements are undertaken with Advanced Pollution Instrumentation (API) real-time O_3 analysers at the Cwm Level Park and Morriston Groundhog sites with the DOAS technique providing the measurements from the St Thomas and Hafod sites. The O_3 analyser from the Swansea AURN was decommissioned on the 27th November 2008 and relocated at Cwm Level Park.

Ratified datasets have been downloaded from http://www.welshairquality.co.uk/data_and_statistics.php in relation to the ozone monitoring undertaken at the Morriston Groundhog and Cwm Level Park sites. Data ratification procedures undertaken at the Hafod and St Thomas DOAS sites are described in more detail within sections 2.1.6 and 2.1.7

Hourly means have been used to calculate the 8-hour means. In order to form a valid 8-hour mean 75% of the hourly means were required to be present i.e. 6 out of every 8. Tables 19 - 22 detail the monitoring undertaken during 2015 along with previous year's results.

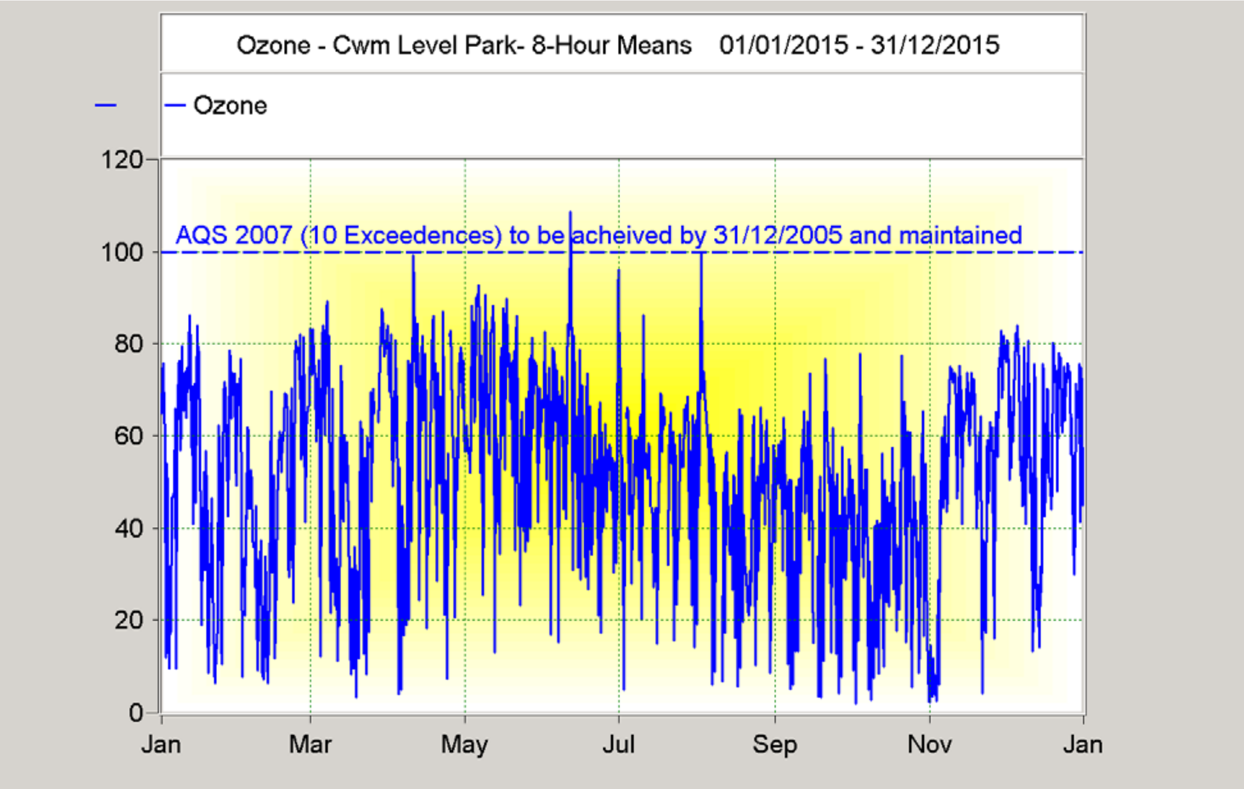
[29] https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-2

Graph 18 – Morriston Groundhog – 8-hour Ozone means 2015



Morriston Groundhog	Max 8-hour Mean (µg/m^3)	Data capture (at 8 hour integration)	Exceedances of 8-hour objective 100µg/m^3 (10 permitted)
2002	109.50	83.3%	3
2003	169.25	95.71%	28
2004	142.75	98%	23
2005	113.00	97.6%	1
2006	152.20	98.8 %	15
2007	114	98%	4
2008	120.75	88.43%	3
2009	103.25	89.04%	2
2010	103.5	94.34%	1
2011	104.25	90.78%	2
2012	126.50	97.63%	5
2013	111.00	93.42%	1
2014	103.25	95.71%	1
2015	105	91.51%	2

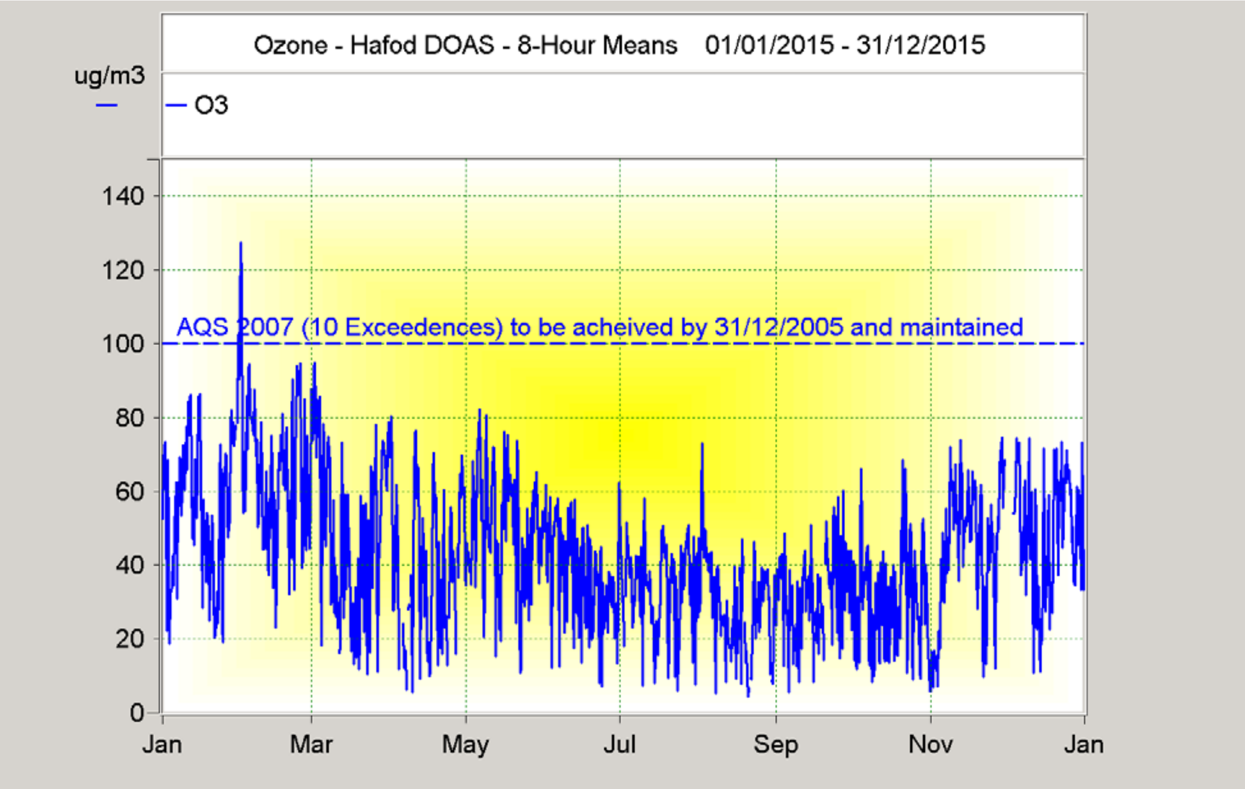
Table 19 - Morriston Groundhog – 8-hour Ozone means 2002-2015



Graph 19 – Cwm Level Park – 8-hour Ozone means 2015

Cwm Level Park	Max 8-hour Mean (µg/m^3)	Data capture	Exceedances of 8-hour objective 100µg/m^3 (10 permitted)
2009	100.75	92.6%	1
2010	106.5	98.26%	1
2011	112.0	98.63	5
2012	130.25	96.17%	5
2013	124.75	98.54%	23
2014	115.25	98.54%	5
2015	108.50	97.81%	1

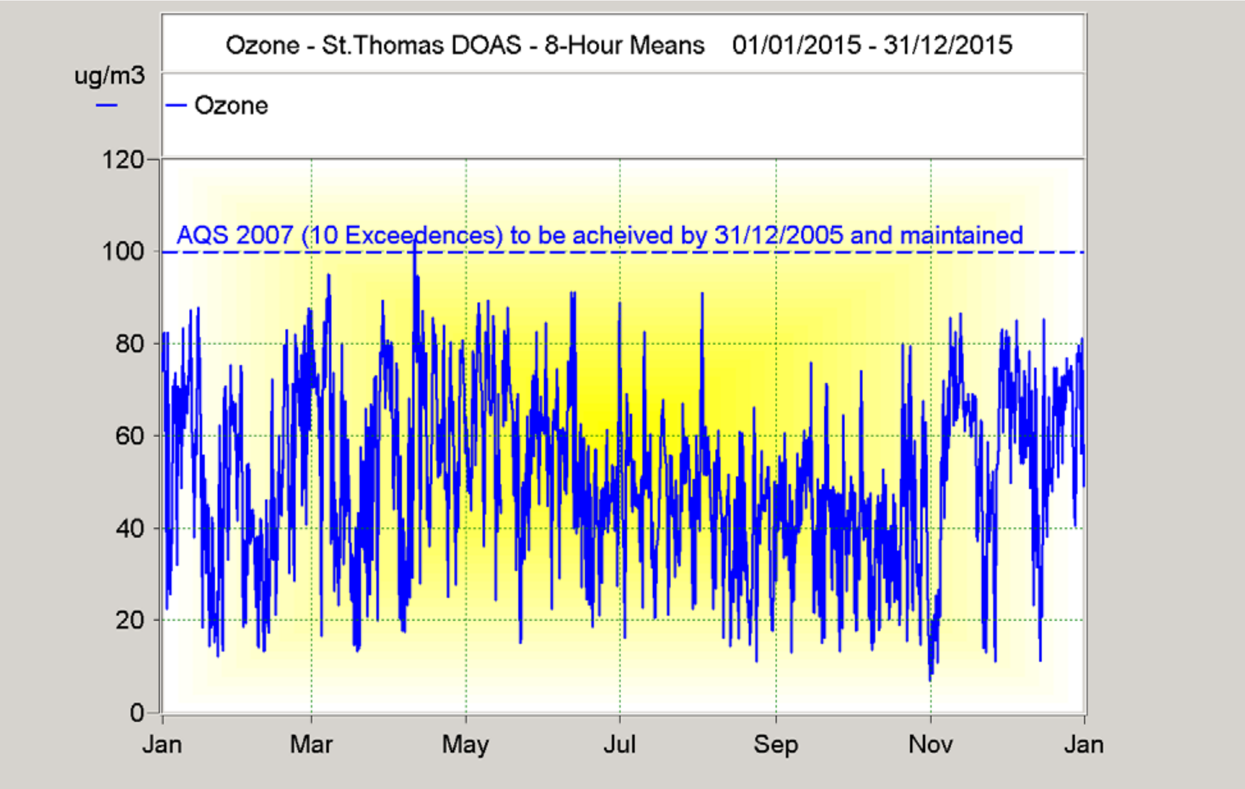
Table 20 – Cwm Level Park – 8-hour Ozone means 2009-2015



Graph 20 – Hafod DOAS – 8-hour Ozone means 2015

Hafod DOAS	Max 8-hour Mean (µg/m^3)	Data capture %	Exceedances of 8-hour objective 100µg/m^3 (10 permitted)
2006	95.95	53.7%	0
2007	87.36	82.3%	0
2008	98.96	38.5%	0
2009	118.49	94.70%	50
2010	115.53	95.98%	6
2011	102.19	99.91%	2
2012	141.71	99.6%	13
2013	112.60	99.1%	9
2014	124.70	85.57%	12
2015	127.46	98.71%	4

Table 21 – Hafod DOAS – 8-hour Ozone means 2006-2015



Graph 21 – St Thomas DOAS – 8-hour Ozone means 2015

St Thomas DOAS	Max 8-hour Mean (µg/m^3)	Data capture	Exceedances of 8-hour objective 100µg/m^3 (10 permitted)
2006	150.6	94.9%	47
2007	106.4	98.7%	10
2008	127.9	99.9%	91
2009	118.93	99.4%	48
2010	120.45	99.36%	37
2011	108.90	99.54%	9
2012	116.42	98.63%	4
2013	113.76	99.7%	22
2014	115.38	98.45%	4
2015	102.49	99%	2

Table 22 – St Thomas DOAS – 8-hour Ozone means 2006-2015

Compliance during 2015 has been achieved at all monitoring locations with no site exceeding the 10 permitted 8-hour exceedances.

2.3.2 Particulate Matter $PM_{2.5}$

The Thermo FDMS $PM_{2.5}$ system was installed upon commissioning of the relocated Swansea Roadside AURN site, and went live on the 26th September 2006.

The data collected for 2006 from the FDMS $PM_{2.5}$ unit amounts to just over two months at best and is not reported here as the period was fraught with breakdowns and other issues. Brief operational issues that have been identified are outlined here for information as the operation of the FDMS units differs substantially from that of its predecessor the R&P Teom units.

The FDMS units are required to operate within an ambient enclosure temperature range between 18-22°C[30]. Opinions vary as to the exact optimum temperature but Swansea's experience indicates around 18-20°C to be adequate and one that is capable of being maintained relatively stable by the installed air conditioning system.

The FDMS unit provided hourly integration data and had been configured as per DEFRA's FDMS parameter protocol (as amended during February 2008). The RS232 port on the FDMS control unit allows the collection of up to 8 parameters via telemetry. The parameters collected from the FDMS units are : Volatile Mass, Non Volatile Mass, External Dew Point, Sample Dew Point, Filter loading, Pressure, Status, External Ambient Air temperature. The control unit referred to these parameters in different terminology. However, the FDMS unit would not directly produce a $PM_{2.5}$ mass concentration. The $PM_{2.5}$ mass concentration was obtained via post processing of the volatile and non-volatile mass parameters by creating a calculated channel the software package Opsis Enviman ComVisioner.

Data collected from the FDMS unit had an integration period of 1-hour. $PM_{2.5}$ mass concentration is obtained via post processing of the volatile and non-volatile mass parameters by the software package Opsis Enviman ComVisioner. The calculated hourly mean mass concentration data have then been further processed by the software package Opsis Enviman Reporter. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the calculated hourly means were specified to

[30] UK Equivalence Program for Monitoring of Particulate Matter dated 5th June 2006 section 5.5.2

be present[31]. LAQM.TG(16) provides no direct guidance on $PM_{2.5}$,except for paragraphs 3.50 – 3.53.

There had been numerous problems since the commissioning of the site in September 2006 with the installation of the Thermo Inc FDMS $PM_{2.5}$ analyser, resulting in significant periods of data loss. During 2007, there were several periods where data has been removed from the dataset. There are: 1st – 5th January 2007; 16th - 18th January 2007; 24th – 26th January 2007; 1st -2nd March 2007; 7th – 21st May 2007(leak test failure and uncertainty in data due to swap out of loan/replacement sensor units). These issues resulted in a ratified data capture rate of 90.7% for 2007.

Operation during 2008 saw a data capture rate of 94.81% with far fewer operational issues arising. However, significant issues were again seen within the data for 2009. Significant data has either been rejected or is absent during January, February, May-August, October and December 2009. The resulting data capture rate for 2009 is a disappointing 49.86% (daily means with 75% of 1 hour means present). During 2010, the operation of the $PM_{2.5}$ FDMS had been queried on many occasions as the $PM_{2.5}$ unit was reporting higher concentrations of $PM_{2.5}$ than PM_{10}. Both FDMS units have been investigated for leaks, dryer issues, pump vacuum issues during. However, problems continued with the reliability of the FDMS from late December 2010 and throughout 2011. Data has been rejected by the UK network from the 21st December 2010 to the 14th September 2011 at 15:00.

Due to the ongoing reliability and data quality issues from the $PM_{2.5}$ (and also PM_{10}) FDMS systems a decision was made during the summer of 2011 to remove both FDMS units. Both FDMS units were removed from site on the 16th November 2011. Met One BAM 1020 $PM_{2.5}$ (smart Bam) and PM_{10} units were installed on the 28th November 2011.

The Met One Bam $PM_{2.5}$ (smart Bam) is heated and has been determined to show equivalency to the EU reference method during recent trials without the need for the application of a correction factor.[32] [33]

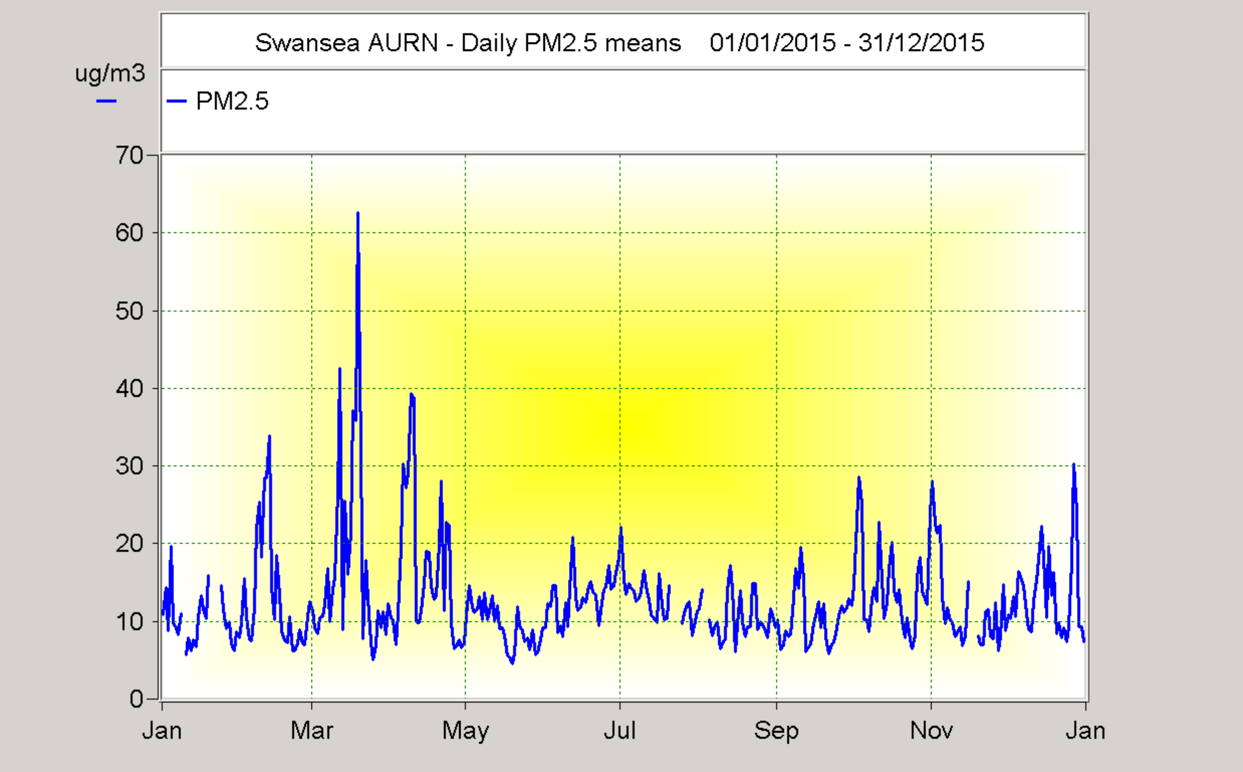
[31] LAQM.TG(16) General Considerations paragraph 7.160 to 7.162 page 7-47 to 7-48
[32] http://www.metone.com/documents/Met_One_Letter_5.pdf
[33] http://uk-air.defra.gov.uk/reports/cat05/0606130952_UKPMEquivalence.pdf

Each hour, a small 14C (carbon-14) element emits a constant source of high-energy electrons (known as beta rays) through a spot of clean filter tape. These beta rays are detected and counted by a sensitive scintillation detector to determine a zero reading. The BAM-1020 automatically advances this spot of tape to the sample nozzle, where a vacuum pump then pulls a measured and controlled amount of dust-laden air through the filter tape, loading it with ambient dust. At the end of the hour this dirty spot is placed back between the beta source and the detector thereby causing an attenuation of the beta ray signal which is used to determine the mass of the particulate matter on the filter tape and the volumetric concentration of particulate matter in ambient air.

Due to the problems experienced during 2011 the combined FDMS $PM_{2.5}$ and BAM1020 $PM_{2.5}$ hourly integrated data capture rate was 28.66%. Graph 22 below present's daily mean data for 2015. Table 23 summarises $PM_{2.5}$ data at the Swansea AURN between 2007 and 2015

As mentioned elsewhere the authority replaced the FDMS PM_{10} unit at the Morriston Groundhog with a heated MetOne 1020 $PM_{2.5}$ (SmartBam) during late December 2015 due to the poor performance of the FDMS system. There is very little meaningful $PM_{2.5}$ data for 2015 from the Morriston Groundhog and as such, none is reported here.

It should be stated that following installation of the Bam 1020 $PM_{2.5}$ unit that data capture since installation and throughout its operation since, has vastly improved. This is true at the Swansea AURN and now also during the early stages of 2016, at the Morriston groundhog site.



Graph 23 – Daily $PM_{2.5}$ means – Swansea AURN 2015

Swansea Roadside AURN $PM_{2.5}$	Data capture %	Annual Mean (25µg/m^3)	Max Daily Mean (µg/m^3)	Max 1-hour mean (µg/m^3)
2007	90.7	13.84	68.9	262
2008	94.81	12.53	70.42	202
2009	**49.86**	11.84	60.54	91
2010	94.52	8.97	33.63	102
2011	**28.66**	10.33	32.04	230 *
2012	97.27	11.45	56.17	199 *
2013	97.26	11.90	48.50	121
2014	94.25	12.80	61.92**	327*
2015	96.44	12.80	62.67	116

Table 23 – Swansea AURN $PM_{2.5}$ daily means 2007-2015

Max 1-hour means 2011, 2012 and 2014 all occurred on 5th November

** ***Max 24-hour mean 2014 occurred on 5th November***

The $PM_{2.5}$ monitoring recorded elevated levels during the 18th - 20th March 2015. Back trajectories performed by Ricardo-AEA indicated that the air arriving in southern regions of the UK was of European origin and was affecting the whole of southern

UK. This was compounded in some regions by poorly dispersed local emissions due to low wind speeds. This episode lasted for two to three days and is also evident within the PM_{10} monitoring within graphs 7 and 8 above

Guidance within LAQM.TG(16) relating to $PM_{2.5}$ and Action Planning only relates to England and Scotland[34]

The Air Quality Strategy 2007 focuses attention on $PM_{2.5}$ particulate matter to that of an exposure reduction approach. Between 2010 and 2020 for UK Urban Areas there is a target of 15% reduction in concentrations at urban background. The 25μg/m^3 is a cap to be seen in conjunction with the 15% reduction. The current policy framework and the legislative requirement to meet EU air quality limit values everywhere in the UK tends to direct LAQM attention to localised hotspot areas of pollution. There is clear and unequivocal health advice that there is no accepted threshold effect, i.e. no recognised safe level for exposure to fine particles $PM_{2.5}$. For $PM_{2.5}$, the current policy framework is therefore not going to generate the maximum improvement in public health for the investment made, as it focuses attention on localised hotspots only, despite much more widespread adverse effects on health being likely.

Therefore, an exposure reduction approach has been adopted for $PM_{2.5}$ to seek a more efficient way of achieving further reductions in the health effects of air pollution by providing a driver to improve air quality everywhere in the UK rather than just in a small number of localised hotspot areas, where the costs of reducing concentrations are likely to be exceedingly high. These measurements will act to make policy measures more cost-effective and is more likely to maximise public health improvements across the general population.

[34] LAQM.TG(16) PM2.5 and Action Planning paragraph 2.51 page 2-8

2.3.3 Heavy Metals Monitoring

The Department of Environment, Food and Rural Affairs (DEFRA) is funding a monitoring study to determine ambient concentrations of lead, cadmium, arsenic, mercury and nickel in the vicinity of a wide-variety of industrial processes.

The City and County of Swansea were requested to participate in this study from its inception during 1999/2000 due to the nickel refinery at Vale (Formerly Vale INCO/ INCO Europe) being located within the authority's area at Clydach. Full details on this monitoring program can be found within section 2.1.10 above which outlines the overall monitoring program and sites chosen.

Several years of monitoring data are available and can be viewed within previous LAQM Reporting undertaken online at http://www.swansea.gov.uk/article/2850/Local-air-quality-management-reports

During August 2007, Vale INCO Europe commenced an abatement improvement program with the installation of particulate bag filters on the main high stack discharge point. Data is presented below from 2008-2013 representing the last 6 years of monitoring. Additional factors should be taken into account when viewing the monitoring data. Due to the economic downturn, Vale have operated in previous years or so at a reduced capacity primarily operating on one kiln. Whilst both the improved abatement techniques and reduced capacity are clearly seen within the data from the four monitoring stations within the City & County of Swansea's area, colleagues from Neath Port Talbot Borough Council have identified previously unrecognised local, and now deemed significant sources of nickel within Pontardawe. These sources within Pontardawe were previously being masked and have only now come to light due to the increased monitoring and analysis undertaken within the Swansea valley into ambient levels of nickel. This additional work is in part being driven by the Nickel in South Wales Review Group whose membership includes the Welsh Assembly Government (Policy and Technical Services Division), DEFRA, Environment Agency Wales, Ricardo AEA , National Physics Laboratory together with the relevant operators and local authorities.

Annexe 1 of the Directive details the target values for arsenic, cadmium, nickel and benzo(a)pyrene and, for ease of reference these are repeated below as table 24**.**

Pollutant	Target value ng/m^{-3}
Arsenic	6
Cadmium	5
Nickel	20
Benzo(a)pyrene	1

Table 24 - Target Values 4th Daughter Directive - Heavy Metals Monitoring

Significant changes have occurred to the heavy metals monitoring network within Swansea during 2013 and the early part of 2014. Due to recurring issues with the equipment deployed at the Glais School site and the imposed budget restrictions the authority is operating under, monitoring ceased at Glais School on the 1st April 2013. In addition, whilst the equipment remains operational at YGG Gellionnen, a decision has been taken that due to the costs of the heavy metals analysis previously funded by the authority that monitoring would cease in January 2014. Whilst regrettable, this decision at least enabled a full year of monitoring to be completed at YGG Gellionnen.

As previously mentioned, the full monthly datasets from each of the four heavy metal monitoring locations within the authority's area have been fully reported within previous reporting.

Nickel annual mean data for the **Coed-Gwilym Cemetery site ❸** and the **Morriston Groundhog ❺** site during 2015 is presented below within table 25 which, for completeness also details the nickel annual mean results from Glais and YGG Gellionnen stations during 2002 – 2013/14. All results are expressed in ng/m^{-3}

Year	* Glais Primary School ❷	Coed-Gwilym Cemetery ❸	** YGG Gellionnen ❹	Morriston Groundhog ❺
2002	**28.91**	-	-	-
2003	18.14	-	-	-
2004	**33.83**	-	-	-
2005	19.62	-	-	-
2006	**26.13**	-	-	-
2007	**28.04**	**37.31**	-	18.3
2008	10.34	19.61	10.99	7.6
2009	4.64	16.0	19.22	9.34
2010	7.0	10.48	15.0	15.28
2011	6.34	10.91	10.0	9.75
2012	6.79	8.51	6.04	5.64
2013	* 4.15	7.78	** 7.53	6.51
2014	-	12.39	-	9.38
2015	-	12.94	-	7.35

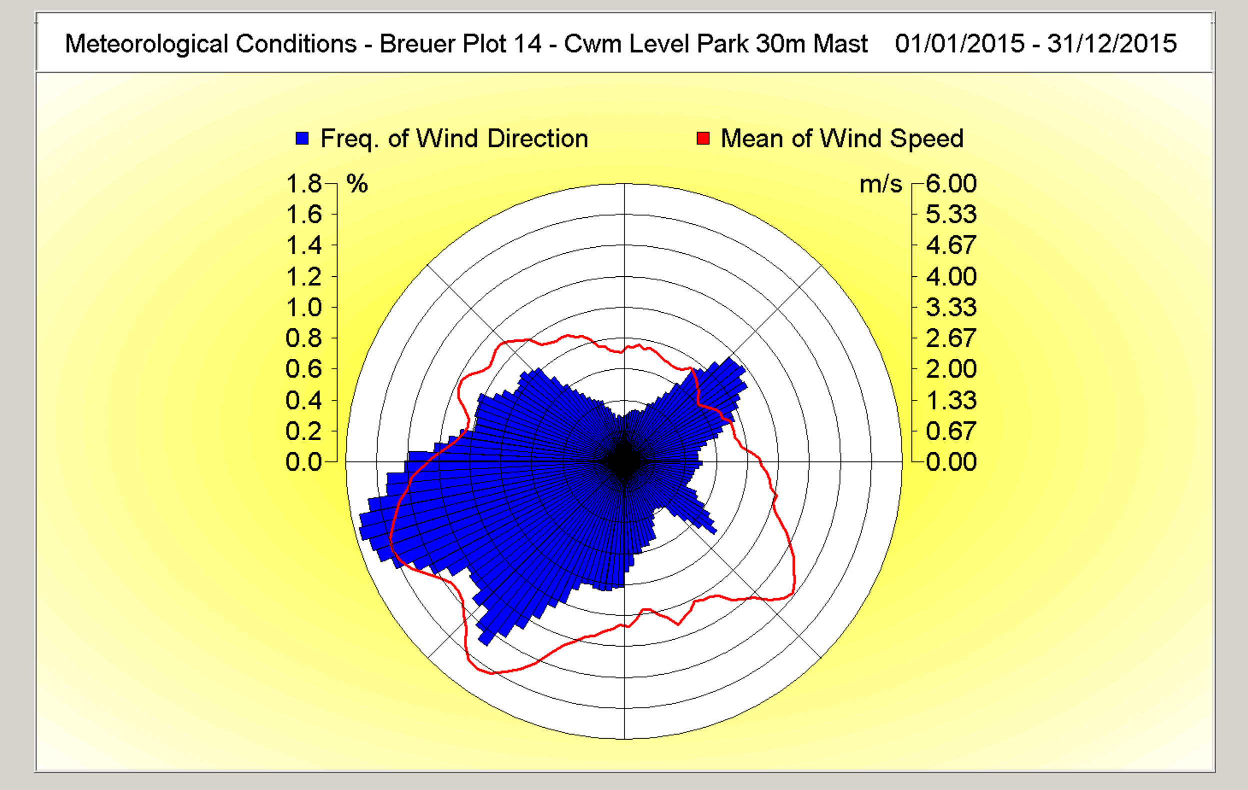
Table 25 – Swansea Nickel Annual Means 2002 – 2015

** Site ceased monitoring April 2013*

*** Site ceased monitoring January 2014*

The debate on what impacts the newly identified nickel sources further up the Swansea Valley within Pontardawe have on the monitoring stations within Swansea is still ongoing but the effect of the improved abatement at the high discharge point within the Vale was visible year on year up to 2014. However, it is not clear at present why the previously confirmed downward trend ceased during 2014 as this upward trend has again been noticed within the 2015 annual mean returned for Coed-Gwilym Cemetery site. There remains an overall downward trend within the 2015 annual mean from the Morriston Groundhog site.

Breuer Plot 14 below shows the meteorological conditions recorded during 2015 at Cwm Level Park in the lower Swansea Valley.



Breuer Plot 14– meteorological Condition – Cwm Level Park 2015 – 1 minute integration

Conditions seen here broadly represent the wider area and indicate a prevalence of predominantly south-westerly/westerly winds. As in previous years, there is also an indication of north-easterly winds (primarily during the winter months) which would blow down the alignment of the Swansea valley, taking any concentrations from the release point(s) at Clydach and Pontardawe down to the Morriston site.

From the data available within table 25 it is clear that nickel compliance has been achieved at all UK Network monitoring sites during 2015 and at all sites since 2008.

Annual mean data between 2008 and 2015 for **arsenic (As) and cadmium (Cd)** are presented below within table 26**.** All results are expressed in ng/m^{-3}

Year	Glais Primary School ❷		Coed-Gwilym Cemetery ❸		YGG Gellionnen ❹		Morriston Groundhog ❺	
	As	Cd	As	Cd	As	Cd	As	Cd
2008	0.64	0.22	0.49	0.17	0.34	0.21	0.51	0.30
2009	0.52	0.15	0.61	0.20	0.59	0.16	0.87	0.30
2010	0.58	0.19	0.76	0.19	0.60	0.18	0.88	0.30
2011	0.50	0.23	0.50	0.17	0.44	0.19	0.78	0.33
2012	0.57	0.21	0.44	0.18	0.34	0.16	0.61	0.37
2013	*0.60	*0.19	0.62	0.22	0.52	0.24	0.83	0.51
2014	-	-	0.64	0.26	-	-	0.78	0.47
2015	-	-	0.53	0.14	-	-	0.65	0.27

Table 26 – Annual Mean Arsenic and Cadmium data 2008-2015

*** Data capture 19%**

From table 26 above, it is clear that annual mean concentrations for arsenic and cadmium at all monitoring locations fall well below the 4th Daughter Directive Target Values.

Annual mean data from all monitoring stations between 2008 and 2015 for **lead** is presented within table 27 below**. All results are expressed in ng/m^{-3}**

Year	Glais Primary School ❷	Coed-Gwilym Cemetery ❸	YGG Gellionnen ❹	Morriston Groundhog ❺
2008	10.21	8.0	9.04	20.5
2009	7.27	10.2	10.06	17.4
2010	9.1	8.4	8.4	18.1
2011	9.95	7.88	8.38	21.40
2012	10.0	6.20	6.0	11.6
2013	* 14.09	10.47	8.15	15.38
2014	-	9.2	-	16.71
2015	-	6.0	-	13.86

Table 27 – Annual Mean Lead data 2008-2015

* Data capture 19%

From the data available within table 27, it is clear that annual mean concentrations for lead at all monitoring locations fall well below the 0.25ug/m^3 required under the Air Quality (Amendment) (Wales) Regulations 2002 to be achieved by the 31st December 2008

PAH data analysis/ratification from the monitoring site within the compound of the 30m meteorological mast at Cwm Level Park, Landore has continued throughout 2015. Results of all compounds measured from 2007 to December 2015 can be found by following link at:

http://uk-air.defra.gov.uk/data/non-auto-data?site_id=SWALP&network=paha&s=View+Site#site_id=SWALP&view=data - select the year i.e. 2015 and the pollutant of interest from the drop down list – each pollutant is displayed individually. Please note that PAH Digitel (solid phase) should be selected in the PAH Network dropdown box. The ability to download the monthly data exists via the “Download this data as CSV” link at the bottom right of the data table on display.

2.4 Summary of Compliance with AQS Objectives

The City & County of Swansea has measured concentrations of nitrogen dioxide during 2015 above the annual mean objective. However these are not at relevant exposure locations outside of the existing **Swansea Air Quality Management Area 2010.**

3 New Local Developments

3.1 Road Traffic Sources

Whilst the report guidance/template indicates that details should only be provided of new road traffic sources identified since the last Updating and Screening Assessment, it is thought worthwhile to repeat and update these details from those contained within the City & County of Swansea's USA 2012. This view is substantiated by the knowledge that over the past years, numerous enquiries have been received from developers and other professionals requesting sight of the latest Updating Screening Assessment. Given this view, the details presented have been updated from those submitted within all USA's 2012 onwards. This rational is also followed elsewhere within this Progress Report.

3.1.1 Narrow Congested Streets with Residential Properties Close to the Kerb

In order to consider which streets fell within the definition of narrow congested streets with a traffic flow of 5000 vehicles per day,[35] the emissions database (EDB) which has been under development over the last several years was first examined. All road links within the EDB (circa 15,000) were exported into an Excel worksheet and index by the Annual Average Daily Traffic flow (AADT). Details held were examined where the AADT for individual road links was above 4,500 vehicles. This approach was taken as numerous counts from temporary or short duration surveys were held i.e. 1 week duration, where, underestimates of the flow could feasibly be possible due to the time of the year the survey was undertaken i.e. during the school holidays. Once individual road links were identified they were then cross referenced with those roads within the then Hafod Air Quality Management Area and discounted[36] from further consideration.

[35] LAQM.TG(09) USA Checklist Box 5.3 – A1 Narrow congested streets with residential properties close to the kerb
[36] LAQM.TG(09) USA Checklist Box 5.3 – (A) Overview

Numerous road links were identified with flows in excess of an AADT of 4,500 but, these roads were discounted as they did not fit the fit the definition of a narrow congested street with residential properties within 2m of the carriageway on at least one side of the road.

Following this exercise, the streets listed below within table 28 were identified. These roads were not previously thought likely to present problems with the nitrogen dioxide annual mean objective but were brought back into the scope of assessment due to the AADT requirement. The identified roads suffer congestion as defined within LAQM [37] to one extent or another mainly due to parked vehicles and restricted movements.

Road Name	Area
Hebron Road	Clydach
High Street	Clydach
Lone Road	Clydach
Vardre Road	Clydach
Chemical Road	Morriston / Cwmrhydyceirw
Cwmrhydyceirw Road	Cwmrhydyceirw
Alexandra Road	Gorseinon
Belgrave Road	Gorseinon
Courtney Street	Manselton
Clyndu Street	Morriston
Morfydd Street	Morriston
Parry Road	Morriston
Newton Road	Mumbles
Highpool Lane	Newton
Parkmill Road	Parkmill
Beach Road	Penclawdd
Blodwen Terrace	Penclawdd
Sea View	Penclawdd
Station Road	Penclawdd
Bolgoed Road	Pontarddulais
St Teilo Crescent	Pontarddulais
Water Street	Pontarddulais
Carnglas Road	Tycoch

Table 28 – Identified narrow Streets with AADT > 5000

[37] LAQM.TG(09) USA Checklist Box 5.3 – A1 Narrow congested streets approach page 5-10

Monitoring has found that annual mean concentrations are below the objective level at the majority but not at all of the identified locations for the complete years of monitoring undertaken. Therefore, further monitoring has ceased at those sites that had exhibited bias corrected annual means concentrations consistently below 30ug/m^3.

However, there were some notable exceptions, mainly Newton Road in Mumbles. The situation at Newton road has been discussed within previous reporting and the situation has been updated within this report. In summary, full compliance is now being seen at all sites along Newton Road.

Monitoring within the Pontarddulais area has ceased as from the returned annual means it is apparent that the major retail store development has not created conditions where any site has exceeded the nitrogen dioxide annual mean objective of 40ug/m^3.

Monitoring commenced during 2012 at additional sites within the Gorseinon area. A request was received from the Traffic Management Group Leader to assess the impact of a traffic calming scheme designed to reduce and remove queuing traffic along High Street, Gorseinon and direct traffic down adjacent narrow residential streets. This work ceased during early 2014 as all locations remain below the nitrogen dioxide annual mean objective.

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

Assessments within the city centre have already commenced following the introduction of the Metro scheme and associated changes to the city centre road network and policy initiatives' to attract people to live within the city centre. The monitoring details are included within section 2.3 above and the results contained within table 11.

From the passive NO_2 tube survey work undertaken within the city centre during 2010/2011, several locations were showing the potential to exceed the 1-hour mean objective. In particular, sites 126 and 127 along The Kingsway, Swansea indicated during 2010 annual mean concentrations exceeding 60ug/m^3 and therefore exceedances of the 1-hour NO_2 objected were thought likely.[38] These locations are either close to, or adjacent to, café environments situated on the pavement area alongside the busy roadway. However, during 2015, whilst concentrations remain above the annual mean objective at numerous sites within the city centre (see map 22 above) there has been no indication that exceedance of the 1-hour objective was likely to have been observed. The authority has increased the number of monitoring locations along High Street, Orchard Street, Castle Street and the Kingsway during 2014 and 2015 due to the regeneration proposals for the city centre. This initiative intends to provide additional dwellings within the city centre to provide additional footfall and therefore economic activity within the city centre.

In terms of LAQM it could therefore now be argued, that relevant exposure no longer exists at these locations along the Kingsway. This view is tempered by the knowledge that relevant exposure does exist at locations along the Kingsway in the form of a development comprising of student flats opposite the café environment and another block of flats approximately 50 meters on the same side of the dual carriageway that are yet to be occupied. It has proved impossible to directly monitor at the student flats location as the development has taken place above an existing retail food outlet and directly outside a series of bus stops that presents no ideal monitoring points.

Concerns also exist for sections of High Street that fall outside of the existing Swansea AQMA 2010 exceeding the NO_2 annual mean objective. Numerous café type environments also now exist along The Kingsway and Westway where the 1-hour exposure objective may be relevant.

Planning Applications received and those proposed for numerous sites along High Street are focusing on introducing residential dwellings in the form of flats into this once commercial area. Other proposals along High Street have not as yet

[38] Laxen et al July 2003 - Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites

progressed to the application stage to convert former office/vacant commercial premises mainly at 1st floor level into living accommodation.

The city centre will see considerable change in the coming years following the review into the road network/layout currently being undertaken. The probable outcome will see considerable alteration of the recently modified road network – in particular along the Kingsway / Orchard Street and High Street routes. It is too early in the process to comment further as all options remain open at present. This review is looking into the commercial activities within the city centre and aims to increase footfall within the city centre by increasing the number of dwellings within the city centre

The authority's intentions with regard to the city centre area are outlined within section 8 – Conclusions and Proposed Actions

3.1.3 Roads with a High Flow of Buses and/or HGV's.

The authority now operate 52 GPRS traffic counters that have been configured to produce a vehicle classification split into the EUR 6 basic categories as detailed below within table 29. Their location can be seen within Annexe 6. These tend to be within the lower Swansea Valley area in and around the Swansea AQMA 2010 but latest deployment have seen this provision expand into other areas, mainly around some of the busier major traffic junctions. Funding is being sought to once again expand this monitoring program but within the current financial climate, significant, rapid expansion is unlikely with any expansion more likely to reflect that seen during recent years with just the addition of two or three sites.

Vehicle class:	Description
0	Unclassified vehicles
1	Motorcycles
2	Cars or light Vans
3	Cars or light Vans with Trailer
4	Heavy Van, Mini bus, L/M/HGV
5	Articulated lorry, HGV+Trailer
6	Bus

Table 29 – EUR6 Classification scheme

Data from the ATC network has been analysed for the years 2005 – 2015 for the basic three categories from the EUR6 classification employed that are required to produce the composition of flow. These details are provided separately for EUR6 classification categories 4-6 below within tables 30-32. Table 33 summarises the total % HDV flows.

Class 4 L/M/HGV	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Site 1	4	5.1	4.8	4.1	3.5	3.6	3.8	**4.1**	4.4	4.4	4.4
Site 2	5.9	6.4	6.1	6.6	6.1	6.2	6.4	**6.2**	6.3	6.4	6.6
Site 3	3.2	4.3	4.5	7.4	16.2	4.7	4.8	**5.0**	5.2	5.4	6
Site 4	3.9	4.4	4.4	4.4	4.4	4.5	4.7	**4.7**	4.9	4.8	4.9
Site 5	5.3	5.6	5.8	5.9	5.4	5.6	5.5	5.8	5.5	5.9	6
Site 6	6.3	6.9	7.4	7.4	7.2	7.5	7.4	7.4	7.5	7.5	7.6
Site 7	3.8	4.2	4.5	4.8	4.6	4.7	4.8	4.9	5.2	4.9	4.8
Site 8	30	29.9	29.8	30.3	29.8	29.9	30.6	30	30.3	31.3	27.2
Site 9	6.2	6.4	6.6	6.2	5.8	6	6.2	6.2	6.5	6.8	6.5
Site 10	4.8	4.8	4.8	4.6	4.3	4.3	4.4	4.4	4.5	4.5	4.5
Site 11	5.8	6	6.5	6.9	6.3	6.9	6.5	6.9	6.9	7.1	7.5
Site 12	4.7	5.1	4.9	4.8	4.6	4.7	4.6	4.6	4.9	5	4.7
Site 13	4.5	4.7	4.6	4.5	4.3	4.6	4.5	4.3	4.5	4.6	4.7
Site 14	5.2	5.6	5.7	5.9	5.4	5.6	5.6	5.7	5.8	5.9	6
Site 15	13.5	8.4	14.4	6.1	6.1	6	6.2	6.1	6	6	6.1
Site 16	4.7	4.6	4.8	4.8	4.6	4.6	4.7	4.7	4.8	5	5.3
Site 17	2	4.3	4.1	5.3	5.1	5.3	5.4	5.4	5.5	5.7	5.9
Site 18	11	6.7	6.4	6.3	6.5	6.5	6.5	6.5	6.7	6.4	6.1
Site 19	5.4	5.6	5.7	5.7	5.4	5.6	5.7	5.6	5.7	5.7	5.7
Site 20	5.7	4.9	4.6	4.3	3.9	4.2	4.3	4.2	4	4.3	4.2
Site 21	5.8	6.4	6.5	6.7	6.5	6.5	6.7	6.8	6.8	6.9	7.1
Site 22	6.2	6.9	7	6.9	6.7	6.1	5.8	5.3	5.2	5.1	5.5
Site 23	4.5	4.8	5	4.9	4.5	4.6	4.7	4.8	4.9	5	5
Site 24	5.5	5.7	5.7	5.5	5.5	5.9	6.1	6	6.1	6	6.3
Site 25	4.1	4.5	6.2	6.0	5.6	5.9	6.0	5.8	6.1	6.2	6.5
Site 26	5.1	5.5	5.7	5.6	5.4	5.6	5.9	5.9	6.1	6.2	6.4
Site 27	4.5	5.1	5.5	5.7	15.6	4.5	4.6	4.4	4.5	4.7	4.8
Site 28	4.3	4.8	4.9	4.9	4.6	4.4	4.6	4.6	4.8	4.9	5
Site 29	4.4	4.7	4.9	4.7	4.7	4.8	5	4.8	4.8	5.2	5.2
Site 30	12.6	6.6	4.1	4.2	3.9	4.2	4.1	4.2	4.4	4.3	4.5
Site 31	4.1	4.4	4.6	4.7	4.7	4.8	5.1	5.1	4.7	4.7	5
Site 32	16.8	8.2	3.8	3.8	3.9	3.9	3.9	4.1	4.3	4.1	4.4
Site 33	3.9	4.2	4.4	4.4	4.5	4.6	4.5	4.6	4.6	4.6	4.7
Site 34	13.2	6.8	4.3	4.4	4.4	4.2	4.1	4.1	4	4.1	4.2
Site 35	37.5	13.9	5.3	5.7	4.8	5	5.1	5.2	5.4	5.7	5.4
Site 36	-	-	-	-	-	-		-	-		
Site 37	3.8	3.4	3.8	3.9	3.5	3.6	3.8	3.5	3.6	5.2	7.5
Site 38	5.9	6.4	6.5	6.3	5.8	8.6	18.8	7	6	6.4	6.1
Site 39	4.5	4.7	4.6	5.2	4.9	5.2	5	4.8	4.7	4.5	4.7
Site 40	3.1	3.5	3.8	3.9	4.0	3.8	3.9	3.9	4	4.1	4.4
Site 41	2.9	2.9	2.7	3.4	3.0	3.1	3.2	3.1	3.1	3.2	3.1
Site 42	10.9	6.9	5.2	5.1	5.0	4.8	4.9	5	5.1	5.3	5.2
Site 43	4.8	5.1	5.6	5.6	5.3	5.5	5.8	6	6.1	5.9	6
Site 44	-	-	6.1	6.1	5.8	6.0	6.1	6.0	6.2	6.1	6.5
Site 50	-	-	-	-	-	-	-	-	3.7	3.6	3.6
Site 51	-	-	-	-	-	-	-	-	4.2	4.3	4.5
Site 52	-	-	-	-	-	-	-	-	4.5	4.4	4.2
Site 53	-	-	-	-	-	-	-	-	4.7	4.5	4.7
Site 54	-	-	-	-	-	-	-	-	6.2	6.2	6.4
Site 55	-	-	-	-	-	-	-	-	7.0	7.1	7.1
Site 56	-	-	-	-	-	-	-	-	-	-	6.1
Site 57	-	-	-	-	-	-	-	-	-	-	6.6

Table 30– EUR6 Classification scheme 2005-2015 Class 4

***Comments -* Site 8** located on Morfa Road, The Stand is directly outside the access road to the main City & County of Swansea transport depot and also to a small industrial estate further up Morfa Road, hence the consistent high percentage composition for this classification. **Site 35** suffered configuration problems during 2005/2006 which failed to take into account the possibility of parked vehicles affecting the classification. This was identified but not fully understood as to why the configuration issues with loop tuning only affected this Class 4 scheme until sometime later. **Site 38** – it is not clear why the sudden increase during 2011 occurred but major gas main replacement works were undertaken along Carmarthen Road (outbound) causing significant delays along Carmarthen Road with traffic possibly diverting to avoid delays.

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

Class 5 Artic HGV + Trailer	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Site 1	0	0.2	0	0	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0
Site 3	0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0	0
Site 4	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Site 5	0	0.3	0.3	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.3
Site 6	0.6	0.8	0.8	0.8	0.7	0.4	0.6	0.5	0.5	0.4	0.4
Site 7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Site 8	2.9	1.9	1.1	1.8	2.1	2.3	2.4	2.2	1.5	0	1.1
Site 9	0.5	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 10	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 11	0	0	0	0	0.0	0	0	0	0	0	0
Site 12	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Site 13	0.4	0.4	0.4	0.2	0.2	0.2	0.4	0.2	0.2	0.2	0.2
Site 14	0.2	0.3	0.3	0.1	0.2	0.3	0.3	0.2	0.2	0.3	0.1
Site 15	0.3	0.1	0.3	0.1	0.2	0.5	0.4	0.4	0.5	0.4	0.3
Site 16	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 17	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 18	0.8	0.2	0.4	0.2	0.5	0.6	0.6	0.5	0.5	0.4	0.5
Site 19	0.4	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 20	0.8	0.7	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 21	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 22	0.6	0.4	0.4	0.4	0.2	0.4	0.3	0.2	0.2	0.2	0.2
Site 23	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.2	0.2
Site 24	0	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Site 25	1.1	0.5	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Site 26	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 27	0.3	0.3	0.2	0.4	0.3	0.4	0.2	0.2	0.2	0.2	0.2
Site 28	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.2
Site 29	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3
Site 30	0.3	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2
Site 31	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 32	0	0.1	0	0	0.0	0	0	0.2	0.2	0	0
Site 33	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 34	0.6	0.3	0.2	0.1	0.1	0.8	0.1	0.1	0.1	0.1	0.1
Site 35	1.2	0.7	0.2	0.4	0.2	0.2	0.4	0.4	0.4	0.4	0.4
Site 36	-	-	-	-	-	-	-	-	-	-	-
Site 37	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.3	0.4	0.8	1.3
Site 38	0	0.3	0	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.3
Site 39	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3
Site 40	0	0	0	0	0.0	0	0	0	0	0	0
Site 41	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2
Site 42	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 43	1.1	0.9	0.9	1	0.8	1	0.9	1	1	1	1.1
Site 44	-	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 50	-	-	-	-	-	-	-	-	0.0	0	0
Site 51	-	-	-	-	-	-	-	-	0.4	0.4	0.3
Site 52	-	-	-	-	-	-	-	-	0.2	0.2	0.2
Site 53	-	-	-	-	-	-	-	-	0.1	0.1	0.1
Site 54	-	-	-	-	-	-	-	-	0.0	0.2	0.2
Site 55	-	-	-	-	-	-	-	-	1.2	1.1	1.2
Site 56	-	-	-	-	-	-	-	-	-	-	0
Site 57	-	-	-	-	-	-	-	-	-	-	0.3

Table 31 – EUR6 Classification scheme 2005-2015 Class 5

Comments - Again, **Site 8** is located on Morfa Road, The Stand directly outside the access road to the main City & County of Swansea transport depot and also to a small industrial estate further along Morfa Road, hence the consistent high percentage composition for this classification.

There are some sites (Sites 2,3, 4,11,32 and Site 40 that see consistent negligible artic trailer flow – these sites tend to be within areas that have no reason to see these type of vehicles within the area

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

Class 6 Bus	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Site 1	0.3	1.2	1.6	1.4	1	0.8	0.6	0.4	0.2	0.2	0.2
Site 2	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.2
Site 3	0.2	0.5	0.5	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0
Site 4	0.3	0.5	0.7	0.7	0.7	0.7	0.5	0.2	0.0	0	0
Site 5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Site 6	1.3	1.8	1.9	1.7	1.0	0.6	0.3	0.2	0.2	0.1	0.1
Site 7	0.4	0.6	0.8	1	0.7	1.4	0.6	0.5	0.4	0.2	0.4
Site 8	1.4	0	1.1	0	0.0	0	0	0	0	0	1.1
Site 9	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.4
Site 10	0.3	0.7	0.9	0.5	0.2	0.2	0.2	0.4	0.5	0.6	1.1
Site 11	0.8	2.7	2.9	3.4	2.9	2.9	2.9	2.9	3.4	3.5	3.5
Site 12	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.4
Site 13	0.4	0.2	0.2	0.4	0.4	0.2	0.2	0.2	0.2	0.4	0.4
Site 14	1.3	2	2.2	1.9	1.3	1	0.9	0.8	0.6	0.6	0.7
Site 15	1	1.1	1.2	1.1	0.9	0.6	0.5	0.5	0.5	0.4	0.7
Site 16	0.2	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.4
Site 17	0.2	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Site 18	1.6	2.1	2.1	1.7	1.3	1.3	1	0.9	0.9	1.1	0.8
Site 19	1.2	2.5	3.3	3.6	3.3	3.1	2.9	3	3	3	3
Site 20	1.1	1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1
Site 21	0.3	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3
Site 22	3.2	6.7	8.4	8.7	7.4	6.5	5.6	5.3	5.9	6.4	6.4
Site 23	0.4	0.7	0.9	0.9	0.8	0.8	0.8	0.9	1.1	1.3	1.3
Site 24	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.8	0.8	0.8
Site 25	0.7	0.5	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9
Site 26	0.4	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.4
Site 27	0.4	0.5	0.6	0.6	0.6	0.4	0.4	0.3	0.4	0.4	0.4
Site 28	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 29	0.3	1.3	1.7	1.7	1.7	1.6	1.4	1.2	1.8	1.2	1.5
Site 30	0.8	0.8	0.8	0.8	0.8	0.6	0.7	0.7	0.7	0.7	0.8
Site 31	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.3
Site 32	1.3	1.3	1.4	1.4	1.2	1.2	1	1	1	0.9	0.9
Site 33	0.5	1.1	1.5	1.3	1.3	1.3	1	1.1	0.9	1	1
Site 34	1.5	1.5	1.7	1.7	1.6	0.9	0.3	0.3	0.3	0.4	0.4
Site 35	2	1.6	1.5	1.4	1.2	1	0.9	1	1	0.9	1.2
Site 36	-	-	-	-	-	-	-	-	-	-	-
Site 37	0.9	0.8	0.7	0.8	0.8	0.7	0.8	0.6	0.8	1.2	1.6
Site 38	0.7	1.6	2.1	1.8	1.0	1.2	1.8	0.8	0.8	0.8	1.1
Site 39	0.2	0.4	0.7	0.8	0.8	0.9	0.7	0.8	0.9	0.9	0.9
Site 40	0.3	0.7	0.7	0.7	0.7	0.8	0.5	0.5	0.5	0.5	0.5
Site 41	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.6	0.4
Site 42	0.8	1	1.1	1.1	1.1	1	0.8	0.8	0.9	0.8	0.9
Site 43	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.5
Site 44	-	-	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9
Site 50	-	-	-	-	-	-	-	-	0.4	0.4	0.4
Site 51	-	-	-	-	-	-	-	-	0.7	0.8	1
Site 52	-	-	-	-	-	-	-	-	1.1	1.3	1.3
Site 53	-	-	-	-	-	-	-	-	0.3	0.3	0.3
Site 54	-	-	-	-	-	-	-	-	0.7	0.9	0.7
Site 55	-	-	-	-	-	-	-	-	0.4	0.3	0.6
Site 56	-	-	-	-	-	-	-	-	-	-	0
Site 57	-	-	-	-	-	-	-	-	-	-	4.1

Table 32 – EUR6 Classification scheme 2005-2015 Class 6

Comments –

Site 11 exhibits a relatively low AADT but it is evident that the fraction of class 6 buses is “significant” within the overall flow. This increased following the opening of the Liberty Stadium and Morfa Shopping complex nearby.

Site 22 has shown increased composition of buses following the developments mentioned above and the fact that all bus services now use High Street (stopping outside the main railway station) as the primary access route leading into the city centre. This effect can also be seen at **site19** Carmarthen Road which leads directly into High Street

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

HDV as % of Traffic Flow	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Site 1	4.3	6.5	6.4	5.5	4.7	4.6	4.6	4.7	4.8	4.8	4.8
Site 2	6.3	6.6	6.3	6.9	6.4	6.6	6.7	6.4	6.7	6.8	6.8
Site 3	3.4	4.8	5	8	17	5.3	5.4	5.2	5.4	5.6	6
Site 4	4.2	4.9	5.1	5.1	5.1	5.2	5.2	4.9	4.9	4.8	4.9
Site 5	5.3	5.9	6.1	6.2	5.7	5.9	5.5	6.1	5.8	6.2	6.3
Site 6	8.2	9.5	10.1	9.9	8.9	8.5	8.3	8.1	8.2	8	8.1
Site 7	4.3	4.9	5.4	5.9	5.4	6.2	5.5	5.5	5.7	5.2	5.3
Site 8	34.3	31.8	32	32.1	31.9	32.2	33	32.2	31.8	31.3	29.4
Site 9	7	7.4	7.4	7	6.6	6.8	7	6.8	7.1	7.4	7.3
Site 10	5.5	5.7	5.9	5.3	4.7	4.7	4.8	5	5.2	5.3	5.8
Site 11	6.6	8.7	9.4	10.3	9.2	9.8	9.4	9.8	10.3	10.6	11
Site 12	5.5	5.4	5.2	5	4.8	4.9	4.8	4.8	5.3	5.3	5.2
Site 13	5.3	5.3	5.2	5.1	4.9	5	5.1	4.7	4.9	5.2	5.3
Site 14	6.7	7.9	8.2	7.9	6.9	6.9	6.8	6.7	6.6	6.8	6.8
Site 15	14.8	9.6	15.9	7.3	7.2	7.1	7.1	7	7	6.8	7.1
Site 16	5.1	5.1	5.3	5.4	5.1	5	5.1	5.1	5.3	5.5	5.9
Site 17	2.4	4.9	4.7	5.9	5.6	5.7	5.8	5.8	5.9	6.1	6.3
Site 18	13.4	9	8.9	8.2	8.3	8.4	8.1	7.9	8.1	7.9	7.4
Site 19	7	8.3	9.2	9.4	8.9	8.9	8.8	8.8	8.9	8.9	8.9
Site 20	7.6	6.6	6	5.7	5.2	5.5	5.6	5.5	5.3	5.7	5.6
Site 21	6.4	7.1	7.2	7.2	7	7	7.2	7.2	7.2	7.3	7.6
Site 22	10	14	15.8	16	14.3	13	11.7	10.8	11.3	11.7	12.1
Site 23	5.1	5.7	6.1	6	5.4	5.6	5.7	5.8	6.1	6.5	6.5
Site 24	6.1	6.6	6.6	6.4	6.6	7	7.2	7.2	7.2	7.1	7.4
Site 25	5.9	5.5	7.4	7.1	6.7	7.2	7.3	7.1	7.4	7.5	7.8
Site 26	5.9	6.2	6.5	6.4	6	6.3	6.6	6.6	6.7	6.8	7
Site 27	5.2	5.9	6.3	6.7	6.5	5.3	5.2	4.9	5.1	5.3	5.4
Site 28	4.9	5.5	5.6	5.6	5.4	5.2	5.4	5.4	5.6	5.7	5.6
Site 29	5	6.2	6.8	6.6	6.6	6.6	6.6	6.2	6.9	6.6	7
Site 30	13.7	7.6	5	5.1	4.8	5	4.9	5.1	5.3	5.2	5.5
Site 31	4.6	5.1	5.3	5.4	5.4	5.5	5.8	5.6	5.2	5.2	5.5
Site 32	18.1	9.6	5.2	5.2	5.1	5.1	4.9	5.3	5.5	5	5.3
Site 33	4.6	5.5	6.1	5.9	6	6.1	5.7	5.9	5.7	5.8	5.9
Site 34	15.3	8.6	6.2	6.2	6.1	5.9	4.5	4.5	4.4	4.6	4.7
Site 35	40.7	16.2	7	7.5	6.2	6.2	6.4	6.6	6.8	7	7
Site 36	-	-	-	-	-	-	-	-	-	-	-
Site 37	5.1	4.6	5	5.2	4.8	4.8	5.2	4.4	4.8	7.2	10.4
Site 38	6.6	8.3	8.6	8.4	7.1	10.1	21.1	8.1	7.1	7.5	7.5
Site 39	4.9	5.4	5.6	6.3	6	6.4	6	5.8	5.8	5.7	5.9
Site 40	3.4	4.2	4.5	4.6	4.7	4.6	4.4	4.4	4.5	4.6	4.9
Site 41	3.3	3.3	3.1	3.8	3.5	3.7	3.8	3.7	3.8	4.1	3.7
Site 42	12.1	8.1	6.5	6.4	6.3	6	5.9	6	6.2	6.3	6.3
Site 43	6.3	6.4	6.9	7	6.5	6.9	7	7.3	7.4	7.3	7.6
Site 44	-	-	7.4	7.4	7.1	7.4	7.4	7.3	7.5	7.4	7.8
Site 50	-	-	-	-	-	-	-	-	4.1	4	4
Site 51	-	-	-	-	-	-	-	-	5.3	5.5	5.8
Site 52	-	-	-	-	-	-	-	-	5.8	5.9	5.7
Site 53	-	-	-	-	-	-	-	-	5.1	4.9	5.1
Site 54	-	-	-	-	-	-	-	-	6.9	7.3	7.3
Site 55	-	-	-	-	-	-	-	-	8.6	8.5	8.9
Site 56											6.1
Site 57											11

Table 33– HDV composition from EUR6 Classification scheme 2005-2015

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

LAQM.TG(16) mentions a threshold of 2500 HDV's/day where exposure is within 10m from the kerb or 20m from the kerb in conurbations >2 million inhabitants In order to begin a screening assessment[39].

The authority calculate the AADT (annual average daily traffic) as well as the AWDT – which can be described as the annual working week(ly) average traffic i.e. Monday-Friday.

In order to calculate the requirement to assess the likely number of HDV's the AWDT is used and multiplied by the total HDV % presented in table 33 above to approximate the number of daily HDV vehicles. The AWDT has been used as it is thought that this would be more representative of working day conditions rather than inclusion of weekends where HGV content is thought to be lower. The approximate number of HDV vehicles for 2015 is presented within table 34 below.

[39] LAQM.TG(16) Table 7.1 – Screening Assessment of Road Traffic Sources page 7-4

2015	HDV as % of Traffic Flow	AADT	AWDT	Approx. Number of HDV's from AWDT
Site 1	4.8	11424	12144	583
Site 2	6.8	14112	15144	1030
Site 3	6	13296	14160	850
Site 4	4.9	10368	11064	542
Site 5	6.3	7224	7704	485
Site 6	8.1	16152	17040	1380
Site 7	5.3	20520	22008	1166
Site 8	29.4	2208	2832	833
Site 9	7.3	13320	14184	1035
Site 10	5.8	21192	22536	1307
Site 11	11	4152	4368	480
Site 12	5.2	19872	21384	1112
Site 13	5.3	11832	13320	706
Site 14	6.8	16416	17280	1175
Site 15	7.1	21312	22752	1615
Site 16	5.9	26424	27936	1648
Site 17	6.3	29424	31152	1963
Site 18	7.4	15864	16752	1240
Site 19	8.9	20328	21144	1882
Site 20	5.6	32640	34512	1933
Site 21	7.6	30840	33000	2508
Site 22	12.1	10560	10632	1286
Site 23	6.5	22104	23520	1529
Site 24	7.4	9192	9816	726
Site 25	7.8	13320	14088	1099
Site 26	7	22248	23616	1653
Site 27	5.4	21528	23016	1243
Site 28	5.6	12552	13344	747
Site 29	7	7920	8472	593
Site 30	5.5	20328	21768	1197
Site 31	5.5	13968	14496	797
Site 32	5.3	15264	16176	857
Site 33	5.9	20736	21744	1283
Site 34	4.7	16392	17448	820
Site 35	7	11928	12480	874
Site 36	-	-	-	-
Site 37	10.4	42888	44880	4668
Site 38	7.5	8952	9600	720
Site 39	5.9	22536	23640	1395
Site 40	4.9	9312	9912	486
Site 41	3.7	26808	28608	1058
Site 42	6.3	15624	16728	1054
Site 43	7.6	30216	32856	2497
Site 44	7.8	12912	13728	1071
Site 50	4	6720	6768	271
Site 51	5.8	32544	34872	2023
Site 52	5.7	11424	12144	692
Site 53	5.1	22152	23424	1195
Site 54	7.3	10440	10872	794
Site 55	8.9	20616	22104	1967
Site 56	6.1	5136	5520	337
Site 57	11	7632	7392	813

Table 34– Approximate number of HDV vehicles from EUR6 Classification scheme 2015

Using this approach the only ATC sites that come near to the assessment threshold during 2015 are sites 21 and site 43. (site 37 has no relevant exposure that satisfies the criteria) Site 21 is on the Ffordd Cwm Tawe dual carriageway between Landore and Morriston. Site 43 is on the A483 link up to/from junction 47 of the M4. There are no receptor locations within 10m of the kerb at either site but there are receptor locations within 20m of the kerb at both sites. However, the population criteria (>2 million) does not apply to Swansea. There are therefore no qualifying receptor locations where the number of HDV's exceeds 2500.

Morfa Road falls within the development proposals of The Tawe Riverside Development Corridor. These proposals include residential developments northwards along the banks of the river Tawe, encompassing Morfa Road. These proposals have already seen the purchase and demolition of several commercial/industrial units in preparation for parts of the privately funded scheme. The economic downturn has not seen construction works commence but it is inevitable that works will commence at some stage in the coming years. It is open to debate at present as to how long the whole scheme will take to complete as it is inevitable that some commercial/industrial units will remain whilst development proceeds along Morfa Road.

As part of the aspiration to provide a "Morfa Distribution Route", forming part of the Tawe Riverside Corridor developments, the lower section of Morfa Road from the entrance to the authorities Pipehouse Wharf depot to its junction with New Cut Road has been widened and upgraded to a signal controlled junction, being completed during the early part of 2014. This work has meant that the ATC at site 8 has been removed during late 2013 and it was relocated during June 2014. Care has been taken to ensure the new chosen location is representative of its current location so that fair comparisons to the past/present traffic flows can be made whilst ensuring high data quality. This ATC will allow monitoring of the composition during the transition of the area from a commercial/industrial area to primarily, a residential area. Phase 2 of the Morfa Distributor Road commenced early spring 2014.

Site 22 High Street was approaching the 20% threshold in previous years but it should be noted that whilst relevant exposure exits within 10m along this section of High Street, the area already lies within the Hafod Air Quality Management Area as described above within section 3.3. However, again as described in section 3.3, concerns are growing in regard to the lower sections of High Street that fall outside of the Hafod AQMA that forms part of The Swansea Air Quality Management Area 2010.

Since the completion of the redevelopment works at the Quadrant Bus Station along Westway in the city centre, all bus routes now enter and egress the terminal along Westway. Residential properties exist along this route but due to funding restrictions there are no finances available to install ATC counters along Westway. Site 36 had already been identified as the proposed site at Westway but a recent investigation into real-time ATC provision has indicated that a minimum of three ATC sites will be required to monitor all lanes and movements.

The City and County of Swansea confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.1.4 Junctions

Guidance within LAQM.TG(09) box 5.3 Section A4 page 5-15 required the identification of all “busy” junctions. A busy junction was defined within LAQM.TG(09) as one with more than 10,000 vehicles per day. An additional requirement was to determine if there is relevant exposure within 10m of the kerb (Swansea’s population of approx. 240,000 does not take it into the major conurbation category where relevant exposure would be within 20m of the kerb). LAQM.TG(16) mirrors these requirements within Table 7.1 Screening Assessment of Road Traffic sources – Road Source Category 4 – Junctions page 7-4.

Whilst as stated within the 2nd round of review and assessment there were several junctions that it was thought would meet the traffic volumes required, it was not thought there were receptor locations within 10m of the kerb. However, this situation has now changed with the construction of the new SA1 junction along Fabian Way and the construction of the new Tesco access road /junction following the reconstruction and expansion of its outlet at Nantyffin Road, Llansamlet

Passive nitrogen dioxide measurements are already being made around several junctions mentioned within previous reporting and these data are included within section 2.3 above. However, following a review of the data monitoring has been scaled back around the Nantyffin Road area of Llansamlet as numerous sites have consistently returned bias corrected nitrogen dioxide annual means below 30ug/m^3. It is thought that to measure PM_{10} at these locations would provide more meaningful data in preference to DMRB calculations. It has proved to be not economically viable or practical to deploy Thermo FDMS PM_{10} analysers at these locations. Therefore, alternative real-time instruments had been sourced to undertake the monitoring works that are desirable. The instruments chosen were Met One Instruments Inc. E-Type sampler (http://www.metone.com/documents/esamplerParticulate.pdf) It is recognised that these were not true gravimetric or type approved instruments for use on the UK network but current guidance indicates that use of the near forwards light scattering technique was suitable for screening assessments. This coupled with their ease of deployment made them an ideal alternative in these situations. It has not been possible to progress this matter since the original comments within the 2nd round USA due to technical difficulties with the operation of the monitoring equipment. Whilst the infrastructure for the monitoring is now in place, the ETypes samplers proved unreliable in operation. Major problems have been experienced with pump failures and other operational issues. The plans to utilise these samplers has now changed and funding was provided to source a different analyser.

The unit chosen was the MetOne EBam PM_{10} [40] (similar in operation to the MetOne PM_{10} Bam1020) but not referenced for equivalency to the EU gravimetric method. As outlined within sections 2.1.8 – 2.1.12 five EBam PM_{10} units have been installed at :-

- Fforestfach Cross
- Uplands Crescent
- Sketty Cross
- Westway
- SA1 Junction Port Tennant Road

[40] http://www.metone.com/documents/E-BAM_Datasheet_Rev_Aug09.pdf

Monitoring results for 2015 are presented within tables 15 and 16 with charts 8-12 and Breuer Plots 5-9 providing additional information.

The remaining junctions with combined traffic volumes likely to be >10,000 AADT flow to be monitored by way of passive nitrogen dioxide diffusion tubes and/or PM_{10} measurements are:

a) Oystermouth Road
b) Llansamlet Cross
c) Quay Parade Bridges
d) Dyfatty Junction

Whilst it has been possible to report the results of the NO_2 monitoring around these junctions, reliable long term PM_{10} monitoring has not proved possible due to the issues described above. It is not known if/when funding will be available to permit installation of EBams at the four remaining locations listed above.

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

With the exception of the information provided above in section 3.3 in relation to the developments with the Morfa Distributor/Relief road the authority confirms there are no new//proposed roads within the authority's area.

The City and County of Swansea confirms that there are no new/proposed roads within the authority's area.

3.1.6 Roads with Significantly Changed Traffic Flows

Data is available from 2006-2015 but only data from 2013 is presented below within tables 35-38 to assess trends with the composition of the traffic flows being measured. Class 0 is intended to provide evidence of data capture as should problems be experienced within the traffic counter with classification then vehicles would manifest within this category. As can be seen within tables 35-38 very few operational issues have been experienced. This does not account for downtime where the loops have been completely severed by either resurfacing works or gas main replacement works. In these situations data loss at the ATC site is total.

LAQM.TG(16) mentions a definition of roads with significantly changed traffic flows as those with a 25% increase on roads with greater than 10,000 vehicles per day, where exposure is within 10m from the kerb or 20m from the kerb in conurbations >2 million inhabitants[41]. In order to begin a screening assessment the above criteria has to be satisfied. The Swansea conurbation does not exceed 2 million inhabitants so the assessment is taken to be within 10m of the kerb. From the data summarised within table 39 below for sites not affected by operational issues, no site has seen this rate of growth.

[41] LAQM.TG(16) table 7.1 road source category 6 page 7-5

2013	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0.0	1	93.9	0.2	4.4	0.2	0.2	11424	12192
Site 2	0.0	0.8	92.4	0.2	6.3	0.2	0.2	14184	15240
Site 3	0.0	0.4	94.1	0.2	5.2	0.0	0.2	13008	13848
Site 4	0.0	0.7	94.4	0.0	4.9	0.0	0.0	9840	10440
Site 5	0.0	1.0	93.2	0.0	5.5	0.3	0.0	7416	7920
Site 6	0.0	1.4	90.3	0.2	7.5	0.5	0.2	15336	16176
Site 7	0.0	0.8	93.4	0.1	5.2	0.1	0.4	20376	21792
Site 8	0.0	6.1	62.1	0	30.3	1.5	0	1584	2040
Site 9	0.0	0.8	92	0.2	6.5	0.4	0.2	12552	13368
Site 10	0.0	0.4	93.6	0.8	4.5	0.2	0.5	20376	21720
Site 11	0.0	0.6	89.1	0	6.9	0	3.4	4200	4368
Site 12	0.0	0.7	93.9	0.1	4.9	0.1	0.3	18072	19488
Site 13	0.0	0.8	94.1	0.2	4.5	0.2	0.2	12192	13848
Site 14	0.0	0.9	92.2	0.3	5.8	0.2	0.6	15648	16488
Site 15	0.0	0.9	91.9	0.1	6	0.5	0.5	18096	19272
Site 16	0.0	0.7	93.8	0.2	4.8	0.2	0.3	26496	28032
Site 17	0.0	0.7	93.2	0.2	5.5	0.2	0.2	29064	30816
Site 18	0.0	2.5	89.3	0.2	6.7	0.5	0.9	15504	16416
Site 19	0.0	0.8	90.2	0.1	5.7	0.2	3	21048	22032
Site 20	4.5	1	89	0.2	4	0.4	0.9	32232	34128
Site 21	0.0	0.7	91.9	0.2	6.8	0.2	0.2	29736	31896
Site 22	0.0	0.5	88.2	0	5.2	0.2	5.9	9792	9936
Site 23	0.0	0.6	93.2	0.1	4.9	0.1	1.1	21168	22584
Site 24	0.0	2.1	90.6	0	6.1	0.3	0.8	8976	9624
Site 25	0.0	0.9	91.6	0.2	6.1	0.4	0.9	13464	14280
Site 26	0.0	0.4	92.6	0.2	6.1	0.2	0.4	22056	23472
Site 27	0.0	0.3	93.8	0.7	4.5	0.2	0.4	21456	22944
Site 28	0.0	0.4	93.5	0.6	4.8	0.4	0.4	12600	13368
Site 29	1.3	0.8	91.3	0.3	4.8	0.3	1.8	9408	10008
Site 30	0.0	0.9	93.5	0.2	4.4	0.2	0.7	20256	21624
Site 31	0.0	0.8	93.7	0.3	4.7	0.2	0.3	14784	15336
Site 32	0.0	0.5	93.9	0.2	4.3	0.2	1	14568	15288
Site 33	0.0	0.8	93.3	0.1	4.6	0.2	0.9	20640	21576
Site 34	0.0	0.4	93.9	1.2	4	0.1	0.3	16632	17664
Site 35	0.0	1.3	92	0	5.4	0.4	1	12528	13128
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0.0	1.1	93	1	3.6	0.4	0.8	37824	39528
Site 38	0.0	0.5	91	1.4	6	0.3	0.8	8760	9432
Site 39	0.0	1.1	92.9	0.2	4.7	0.2	0.9	22032	23112
Site 40	0.0	0.7	94.8	0	4	0	0.5	9744	10416
Site 41	0.0	0.6	95.4	0.3	3.1	0.3	0.4	28292	30168
Site 42	0.0	0.8	92.9	0.2	5.1	0.2	0.9	15168	16296
Site 43	0.0	1.3	90.7	0.5	6.1	1	0.3	28224	30672
Site 44	0.0	0.9	91.4	0.2	6.2	0.4	0.9	12792	13608
Site 50	0.0	1.5	93.8	0.7	3.7	0.0	0.4	6576	6552
Site 51	0.0	0.9	93.7	0.1	4.2	0.4	0.7	32184	34416
Site 52	0.0	0.6	93.3	0.2	4.5	0.2	1.1	11112	11832
Site 53	0.0	0.7	93.7	0.5	4.7	0.1	0.3	20904	22152
* Site 54	0.0	2.9	90.1	0.0	6.2	0.0	0.7	6600	6792
* Site 55	0.0	0.6	90.7	0.2	7.0	1.2	0.4	12408	13272

Table 35 – GPRS ATC Classification split 2013

2014	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0	1	94	0.2	4.4	0.2	0.2	0	1
Site 2	0	0.8	92.2	0.2	6.4	0.2	0.2	0	0.8
Site 3	0	0.6	93.9	0	5.4	0	0.2	0	0.6
Site 4	0	0.7	94.5	0	4.8	0	0	0	0.7
Site 5	0	1	92.8	0	5.9	0.3	0	0	1
Site 6	0	1.5	90.3	0.1	7.5	0.4	0.1	0	1.5
Site 7	2.5	0.8	91.3	0.1	4.9	0.1	0.2	2.5	0.8
Site 8	0	0	68.8	0	31.3	0	0	0	0
Site 9	0	0.8	91.6	0.2	6.8	0.4	0.2	0	0.8
Site 10	0	0.6	93.2	0.8	4.5	0.2	0.6	0	0.6
Site 11	0	0.6	88.8	0	7.1	0	3.5	0	0.6
Site 12	0	0.7	93.8	0.1	5	0.1	0.2	0	0.7
Site 13	0	0.8	93.8	0.2	4.6	0.2	0.4	0	0.8
Site 14	0	1	91.9	0.3	5.9	0.3	0.6	0	1
Site 15	0	0.9	92.1	0.1	6	0.4	0.4	0	0.9
Site 16	0	0.7	93.7	0.1	5	0.2	0.3	0	0.7
Site 17	0	0.7	93.1	0.2	5.7	0.2	0.2	0	0.7
Site 18	0	1.4	90.4	0.4	6.4	0.4	1.1	0	1.4
Site 19	0	0.8	90.2	0.1	5.7	0.2	3	0	0.8
Site 20	0	1.1	93.1	0.2	4.3	0.4	1	0	1.1
Site 21	0	0.7	91.8	0.2	6.9	0.2	0.2	0	0.7
Site 22	0	0.4	87.8	0	5.1	0.2	6.4	0	0.4
Site 23	0	0.6	92.8	0.1	5	0.2	1.3	0	0.6
Site 24	0	2.1	90.8	0	6	0.3	0.8	0	2.1
Site 25	0	0.9	91.5	0.2	6.2	0.4	0.9	0	0.9
Site 26	0	0.4	92.5	0.2	6.2	0.2	0.4	0	0.4
Site 27	0	0.4	93.5	0.7	4.7	0.2	0.4	0	0.4
Site 28	0	0.4	93.4	0.6	4.9	0.4	0.4	0	0.4
Site 29	0	0.7	92.4	0.2	5.2	0.2	1.2	0	0.7
Site 30	0	1	93.5	0.2	4.3	0.2	0.7	0	1
Site 31	0	0.8	93.8	0.2	4.7	0.2	0.3	0	0.8
Site 32	0	0.5	94.4	0.2	4.1	0	0.9	0	0.5
Site 33	0	0.7	93.4	0.1	4.6	0.2	1	0	0.7
Site 34	0	0.4	93.8	1.1	4.1	0.1	0.4	0	0.4
Site 35	0	1.5	91.4	0.2	5.7	0.4	0.9	0	1.5
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0	1.4	90.3	1.1	5.2	0.8	1.2	0	1.4
Site 38	0	0.5	90.6	1.3	6.4	0.3	0.8	0	0.5
Site 39	4	1.2	89	0.1	4.5	0.3	0.9	4	1.2
Site 40	0	0.8	94.6	0	4.1	0	0.5	0	0.8
Site 41	0	0.6	95	0.3	3.2	0.3	0.6	0	0.6
Site 42	0	0.8	92.8	0.2	5.3	0.2	0.8	0	0.8
Site 43	0	1.2	91	0.4	5.9	1	0.4	0	1.2
Site 44	0	0.9	91.4	0.2	6.1	0.4	0.9	0	0.9
Site 50	0	1.4	93.9	0.7	3.6	0	0.4	0	1.4
Site 51	0	0.9	93.5	0.2	4.3	0.4	0.8	0	0.9
Site 52	0	0.6	93.3	0.2	4.4	0.2	1.3	0	0.6
Site 53	0	0.7	93.9	0.4	4.5	0.1	0.3	0	0.7
Site 54	0	2.8	89.6	0.2	6.2	0.2	0.9	0	2.8
Site 55	0	0.5	90.7	0.3	7.1	1.1	0.3	0	0.5

Table 36 – GPRS ATC Classification split 2014

2015	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0	0.8	94.1	0.2	4.4	0.2	0.2	**11424**	**12144**
Site 2	0	0.7	92.3	0.2	6.6	0	0.2	**14112**	**15144**
Site 3	0	1.6	92.4	0	6	0	0	**13296**	**14160**
Site 4	0	0.7	94.4	0	4.9	0	0	**10368**	**11064**
Site 5	0	1	92.7	0	6	0.3	0	**7224**	**7704**
Site 6	0	1.3	90.3	0.1	7.6	0.4	0.1	**16152**	**17040**
Site 7	0	0.8	93.8	0.1	4.8	0.1	0.4	**20520**	**22008**
Site 8	0	2.2	67.4	1.1	27.2	1.1	1.1	**2208**	**2832**
Site 9	0	0.7	91.9	0.2	6.5	0.4	0.4	**13320**	**14184**
Site 10	0	0.6	93.2	0.3	4.5	0.2	1.1	**21192**	**22536**
Site 11	0	0.6	88.4	0	7.5	0	3.5	**4152**	**4368**
Site 12	4.8	0.7	89.1	0.1	4.7	0.1	0.4	**19872**	**21384**
Site 13	0	0.6	93.9	0.2	4.7	0.2	0.4	**11832**	**13320**
Site 14	0	1	92	0.1	6	0.1	0.7	**16416**	**17280**
Site 15	0	0.8	92	0.1	6.1	0.3	0.7	**21312**	**22752**
Site 16	0	0.7	93.4	0.1	5.3	0.2	0.4	**26424**	**27936**
Site 17	0	0.7	92.9	0.2	5.9	0.2	0.2	**29424**	**31152**
Site 18	0	1.1	90.9	0.8	6.1	0.5	0.8	**15864**	**16752**
Site 19	0	0.9	90.1	0.1	5.7	0.2	3	**20328**	**21144**
Site 20	0	1	93.2	0.2	4.2	0.4	1	**32640**	**34512**
Site 21	0	0.7	91.6	0.2	7.1	0.2	0.3	**30840**	**33000**
Site 22	0	0.5	87.5	0	5.5	0.2	6.4	**10560**	**10632**
Site 23	0	0.5	92.8	0.1	5	0.2	1.3	**22104**	**23520**
Site 24	0	2.3	90.3	0	6.3	0.3	0.8	**9192**	**9816**
Site 25	0	0.9	91.2	0.2	6.5	0.4	0.9	**13320**	**14088**
Site 26	0	0.4	92.3	0.2	6.4	0.2	0.4	**22248**	**23616**
Site 27	0	0.3	93.5	0.7	4.8	0.2	0.4	**21528**	**23016**
Site 28	0	0.4	93.5	0.6	5	0.2	0.4	**12552**	**13344**
*Site 29	0	0.6	92.4	0	5.2	0.3	1.5	**7920**	**8472**
Site 30	0	0.9	93.3	0.2	4.5	0.2	0.8	**20328**	**21768**
Site 31	0	0.7	93.6	0.2	5	0.2	0.3	**13968**	**14496**
Site 32	0	0.5	94	0.2	4.4	0	0.9	**15264**	**16176**
Site 33	0	0.6	93.3	0.1	4.7	0.2	1	**20736**	**21744**
Site 34	0	0.4	93.6	1.2	4.2	0.1	0.4	**16392**	**17448**
Site 35	0	1.2	91.7	0	5.4	0.4	1.2	**11928**	**12480**
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0	2	86.8	0.8	7.5	1.3	1.6	**42888**	**44880**
Site 38	0	0.5	90.9	1.1	6.1	0.3	1.1	**8952**	**9600**
Site 39	0	1.2	92.9	0.1	4.7	0.3	0.9	**22536**	**23640**
Site 40	0	0.8	94.3	0	4.4	0	0.5	**9312**	**9912**
Site 41	0	0.4	96.5	0.3	3.1	0.2	0.4	**26808**	**28608**
Site 42	0	0.8	92.8	0.2	5.2	0.2	0.9	**15624**	**16728**
Site 43	0	1.2	90.7	0.5	6	1.1	0.5	**30216**	**32856**
Site 44	0	0.9	91.1	0.2	6.5	0.4	0.9	**12912**	**13728**
Site 50	0	1.4	94	0.7	3.6	0	0.4	**6720**	**6768**
Site 51	0	0.7	93.4	0.1	4.5	0.3	1	**32544**	**34872**
Site 52	0	0.6	93.5	0.2	4.2	0.2	1.3	**11424**	**12144**
Site 53	0	0.6	93.8	0.4	4.7	0.1	0.3	**22152**	**23424**
Site 54	0	2.8	89.7	0.2	6.4	0.2	0.7	**10440**	**10872**
Site 55	0	0.6	90.3	0.2	7.1	1.2	0.6	**20616**	**22104**
Site 56	0	0.5	93.5	0	6.1	0	0	**5136**	**5520**
Site 57	0	1.6	87.4	0	6.6	0.3	4.1	**7632**	**7392**

Table 37 – GPRS ATC Classification split 2015

* Site shutdown for several months due to gas leak

To assess if the AADT has changed significantly over the period 2012-2015, data is presented below in table 39.

Site	AADT 2012	AADT 2013	AADT 2014	AADT 2015	% Diff 2015 over 2012	% Diff 2015 over 2013	% Diff 2015 over 2014
1	11712	11424	11496	11424	-2.46	0.00	-0.63
2	13944	14184	14208	14112	1.20	-0.51	-0.68
3	12888	13008	12984	13296	3.17	2.21	2.40
4	9672	9840	9984	10368	7.20	5.37	3.85
5	7512	7416	7344	7224	-3.83	-2.59	-1.63
6	15480	15336	16272	16152	4.34	5.32	-0.74
7	20424	20376	20400	20520	0.47	0.71	0.59
8▲	2184	1584		2208	1.10	39.39	-
9	11928	12552	12288	13320	11.67	6.12	8.40
10	19824	20376	20184	21192	6.90	4.00	4.99
11	4224	4200	4104	4152	-1.70	-1.14	1.17
12	18768	18072	19392	19872	5.88	9.96	2.48
13	12408	12192	12024	11832	-4.64	-2.95	-1.60
14	15864	15648	16656	16416	3.48	4.91	-1.44
15◆	22080	18096	22008	21312	-3.48	17.77	-3.16
16	26208	26496	26256	26424	0.82	-0.27	0.64
17	29112	29064	29256	29424	1.07	1.24	0.57
18▲	15840	15504		15864	0.15	2.32	-
19	20832	21048	21120	20328	-2.42	-3.42	-3.75
20	31704	32232	31824	32640	2.95	1.27	2.56
21	29640	29736	30288	30840	4.05	3.71	1.82
22	10512	9792	10824	10560	0.46	7.84	-2.44
23	20736	21168	20904	22104	6.60	4.42	5.74
24	8040	8976	9144	9192	14.33	2.41	0.52
25	13320	13464	13512	13320	0.00	-1.07	-1.42
26	20784	22056	22248	22248	7.04	0.87	0.00
27	20688	21456	21528	21528	4.06	0.34	0.00
28	12408	12600	12696	12552	1.16	-0.38	-1.13
** 29	9912	9408	10080	7920	-20.10	-15.82	-21.43
30	20424	20256	20592	20328	-0.47	0.36	-1.28
31	14712	14784	14424	13968	-5.06	-5.52	-3.16
32	15072	14568	15984	15264	1.27	4.78	-4.50
33	20472	20640	21408	20736	1.29	0.47	-3.14
34	16464	16632	17472	16392	-0.44	-1.44	-6.18
35	12480	12528	13104	11928	-4.42	-4.79	-8.97
37▲	29736	37824		42888	44.23	13.39	-
38	8952	8760	8952	8952	0.00	2.19	0.00
39	21960	22032	21840	22536	2.62	2.29	3.19
40	9264	9744	9408	9312	0.52	-4.43	-1.02
41	28680	28292	26160	26808	-6.53	-5.25	2.48
42	15192	15168	15288	15624	2.84	3.01	2.20
43	28080	28224	27600	30216	7.61	7.06	9.48
44	12720	12792	12888	12912	1.51	0.94	0.19
50	3888	6576	6696	6720	72.84	2.19	0.36
51	18864	32184	31008	32544	72.52	1.12	4.95
52	6408	11112	11520	11424	78.28	2.81	-0.83
53	12072	20904	21840	22152	83.50	5.97	1.43
54		6600	10392	10440	-	58.18	0.46
55		12408	18864	20616	-	66.15	9.29
56				5136	-	-!	-
57				7632	-	-	-

Table 39 AADT Percentage Growth 2012-2015

◆Site recut following resurfacing works 2013

▲Sites affected by highway improvements/resurfacing during 2014

** Site shutdown for several months in 2015 due to mains gas leak

No significance should be taken from the data presented within table 39 above for sites 18, 29 data comparisons as these sites were affected by either gas main replacement works or resurfacing works with total data loss for significant periods. Similarly, site 37 data for 2012 and 2014 has been affected by highway alterations as part of the phasing of the Boulevard scheme and is not indicative of any trend.

Similarly, site 8 was removed during late 2013 to permit phase 1 of the Morfa Distribution Road to be undertaken whilst site 15 was affected by resurfacing works during 2013.

Site 24 has seen an increased flow during 2013 but again, no significance can be placed on the growth rate due to gas main replacement works along Carmarthen Road during 2012 distorting the AADT. The AADT for 2013 returned to normal.

Sites 50-53 are presented for information only and no significance should be placed on the growth figures for 2013 as these are based on an incomplete picture for the base year of 2012. Similarly, sites 54 and 55 only commenced monitoring during 2013 so the comparison to previous years is incomplete.

The details relating to the Swansea Metro project have been reported previously as significant highway alterations were undertaken to permit operation of the Metro service. The likelihood is that the metro route will be significantly altered within the city centre within coming years as part of the ongoing review. A limited revision of the adopted layout for the metro service has already commenced along Westway outside the Quadrant Bus Station in the city centre during 2016. Whilst the vehicles used to operate the Metro service have ceased to operate, the service itself remains but is now operated with conventional single decker buses.

The Swansea Boulevard Project

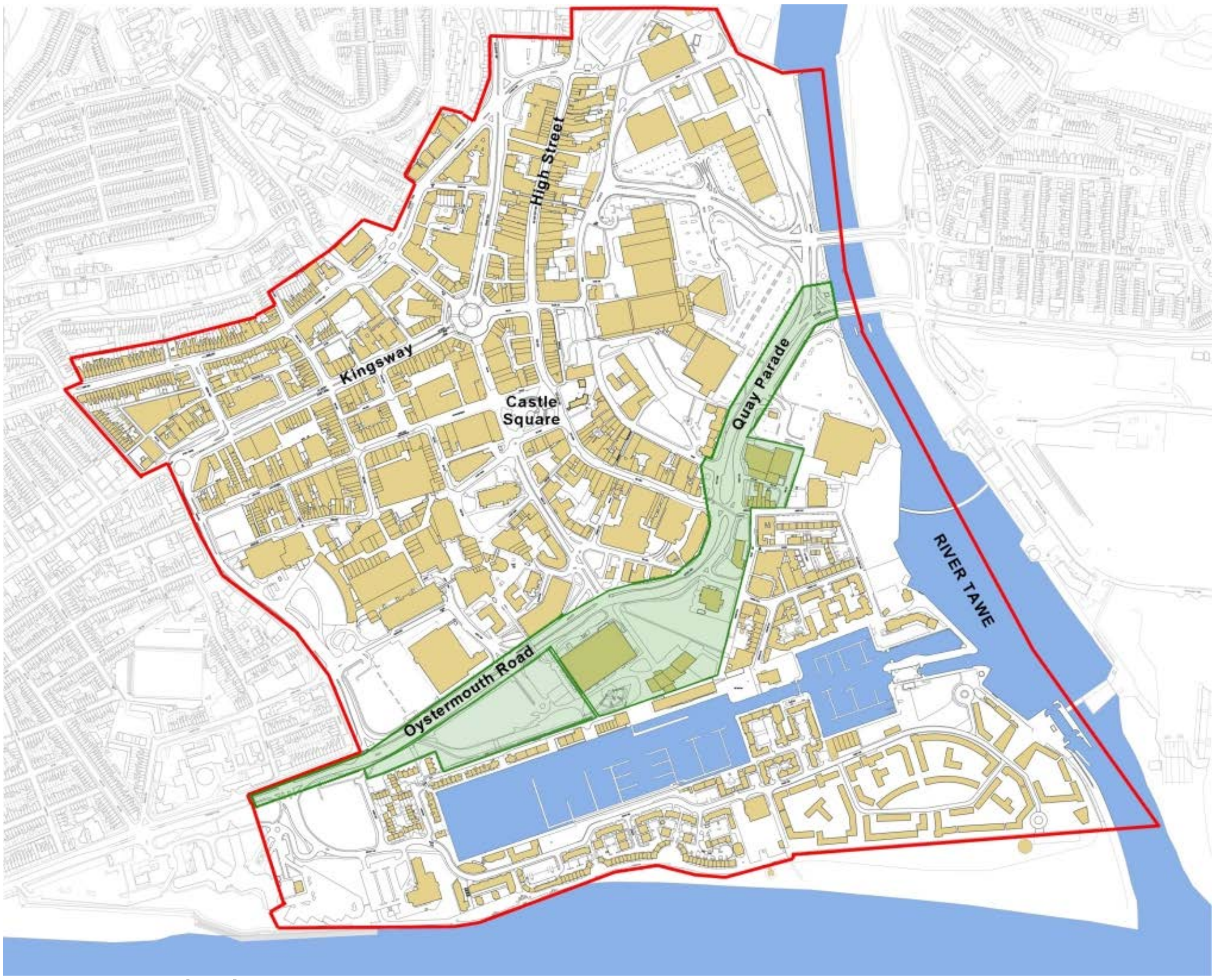
As part of the delivery of the City Centre Strategic Framework, Consultants were engaged to produce a Concept, Design and Implementation Study in relation to the European Boulevard which was agreed by Cabinet in December 2008.
The project is to create a "boulevard" from the river bridges to the Civic Centre which provides a step change in perceptions of this gateway corridor from an urban freeway to a vibrant tree lined city street which allows the connection of the City Centre to the Maritime Quarter. The Boulevard will encourage high quality architectural design, excellent public realm and landscape and provide an effective balance between its role as the key artery into the City Centre and increased pedestrian movement and permeability.

The reconfiguration of the Tawe Bridges was completed in December 2011. This constituted phase 1 of the Boulevard project and was required in order to create additional highway capacity to accommodate pedestrian, cycle and public transport enhancements along the Boulevard.

Phase 2 of the Boulevard scheme commenced in January 2013 and covered the section between the Leisure Centre to Wind Street and was completed December 2013. Phase 3 commenced during January 2014 covering Wind Street to the Tawe Bridges.

The works to Phase 2 and 3 provided the following enhancements:

- upgrading the public realm with high quality materials being used throughout;
- introduction of a bus lane between Princess Way and Wind Street;
- enhanced pedestrian/cycle crossings (toucan);
- widened footways;
- installation of a shared use path on the southern footway;
- trees to be planted in the footways and central reserve;
- lighting and CCTV upgrades;
- telematics upgrade;
- closure of minor junctions and accesses



Map 23 *Swansea Boulevard project*

All works in relation to the Boulevard project were completed during late October/early November 2014. GPRS ATC site 37 Quay Parade was reinstated during October 2014.

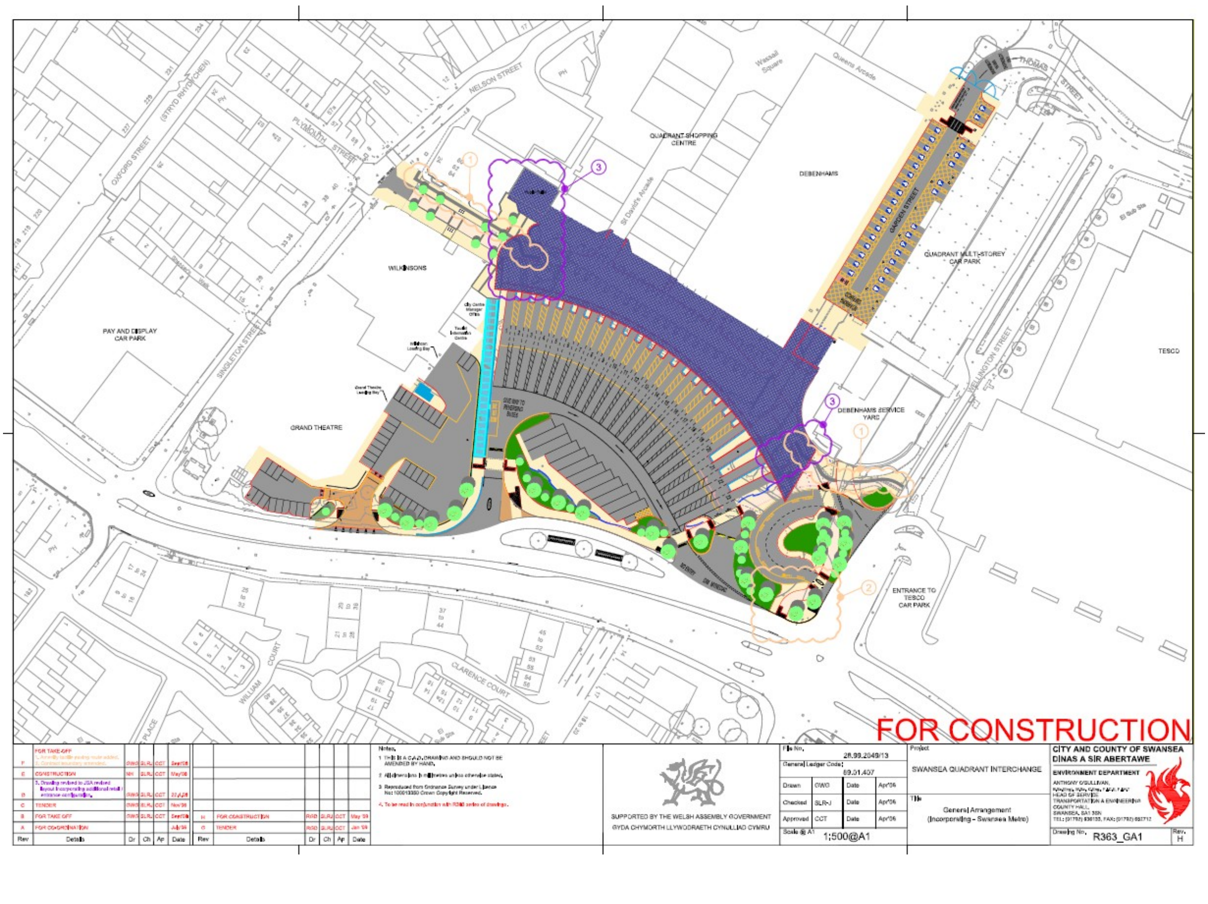
The City and County of Swansea confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.1.7 Bus and Coach Stations

Quadrant bus station

The City and County of Swansea has now completed a scheme to replace the old Quadrant bus station with a modern Transport Interchange to cater for both buses and coaches, including Swansea Metro vehicles, on a larger footprint. The old Quadrant bus station was outdated in terms of passenger convenience, comfort and security. The Council's aspiration was for a modern transport interchange with high standards of cleanliness and security. The refurbishment of the Quadrant bus station was identified as a high priority in the Swansea Local Transport Plan 2000 – 2005 and was completed during November/December 2010.

.A plan of the development area is given below as map 24.



Map 24 – *Quadrant Transport Interchange off Westway, Swansea*

Blocks of flats can be seen opposite the completed Quadrant Interchange. These blocks tend to be occupied by the elderly with warden accommodation. A basic Screening Assessment had been started during 2008 in front of one of the blocks of flats to assess both PM_{10} and NO_2. The PM_{10} light scattering analyser had suffered numerous breakdowns with the result that little meaningful data is available. Provision of a Thermo PM_{10} FDMS is not feasible due to the practical siting criteria issues to be resolved as well as the costs that would be incurred. Assessment of the new facility is required and will require both traffic counts and PM_{10} measurements to be undertaken. A MetOne EBam PM_{10} analyser was installed on Westway during August 2012 (see Sec 3.5 above) and PM_{10} data has been reported in the relevant sections above for 2013 - 2015 – further assessments will be made in future reporting. A photo of the site is shown below as photo 13. The MetOne EBam location is labelled within photo 13. Funding to provide a permanent GPRS ATC (site 36) is still being sought.

Photo 13 – Westway MetOne EBam PM_{10} Monitoring Location

At present, there is existing relevant exposure within approximately 25m of the curtilage of the development. From guidance contained within LAQM.TG(16)[42] relevant exposure is required to be assessed where exposure is within 10m of the kerb or 20m of the kerb in conurbations where the population is greater than 2 million inhabitants and where there are 2500 bus/coach movements per day. A bus

[42] [42] LAQM.TG(16) table 7.1 road source category 7 page 7-5

movement considers a bus either arriving or leaving the station. A bus arriving, then leaving therefore counts for 2 movements. In the case of Swansea, relevant exposure is greater than 20m and with a population of just under a quarter of a million the criteria clearly do not apply. It is not known if the actual bus movements exceed 1250 (arriving and departing) but as the exposure criteria does not apply it is proposed just to continue with the existing passive NO_2 diffusion tube monitoring and PM_{10} monitoring by way of the MetOne EBam.

3.2 Other Transport Sources

3.2.1 Airports

Swansea does have a small airport located at Fairwood Common, Upper Killay that has previously been used as a "regional airport". However, guidance within LAQM.TG(16) paragraph 7.16 page 7-6 indicates that assessment for NO_2 will only be required should relevant exposure exist within 1km of the airport boundary and if the total equivalent passenger throughput exceeds 10 million passengers per annum. Freight traffic is minimal at Swansea Airport.

There are receptor locations within 500m of the airport boundary but clearly the airport does not see passenger numbers in excess of 10 million per annum.

The City & County of Swansea confirm there are no airports meeting the assessment criteria in the Local Authority Area.

3.2.2 Railways (Diesel and Steam Trains)

Stationary Trains

Landore Diesel Sheds is a major servicing centre primarily for Inter City 125 high-speed trains (HST) and is located within the Swansea Air Quality Management Area 2010. The site operates on a 24 hour seven day a week basis. An aerial view of the site is shown below as map 25 indicating the proximity of domestic dwellings to the site

Site activities can be broadly classified into two categories: maintenance and servicing. Maintenance tends to occur within the sheds themselves. Here, engines are repaired, maintained and tested. It is not uncommon for several HST engine units to be under test at the same time. Exhaust emissions are vented through cowl housings to the roof of the sheds.

Map 25 – Landore Diesel Sheds and Surrounding Area

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Maintenance operations involve the routine cleaning and refuelling of the HST units in dedicated sidings. Extensive warm up periods are mandated prior to movement of the HST train back out and onto the main line.

Guidance within LAQM.TG(16) requires the identification of locations where diesel locomotives are regularly stationary(at least 3 times a day) for periods of more than 15 minutes[43]. This is clearly the case at Landore Diesel Sheds but the guidance also indicates relevant exposure within 15m of the stationary locomotives. The nearest façade of any dwelling is approximately 35m from the servicing bay. There is also a public "open grassed area" within approximately 40 m of the servicing bays.

Observations at this location have indicated very infrequent use by the general public. Bearing in mind that the majority of servicing occurs during the night-time

[43] LAQM.TG(16) Section 7.18 page 7-7

hours it is concluded that there is no relevant exposure from this activity at this location. A similar view has been formed over the use of the main shed complex.

An identical view has also been formed for the activities currently undertaken at Swansea Central railway Station. Inter City 125 units and other diesel locomotives are left running during periods leading up to the scheduled service departures. However, there is no relevant exposure within 15m of the stationary locomotives. It should be noted that a development on the former Unit Superheaters site at The Strand / Morfa Road proposes several 15(+) story blocks of apartments/student flats. These apartments when complete will overlook the main platform area at Swansea Central Railway Station. The impact of the rail activities will be assessed once these apartments are complete and occupied.

“Sprinter services” are offered to/from several local stations both on the mainline Swansea – Paddington London line and also the West Wales line. However, these sprinter services are not stationary at these very local stations for periods of 15 minutes or more. Consequently, their impact is minimal.

3.2.3 Moving Trains

Guidance within LAQM.TG(16) Section 7.18 page 7-7 indicates a number of criteria to determine suitable assessment. The main Swansea to Paddington London rail line is listed within table 7.2 of LAQM.TG(16) (page 7-8) indicating rail lines with heavy traffic of diesel passenger trains. In addition, the approach within LAQM.TG(16) requires identification of whether the background annual mean NO_2 concentration is above 25ug/m^3. In order to answer this question, 1k by 1k NO_2 concentrations (for 2015 based on Background maps base year of 2011) were downloaded from http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011 and overlain on a GIS background map within Quantum GIS v2.4.0 (Chugiak). The text file for NO_2 background concentrations for 2015 has been imported into Quantum GIS and examined. If the background NO_2 1k by 1k concentrations are indexed in descending order it can be seen that the maximum 1k by 1k grid square (266500 196500) for 2015 returns a value of 19.87ug/m^3. If this grid point is plotted it can be seen that the centre of the 1k by 1k grid square is just north of the main

Swansea to Paddington London line in the Plasmarl area of Swansea. The next highest 1k by 1k grid square (270500 197500) for 2015 is 19.61ug/m^3. This grid square is located just north of the M4 to the east of junction 44 in the Birchgrove area of Swansea. This grid square lies approximately 350m within the authority's boundary with Neath Port Talbot Borough Council. The main Swansea to London Paddington line runs through this 1k by 1k grid square to the south of the M4 motorway.

Local knowledge of the path of the Swansea to Paddington London railway line would also indicate that that there is no potential for **long-term** exposure within 30m of the edge of the tracks.

In view of the above, there is no requirement to proceed further with a Detailed Assessment for either SO_2 or NO_2 at locations within 30m of the Swansea to Paddington London railway line

3.2.4 Ports (Shipping)

Swansea is Associated British Ports (ABP's) most westerly South Wales port and has developed a trade base with North and Western Europe, the Mediterranean and also with Northern Ireland and the Irish Republic. The port's major cargo-handling trade is receiving and shipping steel cargoes for Tata. It is equipped with a wide range of heavy-duty handling equipment offering quayside cranes and a range of forklift trucks with capacities of up to 40 tonnes. Other traffics include containers, forest products, bulk cargoes, liquid bulks and general/project cargoes. The port can accommodate vessels up to 30,000 dwt.

Guidance within LAQM.TG(16) paragraph 7.20 page 7-8 – Ports, requires the determination on the number of ship movements per year and also to establish if there is relevant exposure either within 250m of the quayside and manoeuvring areas should shipping movements be between 5000 – 15000 per year, or exposure within 1km of the quayside and manoeuvring areas, should shipping movements exceed 15000 per year. Enquiries with the Swansea Bay Port Health Authority indicate that during 2015 there were a total of 336 vessels visiting the port which equates to 672 total shipping movements. Even if the local tug fleet is also taken into consideration this would still not bring the number of movements to above the 5000 threshold required for assessment.

For sake of completeness, there are residential properties located on Bevans Row, Port Tenant within 230m of the Kings Dock quayside. An ever increasing number of residential flats are being constructed on the nearby SA1 development sites. At present these new residential units are outside of the scope of assessment and are likely to remain so given the decreasing number of shipping movements seen at the port. A continuing decrease in movements has been observed during recent years and this has been compounded by the Swansea-Cork ferry ceasing operation from the port during 2011.

3.3 Industrial Sources

3.3.1 Industrial Installations

3.3.2 New or Proposed Installations for which an Air Quality Assessment has been carried out.

Vale, Clydach

Proposals by Vale (see map 15 within section 2.1.15 for location and surrounding area) to develop an energy from waste Pyrolysis Plant at its refinery at Clydach in the Swansea valley may have air quality impacts locally. Whilst Planning Permission has been granted and a permit issued for operation by the now Natural Resources Wales, the project remains on hold at present. Regular updates will be provided in future reporting as to when commencement can be expected.

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

The City & County of Swansea 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.

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

The City & County of Swansea 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.

3.3.5 Major Fuel (Petrol) Storage Depots

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

3.3.6 Petrol Stations

Guidance contained within LAQM.TG(16)[44] indicates that there is some evidence that petrol stations will emit sufficient benzene to put the 2010 5μg/m^3 objective at risk if the throughput exceeds 2000m^3 of **petrol** , especially if combined with higher levels from a nearby busy road. A busy road within LAQM.TG(16) table 7.3 is defined as one with more than 30,000 vehicles per day. The guidance goes on to indicate that relevant exposure within 10m of the fuel pumps should also be present if the above criterion is met.

Details from the Authorisations held by the authority have been examined. There are 29 authorised petrol filling stations within the authority's area, with fourteen of these having a throughput greater than 2000m^3. Of these fourteen stations, eleven are now fitted with stage II vapour recovery (due to the requirements of the Environmental Permitting (England and Wales) Regulations 2010 (as amended) as all existing stations with a throughput over 3500m^3 from 2011 require stage II vapour recovery), with the remainder being fitted with stage 1 vapour recovery. All new petrol stations with a throughput over 500m^3 will require stage II vapour recovery under the above Permitting Regulations 2010. Relevant exposure was examined for each location using Quantum GIS, whereby 10m radiuses were plotted from the actual pumps to access if relevant exposure existed. Of the 14 petrol stations examined, relevant exposure does not exist at any.

A major food retail output located in Gorseinon has constructed a petrol station during 2014 within the existing rear car park of the existing outlet. The nearest dwelling is located 33.6m away from the nearest pump with a doctor's surgery being

[44] LAQM.TG(16) Table 7.3 Screening of Industrial Sources – Petrol stations page 7-15

located 23m away from the nearest pump. The throughput of this station during 2015 was 2186m^3 but due to the location of the nearest dwelling, the location falls outside of the scope of assessment. Map 26 below outlines the location and the nearest receptor dwelling.

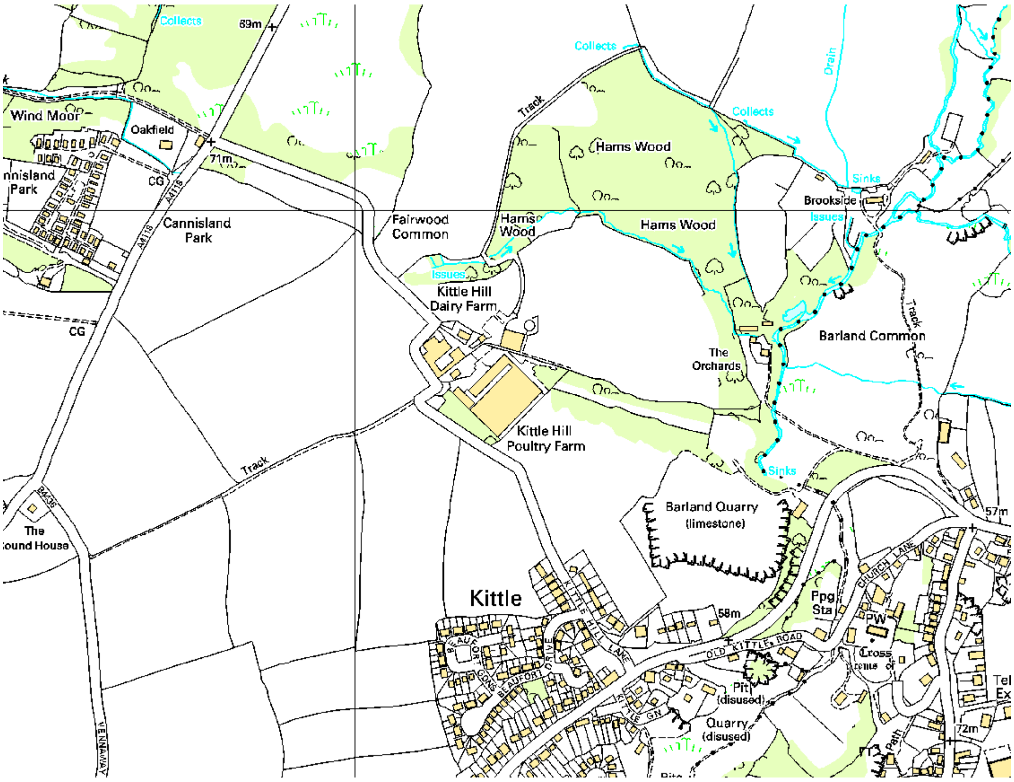
Map 26 Food outlet Gorseinon – New Petrol Station 2014

The City & County of Swansea confirms that there are no petrol stations meeting the specified criteria within the local authority area

3.3.7 Poultry Farms

LAQM.TG(16) contains guidance on assessing potential exceedances of the PM_{10} objectives associated with emissions from poultry farms. Guidance is contained within table 7.3 and also within paragraph 7.38. A methodology is then provided within box 7.2 page 7-14 to assess PM10 emissions should the criteria within table 7.3 be met.

There are two poultry farms located within the authority's area. The first at Kittle Hill Farm is shown below within Maps 27 and 28. Information here is updated from previous assessment reports.



Map 27 – Location of Kittle Hill Poultry Farm, Kittle, Gower, Swansea

Map 28 – Aerial view – Kittle Hill Poultry Farm, Kittle, Gower, Swansea

Natural Resources Wales granted a PPC permit (EPR/VP3736MR) to permit up to 400,000 laying hens to be housed. However, information to hand indicates that the operators only intend to house 380,000 birds at present. As indicated within map 28 above, the direction of the mechanical ventilation of the sheds is in a south easterly direction between the sheds and then finally out, over a field adjacent to the premises. Information from Natural Resources Wales indicates a "release" of 6466Kg of PM_{10} from this operation. The nearest domestic receptor/dwelling is approximately 290m from the sheds. However, there is relevant exposure from a residential property that forms part of the farm itself. There is therefore, relevant exposure within 100m of the sheds housing the birds. There have been previous historical complaints regarding dust from local residents but these were not substantiated. The authority has in past years received numerous complaints regarding noise from the ventilation system.

Whilst there is relevant exposure as defined by LAQM.TG(16) table 7.3 page 7-15 at Kittle Hill Farm itself, **the number of housed bird's remains below the assessment threshold**. In addition, a separate establishment at Highfield Poultry Farm, Parkmill, Gower, Swansea, now houses broiler chickens. Map 29 below indicates the proximity of this establishment to local residential properties.

Map 29 – Highfield Poultry farm, Parkmill, Gower.

Natural Resources Wales granted a PPC permit (EPR/VP3039UR) to permit up to 120,000 broiler chickens to be housed with an approximate actual number of birds actual housed is approximately 114,000. Natural Resources Wales have provided a PM_{10} "release" figure for this operation as 3767kg. Residential properties are within 80m of the sheds at Highfield Poultry Farm with the proprietor's residence being located within 15m of the sheds**.**

There have been numerous historical complaints regarding noise from the ventilation system. Again, whilst there is relevant exposure as defined within LAQM.TG(16) table 7.3 page 7-15 at Highfield Poultry Farm itself, **the number of housed birds falls below the assessment threshold.**

3.4 Commercial and Domestic Sources

3.4.1 Biomass Combustion – Individual Installations

3.4.1.1 Swansea leisure Centre

There is a wood-chip biomass burner installation at the new LC2 Leisure Centre. However, due to control issues, the burner has never operated.

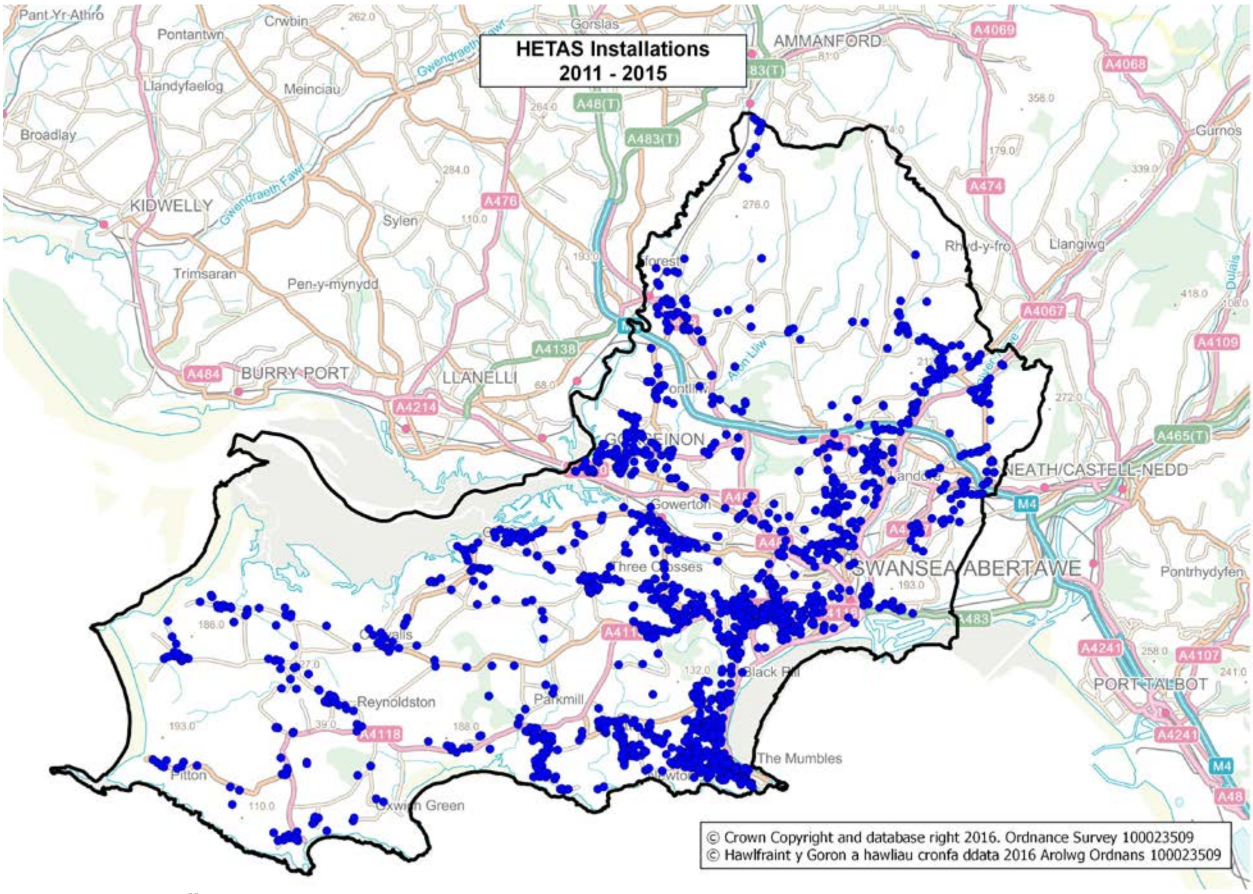
The City & County of Swansea confirms that there are no longer any Biomass Combustion – Individual installations meeting the specified criteria within the local authority area

3.4.2 Biomass Combustion – Combined Impacts

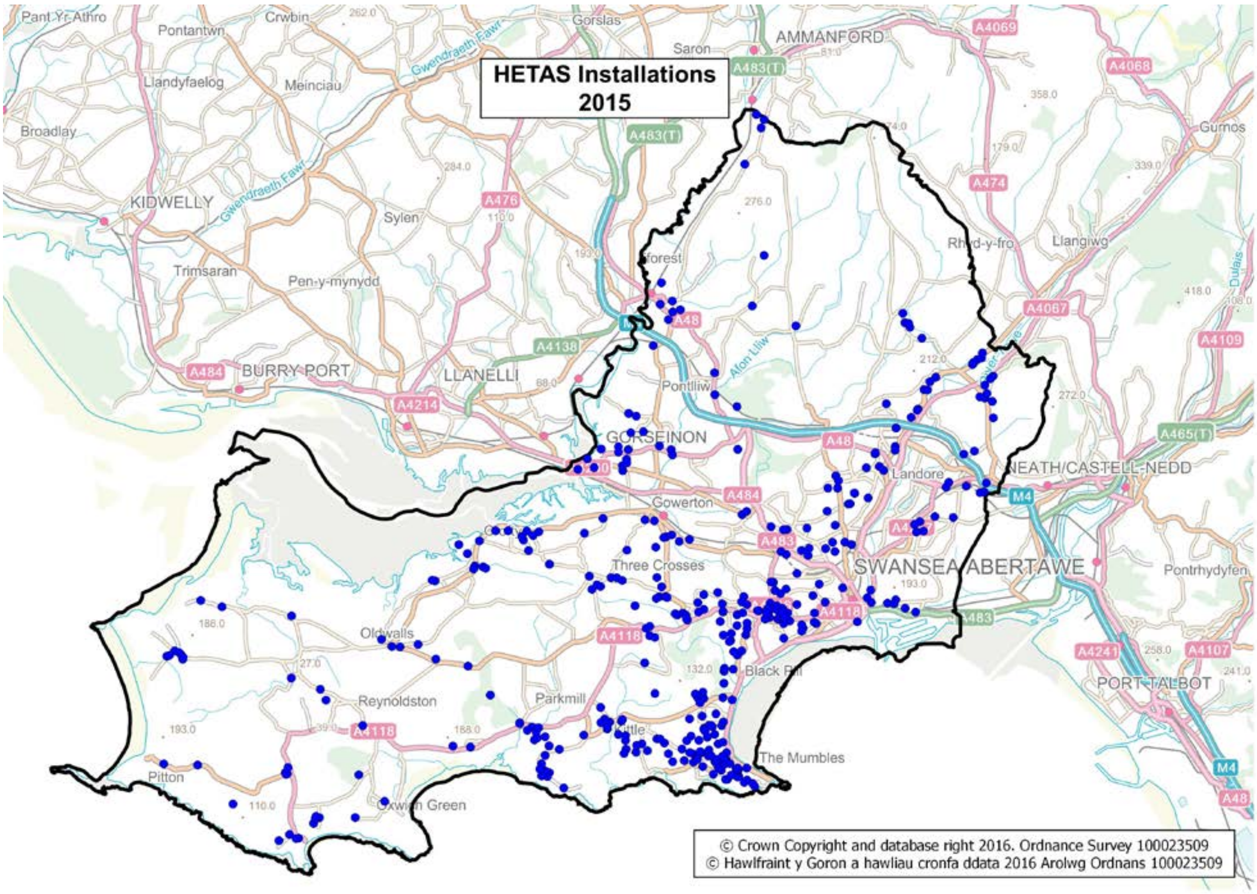
LAQM.TG(16) outlines within table 7.4 and paragraphs 7.54 to 7.62 a method to assess the impact of small, domestic biomass combustion. It has been noticed through conversations held with colleagues within Building Control that a record of domestic biomass installations is held where those installations have been undertaken by a HETAS approved installer of an approved HETAS appliance.

HETAS Ltd approval of appliances consists of assessment of a type test report from a Notified Laboratory to the relevant BSEN supported by the manufacturer's production control, followed by periodic surveillance of the product as appropriate. HETAS Ltd also checks manufacturers Installation and Operating Instructions to confirm that they meet UK Building Regulations and conform to UK practice. While the appliance remains in the Guide, this surveillance continues, to ensure that the product remains the same as the original unit tested. Any solid fuel appliance that was approved at the time of manufacture, and which was subsequently installed, maintains its approved status even if at a later date the model is removed from the Guide. New units of the model, produced after removal from the Guide are, however, not approved as they will have been produced at a time when the product surveillance by HETAS Ltd had ceased. It would not, therefore, be possible to ensure that the new units were the same as the unit originally tested.

Building Control has supplied a list of total notifications received under the above scheme, complete with Ordnance Survey easting and northing coordinates to allow plotting within Quantum GIS system. The only problem found is that the description on the registration doesn’t specifically state the type of appliance i.e. wood burners. It is thought that wood-burners are the more likely installation to be registered within domestic premises. With this limitation in mind and accepting the scope of description, the complete list has been plotted within map 30 below so that an understanding of the spatial distribution of appliances can be made. In addition, installations notified during 2015 have been plotted separately within map 31. It is important to recognise that it is probable that appliances have been purchased and installed by home owners themselves or installers that do not “comply” with the above scheme and that the situation may be different to that presented within maps 30 and 31 below.



Map 30 HETAS Installations 2011-2015



Map 31 HETAS Installations 2015

Paragraph 7.55 of LAQM.TG(16) provides additional guidance in assessing the cumulative impact of biomass combustion. This authority has previously reported on and mentioned that assessment of the impacts from the increased popularity of domestic installation of wood burning appliances has been primarily been assessed in previous years by way of the number of complaints received following the installation of such appliances. It is reassuring to note that this approach is adopted within LAQM.TG(16) as it draws upon the local knowledge of officers within the Pollution Control Division. Based on this approach the number of complaints received from biomass boilers , which in practice can be taken to be from the installation of domestic wood burners is outlined below in table 40.

Year	Number of Complaints Received
2011	13
2012	22
2013	26
2014	23
2015	16

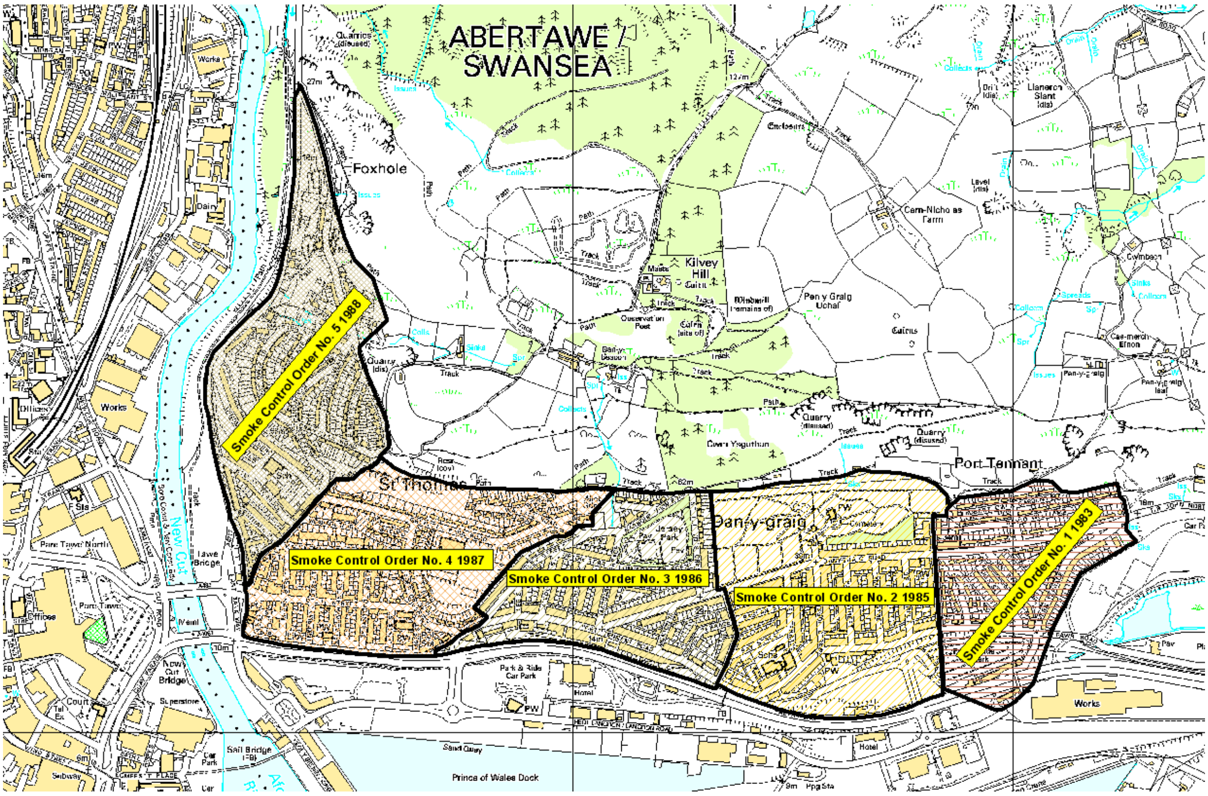
Table 40 – Wood burner Complaints received 2011-2015

As can be seen from table 40, the number of complaints received has been low. Where complaints have been received these normally revolve around issues relating to the height and placement/location of the flue itself which produce very localised issues. Officers investigate and resolve these issues by way of Statutory Nuisance assessments. Given the above and in the absence of local knowledge indicating widespread visual indications of wood burning and/or complaints relating to odour, it is taken that there is no requirement to assess the impact of these installations by way of assessment via the 500m by 500m grids mentioned within LAQM.TG(16).

3.4.3 Domestic Solid Fuel Burning

Swansea City Council, the predecessor to the City and County of Swansea, declared 5 Smoke Control Areas within the Port Tennant and St.Thomas areas between 1983 and 1988 – these Orders can be seen below within map 32.

Whilst these orders limited the burning of solid fuel in approved appliances to smokeless solid fuels, the tradition of burning solid fuel has dramatically declined within Swansea over the last two decades, not solely because of the declaration of the Smoke Control Areas but as part of the national trend away from coal to natural gas consumption as a domestic fuel. This trend continues to this day. Therefore, despite smokeless solid fuel having similar sulphur content to coal, the burning of such fuels in any approved appliances that may remain in these areas is thought to be minimal.



Map 32 – City & County of Swansea Smoke Control Orders 1-5

Guidance within LAQM.TG(16) requires the identification of significant areas of domestic coal burning. Significant areas of domestic coal burning are given as a density of premises burning coal exceeding 50 per 500 by 500 meter area[45]. Local knowledge would indicate that there are no longer any areas within Swansea that have this density of domestic coal burning. This situation has not altered from the previous Updating and Screening Assessments/Progress Reports submitted.

The actual number of properties within the City and County of Swansea's area that burn solid fuel as the primary fuel for central heating is given as 4,398 within the 1997 Welsh Household Information Survey published in 2000. This equates to 4.9% of properties within Swansea. For completeness, the number of properties burning fuel oil as their primary source of heating is given as 1,759, which equates to 2% of properties. The figures for the whole of Wales are 7.4% and 5.3% respectively. In reality, the number of properties that burn solid fuels has in all probability, reduced significantly from those published in the Welsh Household Information Survey.

The City & County of Swansea confirms that there are no areas where the burning of Domestic Solid Fuel meets the specified criteria within the local authority area

[45] LAQM.TG(16) paragraph 7.63 page 7-22

3.5 New Developments with Fugitive or Uncontrolled Sources

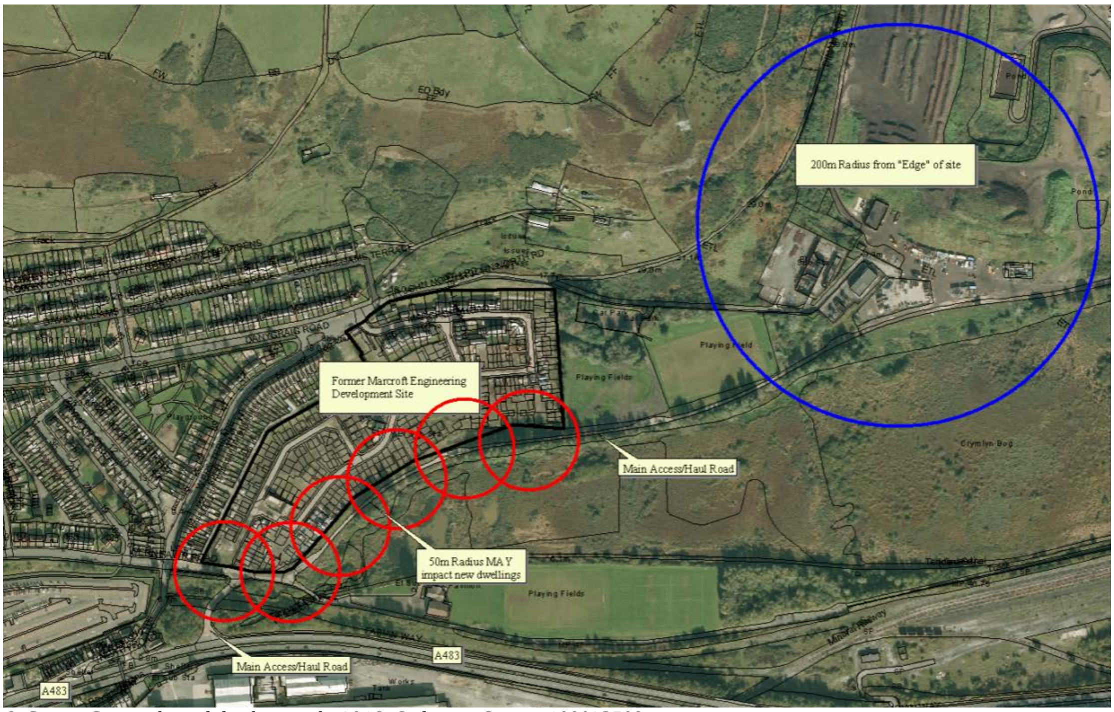
Following the rational mentioned elsewhere within this report, details previously reported are reproduced here again for completeness. Guidance within LAQM.TG(16) paragraph 7.64 to 7.66 page 7-23 and table 7.5 page 7-24 indicates an approach to adopt to assess fugitive sources of PM_{10} from a number of sources including quarrying, landfill sites, coal and material stockyards, or materials handling. Where dust is emitted, a proportion, (typically about 20%) will be present as PM_{10}. The guidance indicates that relevant exposure "near" to the source of emission be established. Near is defined as within 200m of the source and within 1000m if the PM_{10} annual mean background concentration taken from background maps is greater than or equal to 28μg/m^3.

Based on the 1k by 1k grid squares background PM_{10} maps downloaded for 2015 from http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011, and after indexing the field Total_PM10_15 it can be seen that the maximum 1k by 1k grid square (268500 199500) background concentration is 15.78ug/m^3. Therefore, "near" is taken to be the latter distance i.e. 200m

3.5.1 Tir John Landfill Site

LAQM.TG(16) table 7.5 page 7-24 expands on the issue of relevant exposure if exposure is within 50m of an offsite road used to access the facility. These sections of road which may extend up to 1000m from the site entrance are considered to be near, as long as the background concentration is above 25ug/m^3 and there are visible deposits on the road. Map 33 below shows the situation currently at Tir John landfill site. There is very marginal relevant exposure within 50m from the main access road at properties on Wern Terrace, Port Tennant (shown by red circle). In addition, the former Marcroft Engineering site has been developed over recent years to provide numerous new properties. Development of the site was completed during early 2013 with only a small parcel to the south west section available for any additional construction. The development can be seen below within map 33.

Obviously, now the development is complete, dozens of new properties fall within the 50m radius (red circles) from the access road. At present, as the maximum background PM_{10} concentrations do not exceed 25ug/m^3 anywhere within the authority's area and, as there are no visible deposits on the road, these locations can be discounted. This view is reinforced by knowledge that no complaints have been received from either the long-term existing residents along Wern Terrace or the new residents surrounding the landfill site.

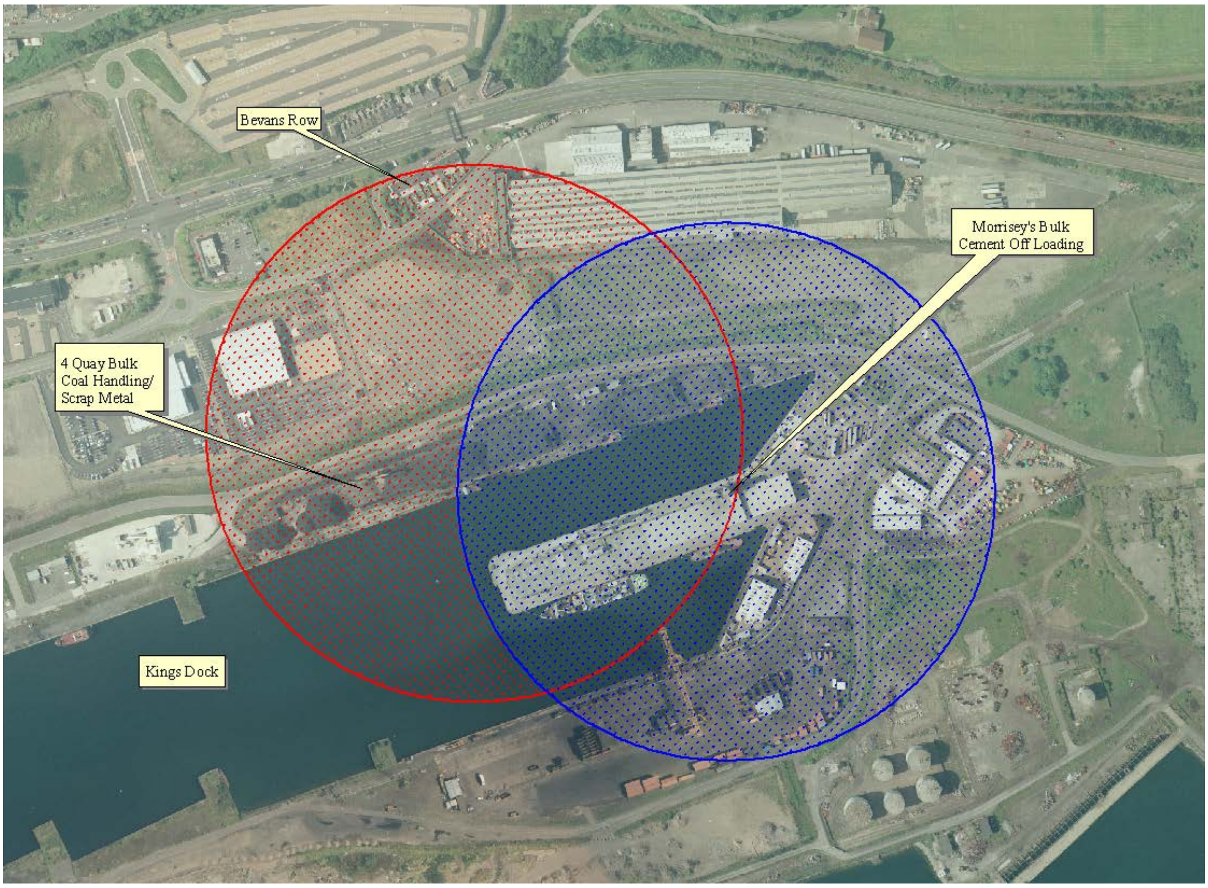


Map 33 –Tir John Landfill Site, Port Tennant, Swansea

There are no receptor locations within 200m of the main landfill area (blue circle). The Environment Agency (since April 2013 in Wales now known as Natural Resources Wales) refused to issue a permit for the ongoing use of Tir John to the LAWDC – Swansea Waste Disposal Company as a landfill site. The site therefore ceased operation for several years, pending an appeal by the LAWDC. The LAWDAC subsequently won the appeal and the site is now once again fully operational. However, during 2012 the LAWDAC was disbanded and the operations at Tir John have been brought back under the direct control of this authority.

3.5.2 ABP Port of Swansea

There are operations carried out within the ABP Port of Swansea that have the potential for fugitive emissions i.e. 4 Quay bulk coal-handling facility and Morrissey's Cement Bulk offloading facility both located around the Kings Dock. The Port Health Authority regulates both of these operations. Map 34 below identifies both these activities at Kings Dock. 4 Quay handles a bulk coal handling facility on the dock side.



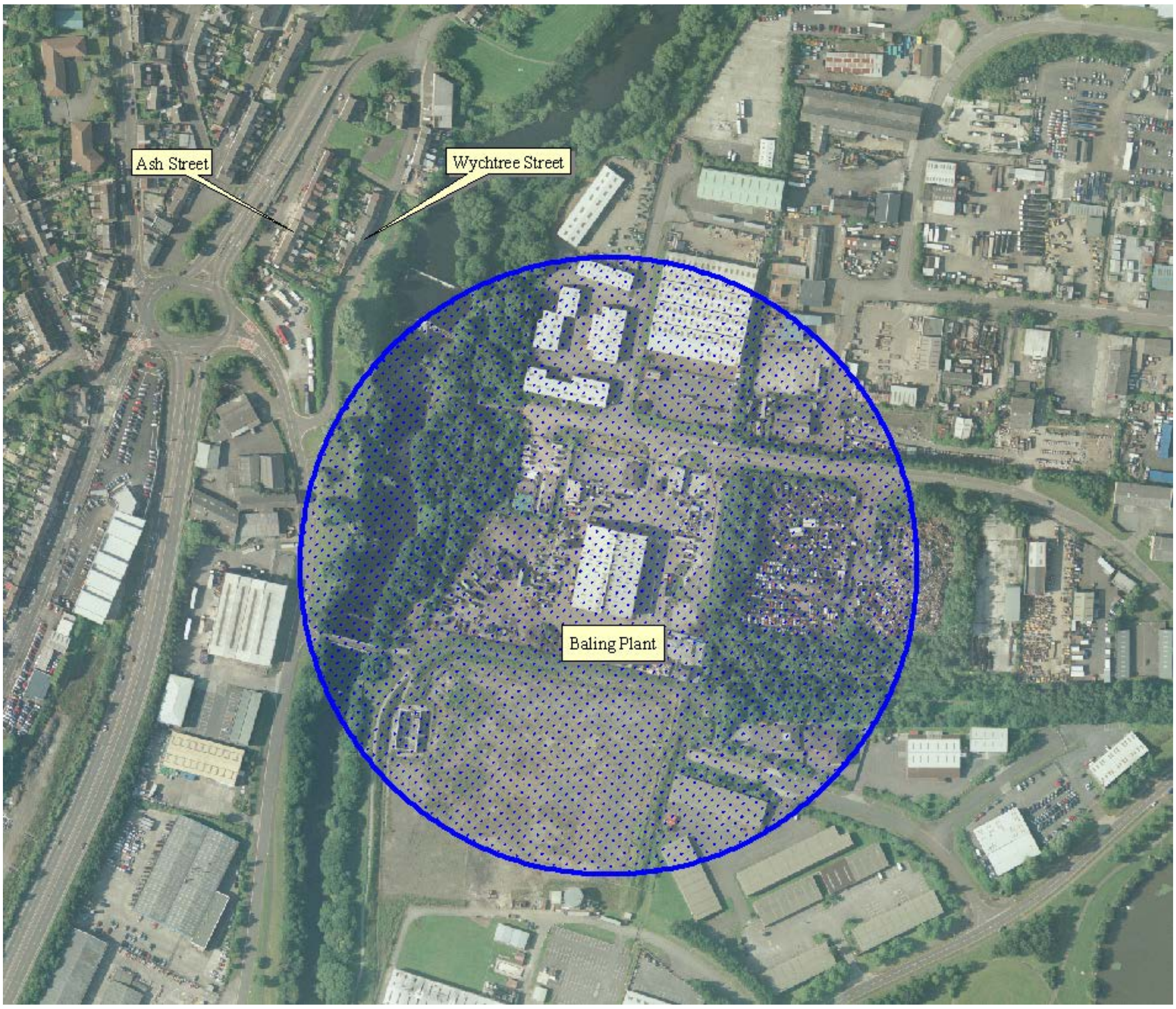
Map 34 – Location of 4 Quay and Morrissey's Bulk Cement Kings Dock, Swansea

In recent years, stockpiles of scrap metal are also handled on 4 Quay. Receptor locations at Bevans Row, Port Tenant are located within 200m of the bulk coal/metal stockpiles (red circle). Litigation several years ago, resulting from an action from residents of the wider Port Tenant community resulted in a High Court judgement ruling in favour of the operators. It is not intended to revisit this issue in the light of the lack of dust complaints from Bevans Row. Morrissey's cement bulk offloading facility has been the subject of enforcement actions by the Port Health Authority to affect abatement techniques. Negative pressure systems, combined with a new bagging plant and construction of internal walls within the offload area have now negated the previous substantial fugitive emissions from the offload process. There is no relevant exposure within 200m of the bulk cement offload operations (blue circle).

3.5.3 Waste Management Facility – Baling Plant

The LAWDAC operated the Baling Plant off Ferryboat Close, Morriston Enterprise Park until the authority disbanded the LAWDAC during 2012 and took back complete operational control of the facility during 2012. The facility handles all domestic waste arising's within Swansea as well as being the main recycling centre within Swansea. Domestic waste in all its forms is transported into the Baling plant pending its bulk transportation to Tir John Landfill site and elsewhere. Map 35 shows the proximity of the facility to the nearest receptor locations.

There have been numerous complaints of odour spanning several years, resulting mainly from the composting activities at the facility, but no substantive dust complaints. Composting activities have now ceased at the facility. In any case, with reference to LAQM.TG(16) table 7.5, there are no receptors within 200m of the centre of the facility (blue circle).



Map 35 – Baling Plant, off Ferryboat Close, Morriston Enterprise Park

3.5.4 Operational Opencast Coal Mines or Quarries

There are no operational opencast coal mines or quarries within the Swansea area

The City & County Swansea confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

The City & County Swansea confirms that all the following have been considered:

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

4 Local / Regional Air Quality Strategy

Air quality was highlighted in the *Swansea Environment Strategy: Time to Change*, which was published by Swansea Environmental Forum (SEF) in 2006. One of the Strategy's five themes is Sustainable Transport and Air Quality – the combination of these two issues reflecting the fact that transport is the main cause of air pollution problems in Swansea. Two of the twenty two strategic priorities in the document relate to air quality – ST3: *Improve air quality and reduce air pollution* and ST4: *Improve air quality monitoring and reporting mechanisms*. A number of air quality measures are also used as indicators for the Strategy and these have changed and increased in number over the last decade as air quality monitoring has developed.

The Strategy and accompanying biennial action plans are reviewed every two years and in most of these reviews the strategic priorities for air quality have received a red or amber RAG status. In the most recent review, the two priorities received amber status and the summary report commented that *"Air quality in Swansea is still a concern and as inner city dwellings and café type environments increase then the number of people exposed to poor air quality may also increase unless traffic can be reduced or diverted."* The Swansea Environment Strategy and associated action plans and reviews can be accessed from the Swansea Environmental Forum website: www.swanseaenvironmentalforum.net

In 2008, air quality was also selected as one of five local environmental issues identified by SEF as requiring greater prioritisation and wider collaboration in order to effect progress. In 2009, SEF convened a task group of officers from various council departments and services to share information on air quality issues and draft an air quality improvement action plan. The task group meetings were chaired by the Director of Environment (who was also, at the time, chairperson of SEF).

The draft air quality improvement action plan lists eight aims, in order of priority:

1. Develop traffic management systems to reduce air quality impacts
2. Improve monitoring and reporting of air quality

3. Ensure air quality issues are considered in planning processes and major development schemes
4. Reduce the direct impact of the council and partner organisations on air quality
5. Reduce the impact on air quality from journeys to schools
6. Encourage improvements to public transport
7. Arrange research projects to support air quality improvement schemes
8. Reduce air pollution from other sources

The task group met on several occasions throughout 2010 and 2011, sometimes inviting presentations from outside bodies and organising, in partnership with SEF, a seminar on Low Emission Zones, which attracted a wide audience. Though the task group did not meet during 2012, the group did reconvene in September 2013 to review the action plan. The phrase ‘promote cycling’ was added to action no.6. The group has not met since.

SEF has sought to maintain air quality as a key strategic priority in overarching strategic documents such as *Ambition is Critical* (the community strategy for Swansea) and its successor, the One Swansea Plan (the Integrated Plan for public service delivery in Swansea). Air quality indicators have been used in connection to these and their related needs assessment documents. In 2015, air quality was included as a ‘Challenge’ (one of 22 key priorities) in the One Swansea Plan and was retained as such in the 2016 update. The latest version of the One Swansea Plan is structured around a series of driver diagrams with a secondary driver labelled ‘Improve and maintain air quality’. This will be further explored and developed over the next twelve months as the public sector works towards the Wellbeing Plan (which will supersede the Integrated Plan).

Air quality improvements also feature in the goals of Swansea Healthy City initiative. A new Healthy Urban Environment (HUE) group, which oversees progress in Swansea with Theme 4 of Phase VI of the international Healthy City programme. HUE has prioritised the proposed city centre developments as its priority focus for the next year and air quality is included in its action plan

5 Planning Applications

Prior to the economic downtown nationally over the last couple of years, Swansea had seen in the preceding years, a substantial amount of interest in development of both green field sites and brown field sites. The catalyst for this upsurge in development was undoubtedly the DIEN (Department of Innovation Enterprise and Networking – formally the Welsh Development Agency) led redevelopment of the old docklands within Swansea Port that has become known as the SA1 development. This major investment site has seen developers submitting Planning Applications both within the SA1 area and more lately outside of that area but to the main within the influence zone of the SA1 development. The situation has changed during 2015/2016 with numerous development sites once again now entering the planning process for diverse sites throughout the authority's area. There has also been an increase in the number of student flat developments within the city centre and Morfa Road area – this increase has undoubtedly been driven by the opening of the Swansea University second Bay Campus on the boundary of this authority with the neighbouring Neath Port Talbot authority (at Crymlyn Burrows adjacent to the wider St.Thomas/Port Tenant area.)

Details of all major projects known of are summarised below as some developments have the potential to impact upon air quality. In the main, these impacts will largely have been/ will be resolved through the planning process. Some development sites have been completed while others remain either in the early stages of construction or of the planning processes. These details have previously been reported fully within the Updating and Screening Assessments and Progress Reports and the details can be found within the various reports at http://www.swansea.gov.uk/article/2850/Local-air-quality-management-reports.

5.1 The Tawe Riverside Development Corridor

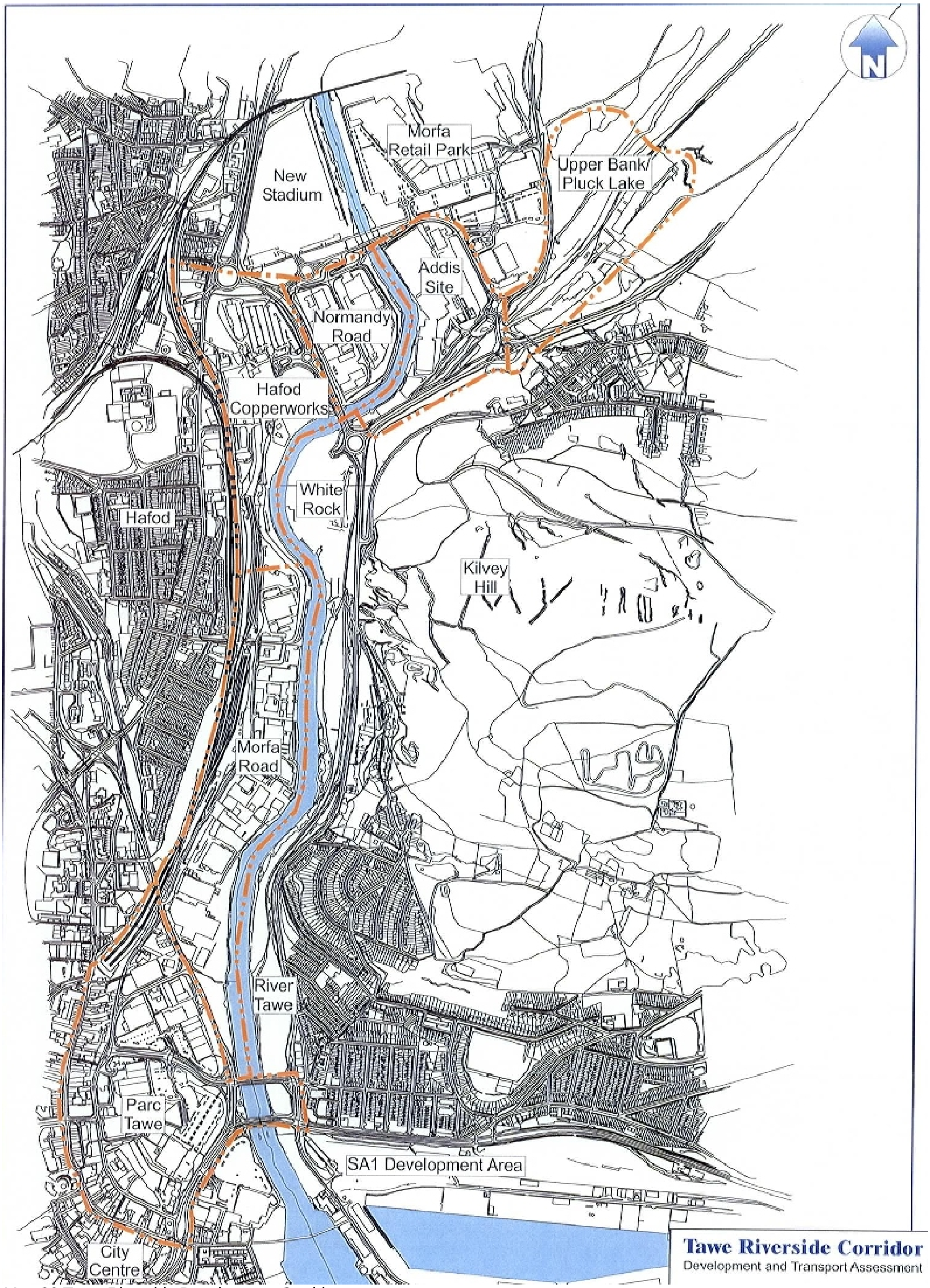
Proposals for the Tawe Riverside Development span a large area of former derelict industrial land and currently occupied commercial sites from Quay Parade Bridges up to, and beyond the new Liberty Stadium and Morfa Retail Park area of the lower

Swansea Valley. The proposals include some housing development sites as well as mixed use sites. All details relating to this development corridor are identified and discussed here as to split the developments may detract from the overall scale of the proposals and significance that the authority is placing on the regeneration of the lower Swansea Valley/Tawe Riverside area. The development area can be seen within map 36 below[46]. The Morfa Road and Hafod Copperworks proposals fall within the existing Swansea Air Quality Management Area 2010.

The River Tawe Corridor provides a series of distinct locations linked by the river and its rich industrial past. The Tawe forms part of the Swansea Waterfront concept, which is of national importance. The concept seeks to integrate the City Centre, Maritime Quarter, SA1 and the River Tawe corridor to allow the creation of a high density, mixed use, modern core for the City. The riverside corridor area provides the next significant opportunity to create a new place in the City for living, working and visiting, capitalising on the heritage importance of the area, which is a key theme linking the development of the area, and the potential of the river for visual interest, leisure and recreation. The Tawe Corridor provides a new sector of the city between the Waterfront and City Centre and links the modern developments at Morfa to the City Centre.

These proposals have the potential to impact significantly on air quality both within the existing Swansea Air Quality Management Area 2010 and outside. An internal working group has been established in order that discussions can take place on how the air quality issues raised can be addressed as air quality objections have already been tabled in respect to certain parts of the master plan.

[46] Tawe Riverside Corridor Study Development and Transport Assessment Final Report June 2006 Hyder Consulting



Map 36 Tawe Riverside Development Corridor.

The Corridor is of immense importance in terms of its industrial past. The development area comprises the western edge of the former Hafod and Morfa Copperworks, which merged in 1924 and were acquired by Yorkshire Imperial Metals in 1957, and are therefore widely known as the YIM site. It lies on the west bank of the River Tawe, bounded to the west by the Swansea Canal, which was established in 1794-8 to open up the coal trade from the head of the Swansea Valley. Its presence encouraged the establishment of other industries, such as Hafod and Morfa Copperworks. No longer profitable by 1902, it became disused and finally closed in 1931. It was infilled, both naturally and deliberately, and was complete by the 1970s. Sections higher up the valley, at Clydach and Pontardawe, were still "wet" in 1988. In 2002, a study was undertaken by Atkins Consultants on the restoration of the Swansea and Neath-Tennant Canals. This developed a range of proposals for restoration, although it was not proposed to restore the canal within the development area to a working waterway given that significant sections are no longer in place.

Hafod Copperworks was established in 1810, the adjoining Morfa Works dating from 1828. A video detailing the history of the area has been compiled and can be viewed at https://www.youtube.com/watch?feature=player_embedded&v=ZpNgDYLQW7A

At its peak in the mid-19th century, Hafod was the largest copperworks in the world, with the greatest output. Morfa's output followed closely behind and between them, the 13 copperworks in the Lower Swansea Valley accounted for 90% of the world's copper production.

The two works merged in 1924 and were acquired as Yorkshire Imperial Metals in 1957. Copper working ceased in 1980 and the site was acquired by (then) Swansea City Council. Much of it was cleared. The A4067/A4217 Cross Valley Link Road was carried through the centre of the site in the early 1990s, and light industrial units established in the eastern half. In the 2000s, part of the site was occupied by the Landore Park-and-ride scheme.

To the south of these copperworks, between Morfa Road and the River Tawe, were a number of other industries. These were largely established in the 19th century although the Cambria Pottery, at the south end of the development area, dates from 1720. It was disused by 1868 and has now gone. This area lay between the Swansea Canal and the River Tawe and was a natural site for a series of coal wharves, and wet- and dry-docks. Other industries developed in this area during the 19th century including a foundry, a nickel-cobalt works and a phosphate works. Many of them had closed by the earlier 20th century. The canal, wharves and docks were progressively disused and infilled during the 20th century, and much redevelopment took place, mainly comprising light industrial units. An area to the south, between Morfa Road and the River Tawe, during the 19th century, was the site of a number of subsidiary industries including two large and important potteries, in addition to the coal wharves and dry docks that served the port of Swansea.

The area is of crucial importance to the later history and development of Swansea. The Hafod and Morfa Works, two 19th century copperworks were, during the mid-19th century, the largest in the world, with the greatest output. Hundreds were employed in these industries, and housed in purpose-built densely packed back-to-back terraced housing - notably, the Hafod area.

The area is also an important feature of the urban landscape. It is one of the very few assemblages of 18th-19th century industrial buildings that survive in Swansea. There are 11 listed buildings within the development area, and two Scheduled Ancient Monuments, alongside the incomplete remains of a large number of other structures and features.

The structural remains within the development area are not limited to listed buildings and Scheduled Ancient Monuments. There are the remains of further former structures, and former surfaces, which together increase the Group Value of the site. The extensive use of local building stone (Pennant sandstone), and indigenous copper slag blocks, are an important contribution to the 'sense of place'. The geometry of the area and its relationship with the Swansea Canal and the river, is also important, and is still well preserved.

The protection of the surviving remains is seen as "the last chance" to preserve and interpret the industrial copper heritage of Swansea.

5.1.2 Summary of Area Strategies

The strategies for the development and regeneration of the parts of the development area are in summary:

Morfa Distributor Road

- The introduction of a new road between the A4067 (Hafod Site) to the Strand and New Cut Road (Morfa Road site) to have a “distributor route” function to serve development in the area, enabling maximum development opportunities with minimum environmental impact, particularly on industrial heritage;

Morfa Road Area

- Altering the balance of uses in the Morfa Road area from light and heavy industry and dereliction, which ignores the river frontage, to a high quality mixed area of residential, commercial and light industrial uses. The development would thus capitalise on the superb riverside setting, the proximity of the area to the City Centre and waterfront and also celebrate and interpret the heritage of the area.

Hafod Copperworks Area

- An integrated, mixed use development of Hafod Copperworks, which:
- preserves heritage structures, interprets industrial history and finds new uses for heritage buildings, to ensure the heritage importance of the area is fully celebrated;
- capitalises on the waterfront location and strategic proximity to the stadium by the introduction of a hotel and restaurant/ bar/ café uses, bringing economic vitality back to the river frontage by day and evening;
- provides for water transport links and recreation, in particular a ferry stop to enable the site to be linked to the Swansea Waterfront and the National Museum;

- provides for park and ride links to the City Centre; and
- provides a high quality living environment with strengthened links to the existing Hafod community.

Normandy Road Industrial Estate

- The retention of Normandy Road Industrial Estate as a location for employment and industry, whilst visually enhancing the site, reducing the visual impact on adjacent land uses and investing in improvements to properties to raise the quality of the estate.

Addis Site

- The redevelopment of the Addis site for residential uses as the next stage in forming a truly mixed use and high quality part of the riverside – with leisure, retail, industrial and residential uses, whilst respecting the heritage importance of the site. Development of this site commenced during 2006 with the former factory units being demolished and the site remediated. Construction works commenced late 2006/early 2007 but ceased during 2009 due to the economic downturn. In 2010 works recommenced at the site with several new blocks being erected. Development has continued throughout 2015.

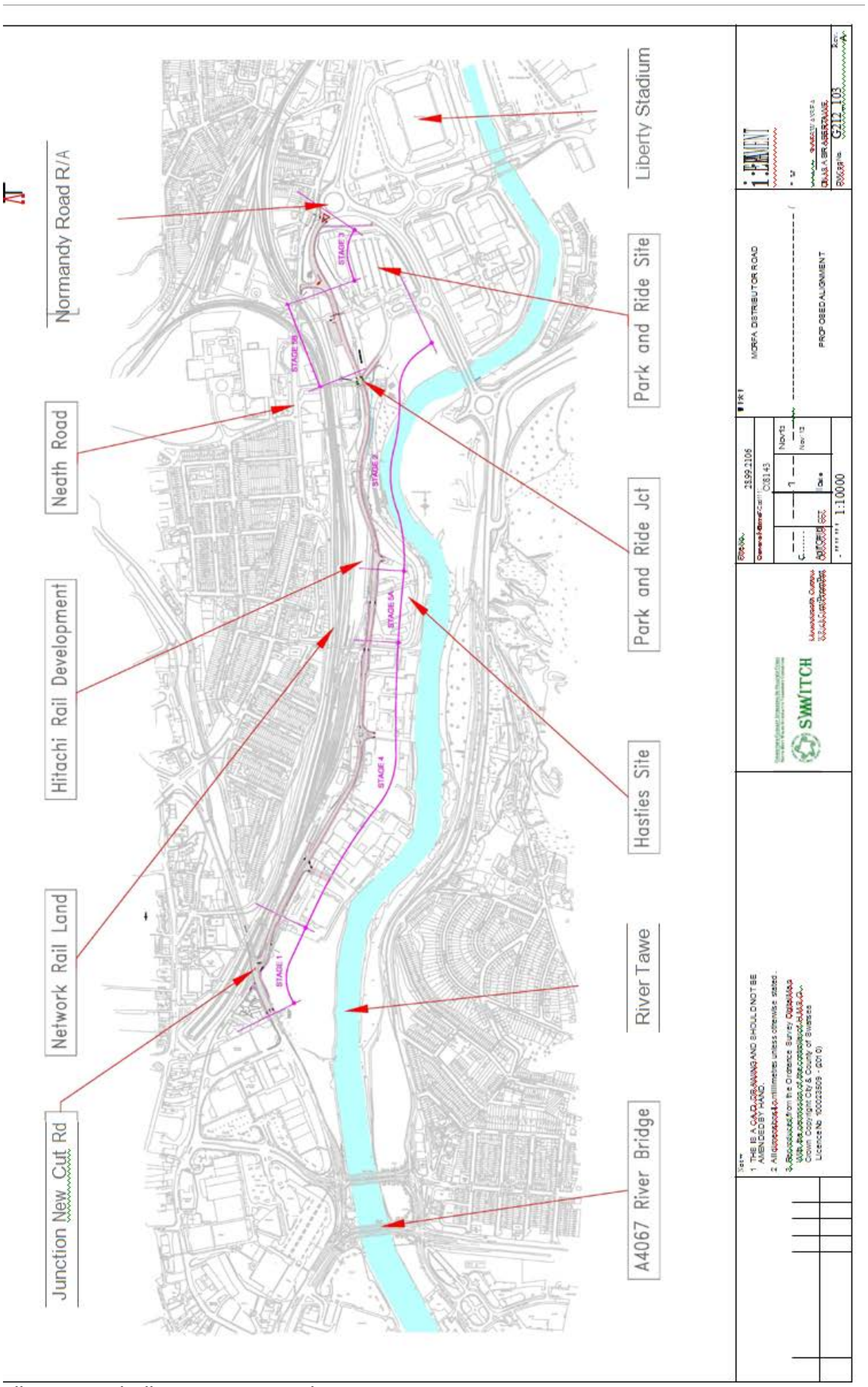
Upper Bank/ Pluck Lake

- Encouraging a compatible mix of land uses to regenerate the Upper Bank site, removing the current areas of dereliction and contributing to the regeneration of the wider area;
- Accommodating the objectives and future plans of the Swansea Vale Railway Company and recognising the heritage value of the site; and

Recognising the amenity importance of Pluck Lake and Kilvey Woodland, whilst bringing selective development into the area to improve the attractiveness of the site

5.2 Morfa Distributor Road

The City and County of Swansea is proposing to introduce a new road from the vicinity of the existing junction between the B4603 and A4067 to the Strand and New Cut Road.



Map 37 Morfa Distributor Road Alignment Proposals

It is intended that the road would have a “distributor route” function aiming to serve development in the area. Map 37 above shows the Distributor Road proposals. Alternatives to this route have been investigated by the Highway Authority as part of the development proposals. This is to ensure that the route chosen enables maximum development opportunities in the Hafod/ Morfa Road area with minimum environmental impact, particularly on industrial heritage, as well as providing the distributor road.

The majority of the route runs along the line of the former Swansea Canal.
As a result, significant works have been undertaken to assess the existing ground conditions and mitigate any impact on nearby listed structures

Stage 1- The Authority’s Highway Construction Unit has completed during early 2014 the first stage of the Morfa Distributor Road scheme. This involved the reconfiguration of the junction between New Cut Road and Morfa Road to accommodate predicted future traffic flows and to provide improved pedestrian crossing facilities. The works extend up to the frontage of Pipehouse Wharf and will be progressed along Morfa Road in conjunction with future redevelopment of adjacent sites.

Stage 2 - Recent work has focused on reconciling the planning applications and proposals submitted by PMG Development at the Hastie’s Site and by Hitachi Europe Ltd at Network Rail’s Maliphant St Depot, which will enable the release of land required for the Distributor Road.

Enabling works are now progressing in parallel with the detailed design of Stage 2. This utilises additional site investigation information and Stage 2 will provide a route from the existing Park and Ride bus route to the entrance of PMG’s site. This is integral to the development of the PMG site which is identified for residential use. The design is also being adapted to accommodate potential development works at the adjoining Copper works Site. Proposals will enable key linkages for potential visitors to this important historic area. The main construction of this stage will not commence until dedication of land has taken place and until sufficient funding is available from the developer’s financial contribution and / or

Regional Transport Plan Grant funding.

Stage 3 - Traffic modelling work is currently underway to help develop a design that will maximise flows through the junction, whilst maintaining bus priority arrangements. The design is being developed so as to ensure that the majority of the works can be developed outside of the existing highway boundary, thereby limiting the impact on the highway network during the construction process

Stage 4 - The majority of works involve enhancements along the existing length of Morfa Road. These are to be delivered in conjunction with the proposed development of the adjoining sites. Key access points have been identified to permit development adjacent to the route whilst maintaining traffic flows along what will be a key distributor road.

Stage 5 - Stages 5A and 5B will provide the final linkages, connecting the Distributor Road as a through route. These elements will not be undertaken until all other stages are complete, so as to ensure that the road and junctions linking to the existing network are safe and sufficient to cater for the proposed highway demand.

It is envisaged that the link under the railway from Maliphant Street would become for pedestrian and cyclists only, and be enhanced. This could include painting or cladding of the underside of the bridge in a light colour, a shared surface for cyclists and pedestrians which also allows emergency access, new signing and lighting.

5.3 Morfa Road Area

Morfa Road presents a significant opportunity for redevelopment, capitalising on the riverside setting, the proximity of the area to the City Centre and waterfront and also to celebrate and interpret the heritage of the area. The strategy for the regeneration of the area is to alter the balance of uses from light and heavy industry and dereliction, which ignores the river frontage, to a high quality mixed area of residential, commercial and light industrial uses.

While the land uses provide the framework for development, it is envisaged that the City and County of Swansea will take a flexible view of the use of each site, taking into account any changes in the market situation and the aspirations of land owners. Thus in the longer term, should market conditions change, the majority of the sites in the area may be redeveloped for housing and this is also considered to be acceptable.

The strategy is to be achieved through the provision of a master plan that sets the framework for investment by the private and public sector in the area and is shown within map 38 below.

Map 38 - Morfa Road Area Master Plan

The overall design concept is for:

- a mixed use development of individual sites according to land ownerships;
- the prime focus of each development site being orientated towards the river;
- a network of routes for pedestrians focussed on the riverside walkway/ cycleway with links through the sites at key locations to Morfa Road;
- a secondary focus to development sites to the centre of each site, giving a more intimate scale to the living environment. The central parts of site would be the location for any community facilities and local open space;
- traffic access from Morfa Distributor Road into each site. Within the sites, residential development in accordance with the 'Home Zone' principle of shared pedestrian and vehicular surface, designed for a speed of 10 mph.

The master plan incorporates the following elements:

- An upgraded Morfa Road to a distributor road standard, linking from the north between the Hastie Site and the railway. The road link is proposed to have a limited number of junctions, the locations for which have been chosen to enable phased development in accordance with the various land ownerships.
- A riverside walkway and cycle route of minimum width of 6 metres. This would provide continuous access from Parc Tawe through to the Hafod Site. A footpath is in place for the majority of the route at present, with the exception of the Swansea Industrial Components site. Moreover it is currently impassable in places due to overgrowth and there is no barrier to protect users along the river edge.
- The provision of a new pedestrian and cycle bridge across the Tawe between the areas of open space south of the former Unit Superheaters site, across to the former St Thomas Station site. This,

together with a similar facility shown for the Hafod Site, would enable use of both sides of the river bank, connecting to the National Cycle Route on the east bank and link the Morfa Road area to the St Thomas community;

- Mixed-use development of the sites including approximately 360 homes, enhancement and some new development of light industrial uses and trade counter uses; retention of the Dragon Arts Centre facility and approximately 23,000 m^2 of office space. Specifically:
    - Residential development of the former Unit Superheaters, Swansea City Highways Depot and Hastie site (7.3 ha, approximately 360 dwellings at a density of 50/ha);
    - Light industrial uses or trading counter uses on the Bevan and Gladeborough sites, involving a mix of enhancement of existing buildings and new development (2.7 ha, approximately 13,500 m^2 of industrial/ trading space);
    - Office development of the former dairy site, average of three storeys (1.55 ha, approximately 23,250 m^2 gross floor area);
    - Retention of the Dragon Arts Centre facility;
    - Light industrial uses on the Swansea Industrial Components site, possibly comprising a single large factory unit of 5,500 m^2/ 60,000 sq ft; and
    - Retention of light industrial units on the GLT Exports site.

The master plan also illustrates the potential for an element of local needs convenience shopping, open space, and a public house/ café making up part of the overall development as illustrated.

Works commenced during late 2010 /early 2011 to the area formally occupied by Unit Superheaters and continues to see the development progress during 2015 with the construction of a multi storey block of student flats. This site fronts New Cut Road and Morfa Road and is adjacent to the existing Council transport unit at Pipehouse Wharf.

5.4 Hafod Copperworks Site

The Hafod Copperworks Site or Yorkshire Imperial Metals (Y.I.M.) Site is a site of international importance in industrial history and has the potential to help tell the story of Swansea's development over the past three hundred years, provide a place for public enjoyment of the riverside, and a new place for living and working.

The site has lain largely vacant for several decades however, the industrial monuments are deteriorating and certain buildings are at serious risk of loss. The site is the last opportunity to preserve and interpret the City's industrial history.

The strategy for Hafod Copperworks is for an integrated, mixed use development which:

- preserves heritage structures, interprets industrial history and finds new uses for heritage buildings;
- capitalises on the waterfront location and strategic proximity to the stadium by the introduction of a hotel and restaurant/ bar/ café uses, bringing economic vitality back to the river frontage by day and evening;
- provides for water transport links and recreation, in particular a ferry stop to enable the site to be linked to the Swansea Waterfront and the National Museum;
- provides for park and ride links to the City Centre; and
- provide a high quality living environment with strengthened links to the existing Hafod community.

The strategy is to be achieved through the master plan that sets the framework for development of the site. The overall design concept for the Hafod Copperworks site aims to:

- create a stimulating contrast between the dispersed historic buildings and structures and contemporary architecture and activities, all set in a consistent landscape theme;
- exploit the riverfront and differences in level to create memorable views and a sense of drama;
- establish a pattern of mixed uses which will help create vitality, day and evening, particularly on the waterfront;
- organise linkages into and through the site which will be convenient, safe and secure;
- maximise the development potential of the key riverside site; and
- minimise the potential impact of the railway.

A master plan has been developed for the Hafod site, based on the proposed route of the distributor road with the crossing from White Rock and can be seen below in map 39.

Map 39 Hafod Copperworks Development Site

The main elements are:

- a new river crossing for traffic with an alongside pedestrian and cycle route, from White Rock to a roundabout junction south of the Musgrove Engine House;
- an extension to the existing park and ride scheme (300 additional spaces);
- Mixed use waterfront development – a mixed development of apartments, hotel and public house/ restaurant;

- High density housing on two sites either side of the former canal route (approximately 100 units);
- Restoration of the canal as a landscape and heritage feature with a walk along the route;
- Creation of a public space on the river front, giving setting to the Engine Houses and a location for a river ferry stop;
- Continuous walking and cycling route from the footbridge south along the riverfront;
- The consolidation and re-use of the listed buildings and Scheduled Monument within the site:
  - Further development of the Museum Stores for public access, with car parking and pedestrian routes from Neath Road;
  - Consolidation and refurbishment of the Laboratory and Canteen Buildings for commercial use, such as eating and drinking;
  - Consolidation and interpretation of the Musgrove Engine House for public access; and
  - Commercial uses in the Vivian Engine House.

The master plan sets out the potential form of development, but within the framework there is some flexibility to respond to demands for other uses. In particular, there may be potential demand for alternative uses, such as:

- Student and potential key worker accommodation;
- A residential care home;
- Social low cost and specialist housing, including older person accommodation, family accommodation and special needs bungalows.

A new doctor’s surgery/medical centre to replace one surgery potentially requiring relocation in the Hafod.

5.5 Normandy Road Industrial Estate

Normandy Road is an industrial estate lying to the east of the Hafod Site and the south of the Liberty Stadium and Morfa Retail Park. It is almost fully developed and bounded by the river on the eastern boundary, the A4217 to the west and stadium to the north. The estate is occupied predominately by industrial premises, with the exception of the Territorial Army premises and a three-storey office block. The estate is visually prominent in an area, which has seen considerable recent development.

It is considered that the industrial estate serves an important function in providing premises close to the city centre, and it would neither be desirable or easily achievable (given the large number of occupiers and leases with the local authority) to comprehensively redevelop the estate. The buildings are however relatively dated and the estate could benefit from selective redevelopment and refurbishment. The location of the industrial estate is shown below as map 40.

Map 40 Normandy Road Industrial Estate

The site is not proposed for comprehensive redevelopment and therefore the proposals involve a package of environmental improvements rather than a master plan for the site. The strategy for the future of Normandy Road is therefore to:

- Retain the site as a location for employment and industry;
- Visually enhance the site and reduce the visual impact on adjacent land uses

5.6 Addis Development Site

The Addis site occupies a strategic location adjacent to the Morfa Retail Park. The site was formally occupied by the Addis factory, which produced plastic household goods. It was acquired by PMG Developments Ltd who sought planning permission for the redevelopment of the site for residential uses. The redevelopment of the site for residential will be the next stage in forming a truly mixed use and high quality part of the riverside – with leisure, retail, industrial and residential uses, whilst respecting the heritage importance of the site (notably the listed industrial building and Bascule bridge)

A planning application was submitted in January 2006 by Holder Matthias Architects for the redevelopment of the site with construction of 564 residential units including:

- 8 no five storey blocks of 296 residential apartments along the riverside;
- 146 apartments in 2 and 3 storey blocks;
- 122 terraced 2 and 3 storey dwellings; and
- retention of the listed building in the centre of the waterfront area, with future uses to be determined.

The application includes for access, car parking (including under croft), landscaping, open space and infrastructure works including a new riverside cycle path/ walkway.

The overall design concept is to develop a strong river frontage with blocks of apartments and a new riverside walkway and cycleway, graduating eastwards to lower rise two and three storey town houses and terraces. The development uses the principles of a home zone, with access within the site as shared surface between pedestrians and vehicles. The housing design has the majority of properties fronting directly onto the street with gardens to the rear in courtyards/ enclosed spaces. Images of what the development may look like are included as Figures 1 and 2.[47] The Master plan for the site produced for the application is included as map 41.

[47] Images courtesy of Hyder Consulting Final Report Tawe Riverside Corridor June 2006

Works commenced during late 2006/early 2007 with the five story blocks closest to the A4217 (blocks E, F, G and H). During late 2007 the first of these blocks were occupied. Development has recommenced after a short period of inactivity during 2011 due to uncertainty within the housing sector as a result of the financial crisis. Further areas of the site have now been cleared during 2015 and construction of other dwellings within the overall scheme is well advanced.

Map 41 – Former Addis Development Site

5.7 Upper Bank/Pluck Lake

Upper Bank represents one of the few predominantly underused sites in the area occupying a key location overlooking the redeveloped area of Liberty Stadium and Morfa Retail Park. The opportunity now exists to regenerate the site, connecting to the key development land and transport links in the area, whilst promoting a mix of different land uses.

The last remaining section of the Swansea Vale Railway runs through the centre of the site and is occupied by the Swansea Vale Railway Society. The Society has a vision to create a Railway Heritage Centre. The majority of the Upper Bank site is however in a state of considerable dereliction. The adjacent Pluck Lake area is an important amenity area and ecological resource.

The strategy for the future development of the site is to:

- encourage a compatible mix of land uses to regenerate the site, removing the current areas of dereliction and contributing to the regeneration of the wider area;
- accommodate the objectives and future plans of the Swansea Vale Railway Company and recognise the heritage value of the site;
- recognise the amenity importance of Pluck Lake and Kilvey Woodland, whilst bringing selective development into the area to improve the attractiveness of the site;

The overall design concept for the Upper Bank/ Pluck Lake site aims to:

- maximise the commercial development potential of the site;
- exploit the differences in level to provide attractive views out from the site to the west;

- establish a pattern of viable mixed uses which will create an attractive living environment and complement the regeneration of the wider area;
- enhance the role of the site in telling the story of Swansea's industrial heritage;
- improve linkages to the Pentrechwyth community and the Kilvey Community Woodland.

The master plan for the site is illustrated in map 42 below and includes:

- A new access westwards from a proposed roundabout junction on Nantong Way;
- A mix of affordable and general housing, totalling approximately 125 units;
- A roundabout junction providing access into the housing areas and railway heritage area;
- Relocation of the Railway Society operations with provision to enable future phases of development of a heritage centre; and
- Potential development site for a hotel south of Pluck Lake

The master plan as proposed would release a significant parcel of brownfield land for housing development. The area of housing land identified on the plan would amount to 3.19 hectares.

The site would be sensitively integrated with the adjacent rail land and the amenity of the future occupiers will be safeguarded from any of the potential impacts of the rail activity by close attention to a green buffer between the two.

Map 42 Upper Bank/Pluck Lake Development Site

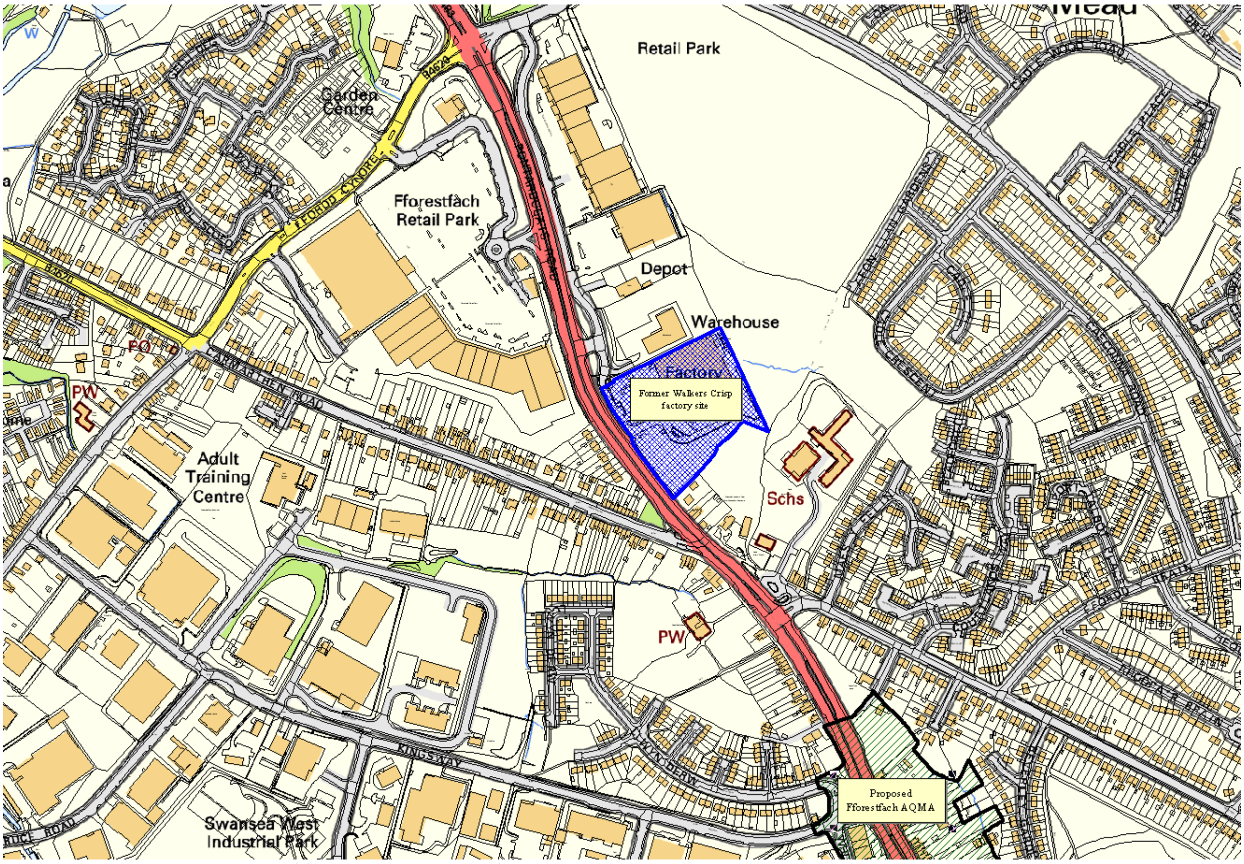
The master plan includes the provision of an area to safeguard the future operations and expansion of the Railway Society site. The proposal includes the recommendation that the site redevelopment includes for implementation of Phase 1 works (by negotiation between the Railway Society and City and County of Swansea) to enable the Railway Society to continue their current operations of upgrading the remaining section of the Swansea Vale Railway and restoring the locomotives and rolling stock within a covered modern industrial unit. The proposals would also enable the Society to fully explore the feasibility of establishing a shuttle service between the two terminals at Upper Bank. This will require basic facilities at either terminal, but will help to establish a revenue stream for the Society and the impetus to progress subsequent phases.

Site clearance commenced during early 2013 in preparation for implementation of the scheme. Construction works commenced during early 2014 and have continued during 2015 and the early months of 2016.

5.8 Former Walkers Crisp Factory, Pontarddulais Road

The proposals for this former industrial complex include partial demolition of the rear portion of the existing factory building, to provide 107 residential dwellings (comprising 12 detached dwellings, 14 semi-detached dwellings, 3 blocks of 14 no. terraced dwellings, 4 blocks of 67 no. flats) parking and associated works.

The site fronts onto the busy A483 and north of the boundary of the Fforestfach Air Quality Management Area that itself forms part of the Swansea Air Quality Management Area 2010. The site is adjacent to the Pontarddulais Road Retail Park and opposite the Parc Fforestfach Retail Park with the Swansea West Industrial Park located off the A483 approximately 550m to the south. Map 39 below outlines the proposed development site. As of early 2016, the development has not commenced.



Map 43 Proposed Development of former Walkers Crisp factory site

5.9 Liberty Stadium Expansion

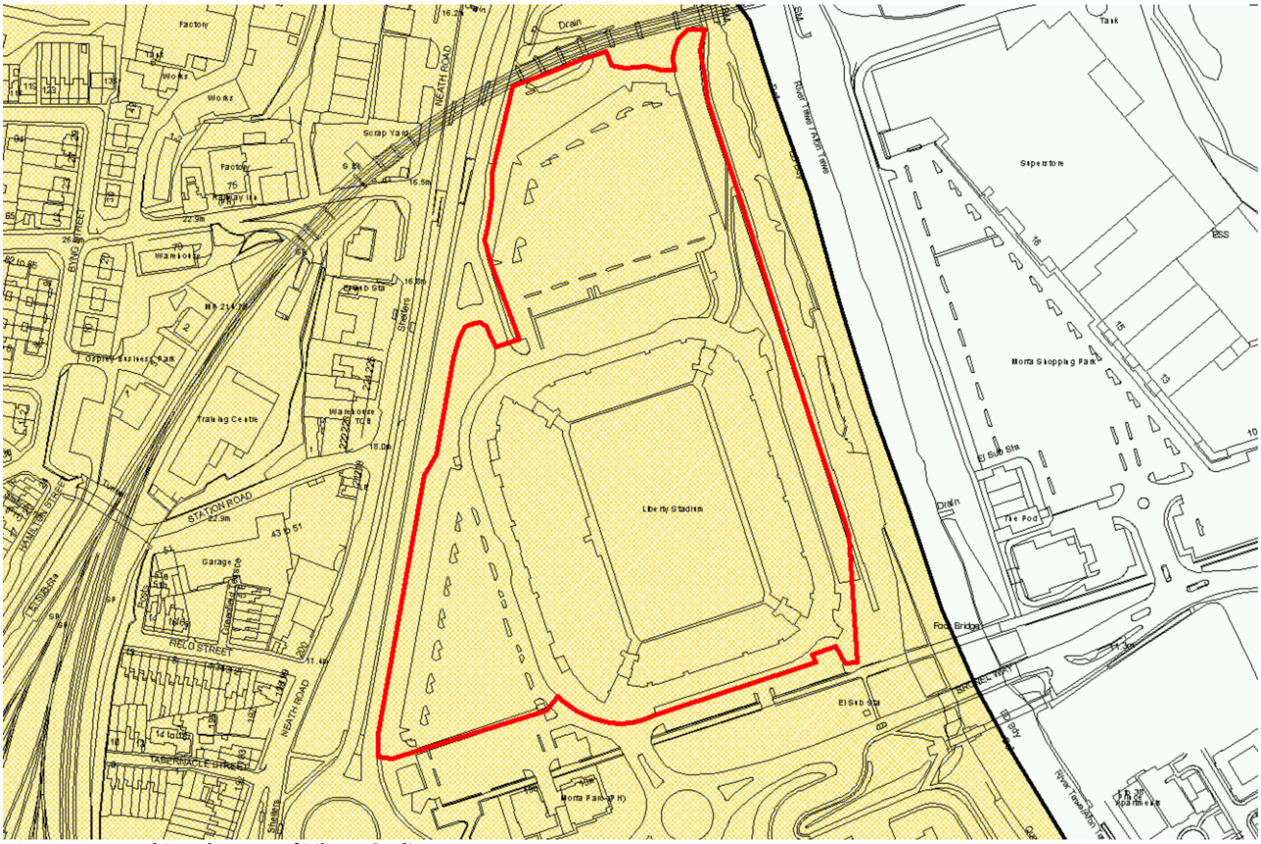
A Planning Application was submitted by Swansea City AFC (ref 2013/0554) to expand the Liberty Stadium, Landore, Swansea from 21,600 seats to 34,000 seats.

The proposed development was planned to be split over three phases:-

- Phase 1 provides an additional 3,844 seats and was proposed be completed in time for the start of the 2014/2015 season.
- Phase 2 will provide a further 4,718 seats and was proposed to be available for the start of the 2015/16 season
- Phase 3 will provide an additional 3,383 seats and was proposed to be constructed after the 2015/16 season.

The application site lies within the Swansea Air Quality Management Area 2010 and has the potential to generate additional traffic movements on match days. Air quality considerations are being dealt with by way of the Travel Plan submitted as part of the application. The primary aim is to intercept travelling spectators some distance away from the stadium area and direct them to Park and Ride sites – both home and away supporters. Numerous items are under consideration including discounting the park and ride as part of season tickets etc. The application was approved during early 2014 but as of early 2016 the works are yet to commence. Further updates will be provided in due course.

A map of the proposed development location is given below as map 44. The Swansea 2010 Air Quality Management Area is highlighted as the shaded area.



Map 44 Proposed Development of Liberty Stadium

5.10 Additional Planning Applications Received

Lists of additional planning applications received where the scheme could possibly impact upon local air quality are listed below within table 41.

App Ref. No.	Location	Description
2013/0261	Land at Cae Duke Loughor Road Loughor Swansea	Construction of 106 residential units and associated works, including a new access spine road, public open space, recreational space, surface water attenuation ponds & reed bed, and public footpath linking onto Waun Road
2013/0741	T D Williams Site, Pleasant Road, Gorseinon, Swansea	Change of use of warehouse distribution centre to Local Authority corporate transport depot (including associated vehicle maintenance), layout out of vehicle/staff car parking, external alterations to existing office/warehouse building, 3m high perimeter fencing, ancillary outbuilding/structures and alteration of existing vehicle access points (Council Development Regulation 3)
2013/1017	Tidal Lagoon Swansea Bay Swansea	Proposed application for development consent to construct a tidal lagoon for the purpose of generating renewable energy (consultation under Section 42 of the Planning Act 2008)
2013/1069	Maliphant Rail Depot, Maliphant Street, Landore, Swansea, SA1 2EN	Construction of Intercity Express Programme Maintenance Depot including a pedestrian footbridge and access ramp, maintenance building, train wash facility, two storey accommodation building, fuel pump room & tank, CET pump room & water tank, train wash plant room, HV substation, LV switch & transformer rooms, with associated security fencing, lighting, CCTV, retaining wall, groundworks, trackworks, car parking and landscaping (amendment to Planning Permission 2011/1305 granted 1 February 2012
2013/1114	Land south of Heol Dulais Birchgrove Swansea	Construction of 148 residential units and associated works
2013/1254	Former Clayton Works Site, Station Road, Pontarddulais, Swansea, SA4 8TJ	Construction of up to 53 residential units including public open space, public car parking (13 spaces), pedestrian access to Water Street, new vehicular access from Station Road and secondary emergency vehicle access onto High Street (outline)
2013/1360	Eastern plot of Cwmbwrla Park, Gerddi Alexander, Swansea	Construction of new Burlais Primary School (two storey / part single storey) building incorporating roof-top PV array, with associated playground / sports courts, waste and sprinkler tank building, delivery area, 2.4m - 2.1m high perimeter fencing, cycle shelter, associated landscaping, external lighting, CCTV and external works. Demolition of existing fire damaged changing facilities building and construction of replacement pavilion building and new 69 space car park with vehicular lay-by on Maes Glas for drop-off / pick up (Council Development Regulation 3).
2013/1402	Plot D5A, Langdon Road, SA1 Swansea Waterfront, Swansea	Construction of 5 storey residential block incorporating 69 no. apartments (Class C3) with undercroft parking, external amenity space and landscaping (variation of Condition 13 of planning permission 2009/0330 granted on the 27th May 2009 to vary the proportion of affordable housing to be provided within the development).
2013/1403	Former Castle Cinema, Worcester Place, Swansea, SA1 1JQ	Substantial demolition of the former Castle Cinema with retention of two storey entrance foyer to Worcester Place elevation & two storey element to the Strand elevation, and construction of a part 5 / part 4 storey mixed use development incorporating parking / storage on the Strand, commercial space (Class B1) on lower ground floor, commercial unit (Class A1, A2 / A3) at ground floor (to Worcester Place), with 66 student study bedrooms within 16 cluster flats
2013/1522	Swansea Gors TEC site	Residential development for up to 73 dwellings (outline)

	Heol y Gors Cockett Swansea SA1 6SB	
2013/1665	The River Bank Pentrechwyth Swansea SA1 7DD	Construction of 4 blocks of three storey residential apartments (60 No in total) with associated car parking, cycle, bin, caretakers stores and associated works (amendment to planning permission 2006/0344 granted 13th September 2006)
2013/1806	Former Pantycelyn Hotel 368-370 Oystermouth Road Swansea SA1 3UL	Construction of 29 no. 1 bedroom flats
2013/1815	Phase 1 Parc Tawe Plantasia Swansea SA1 2AL	Alterations to existing retail park comprising demolition of vacant piazza units, kiosks, and some retail floorspace (Class A1/A3 use), substantial demolition of the enclosed walkway, potential demolition of vacant Class A3 former pizza restaurant, sale of DIY goods in proposed unit 6A, extension of Unit 6A into rear servicing area to form external garden centre with associated enclosure, alterations and refurbishment of building facades, physical enhancements to the existing footbridge and associated ramp, erection of a standalone drive-thru restaurant unit (Class A3), reconfiguration of car parking layout, erection of 3m screen walling; landscaping and public realm works and associated highways works.
2013/1844	Land at Elba Playing Fields Ffordd Beck Gowerton Swansea	Construction of new Gowerton primary school with associated playground, car parking, vehicular access, perimeter fencing, landscaping, external lighting / CCTV and external works including reconfigured children's play area (Council Development Regulation 3).
2014/0275	Land at Samlet Road Llansamlet Swansea SA7 9AF	Demolition of existing buildings and construction of a 1,764sqm (gross) food store (Class A1) with associated access, parking, landscaping and ancillary works
2014/0328	Land to the rear of 212-222 High Street Swansea SA1 1NN	Construction of 5 storey block with roof accommodation (incorporating mezzanine/plant room within roof void), comprising lower ground floor restaurant/coffee shop (Class A3), with 5 storeys for creative cluster activities or office use (primarily Class B1 and ancillary uses), external alterations to existing Kings Lane warehouse and use of building for creative cluster activities or office use (primarily Class B1 and ancillary uses) over 3 floors with new bridge/walkway linking the northern elevation to High Street level, creation of lower level courtyard public open space and temporary extension of car parking area at The Strand level; associated infrastructure works, means of enclosure and landscaping.
2014/0434	Swansea University Bay Campus, Fabian Way, Jersey Marine, Neath	The construction of 545 residential student bedspaces, gym, sports hall, creche and student union facilities and associated works (Bay Campus Phase 1B) (referral from Neath Port Talbot County Borough Council)
2014/0626	Former Sketty Junior & Infants School Carnglas Road Sketty Swansea SA2 9BP	Construction of 45 flats within 3 three storey blocks with associated car parking and external works, with vehicular access and additional car parking on Carnglas Road (Variation of condition 18 of planning permission 2010/1813 granted 15th July 2011 to vary the proportion of affordable housing to be provided within the development from 100% to reflect Council's Policy).

Table 41 – List of Planning Applications Received

5.11 Swansea Local Development Plan 2010-2025

The City and County of Swansea Deposit LDP was presented to Council on 16 June 2016 and endorsed for a public consultation. The public consultation is now underway and will be ongoing throughout July and August 2016.

The full text can be viewed at http://www.swansea.gov.uk/ldpdeposit

The Deposit LDP presents a positive approach to managing the inevitable future growth and change that will occur within the City and County of Swansea. The policies and proposals set out in the plan address the county's need for new homes, jobs, infrastructure and community facilities to support economic growth and raise standards of living. Policies that promote development are set out alongside those that will ensure future proposals respect and promote the county's cultural heritage, important landscapes and sensitive environments.

The plan promotes a clear 'placemaking' agenda and strategy, and emphasises that future development must accord with the overarching aims of enhancing quality of life and well-being. Planning for growth that is commensurate with the aspirations of a City Region inevitably involves difficult decisions about releasing greenfield land for development. However, the Deposit LDP provides the opportunity to ensure that such development is of a quality and nature that will ensure the place that is ultimately delivered provides a proud legacy for future generations.

The Deposit written statement comprises:

- Overview and Strategy
- Policies and Proposals
- Monitoring Framework
- Proposals Map
- Glossary
- Appendices

The LDP Proposals Map comprises a series of maps covering all areas of the county, and features a variety of designations overlain on an Ordnance Survey base. These include sites and development areas described in the preceding policies and proposals. It also defines the settlement boundaries of the main urban area and key villages, beyond which are the areas considered open countryside, where most forms of development are not favoured. The Proposal Map designations include:

- Housing Sites (allocations and commitments)
- Strategic Development Areas
- District Centres and Retail Parks
- Mineral Safeguarding Areas
- Green Belt/Green Wedges
- Special Landscape Areas

Within the LDP 2010-2025 Strategic Development Areas (SDAs) are allocated at 12 locations to provide new homes and opportunities for job creation and commercial investment at a strategic scale.

Residential led SDA's are capable of accommodating a minimum of 500 homes, in accordance with the schedule of estimated units set out in this policy, and other complementary and supporting uses depending on the nature and scale of the site. Mixed use SDA's will provide new homes as part of wider mixed-use proposals to also deliver significant investment and economic benefit arising from commercial, community and/or cultural regeneration projects.

SDA's boundaries are defined on the Proposals Map and include areas that will not be suitable for development due to technical constraints, environmental sensitivities and/or site specific requirements, including public open space and infrastructure.
Six SDA's are capable of delivering a greater number of homes beyond the Plan period, as highlighted in the following schedule, the details of which are set out in the relevant site specific SDA policy:

Residential led Strategic Development Areas

Proposals Map Site Reference	Strategic Housing Policy Zone	Site Name	Estimated Units during Plan Period
A	Greater N west	South of Glanffrwyd Road, Pontarddulais	720
B	Greater N west	North of Garden Village	750
C	Greater N west	South of A4240, Penllergaer	750*
D	North	West of Llangyfelach Road, Penderry	1160*
E	North	North of Clasemont Road, Morriston	675
F	West	Cefn Coed Hospital, Cockett	500
		Total number of homes for residential led SDAs	4555

Mixed use SDAs

Proposals Map Site Reference	Strategic Housing Policy Zone	Site Name	Estimated Units during Plan Period
G	Greater N west	Northwest of M4 Junc.46, Llangyfelach	850*
H	North	North of Waunarlwydd / Fforestfach	800*
I	East	Swansea Vale	750*
J	Central	Central Area and Waterfront	1000*
K	East	Fabian Way Corridor	525
L	Central	Tawe Riverside Corridor and Hafod Morfa Copper Works	370
		Total number of homes for Mixed Use led SDAs	4295

*** Sites capable of delivering a greater number of homes beyond the Plan period**

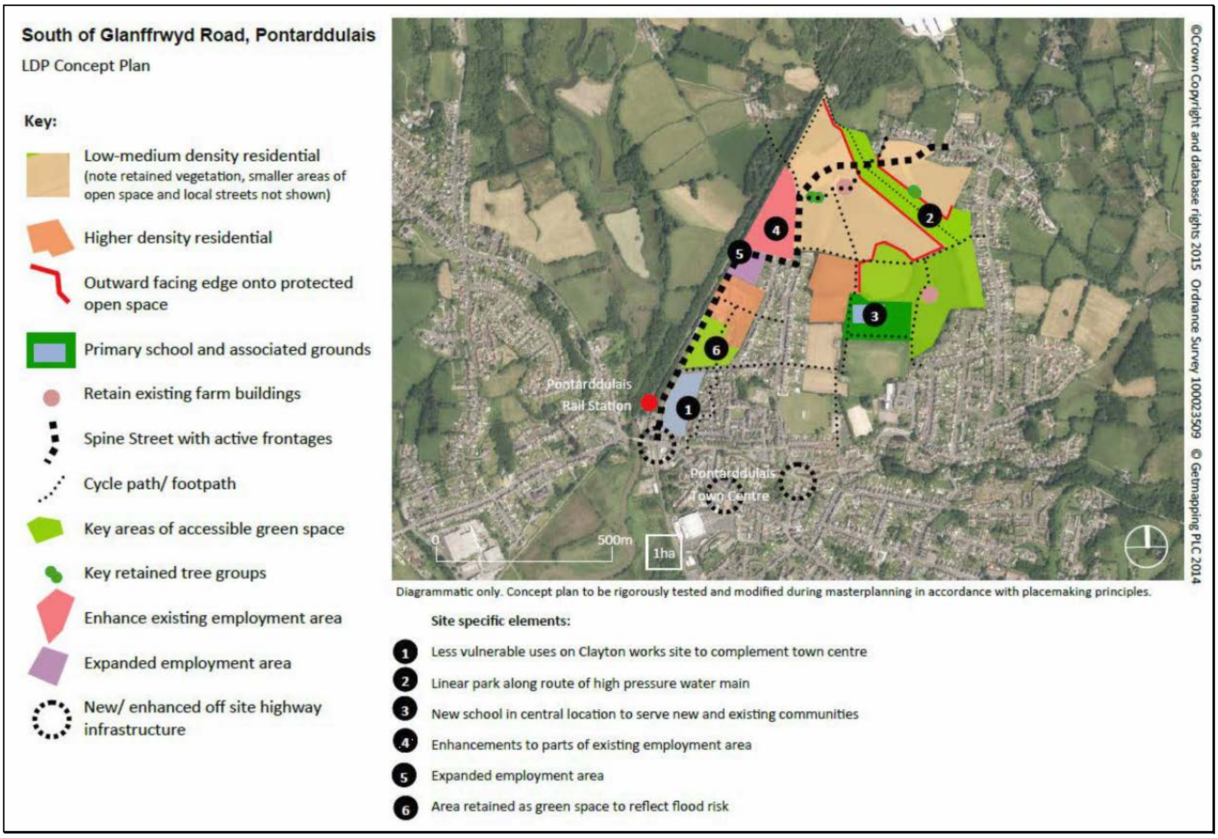
The nature and scale of development for each SDA is set out in individual site specific policies (Policies SD. A-L), which define the Placemaking Principles and Development Requirements at each location. These include details of the necessary range of uses, infrastructure, open spaces and any distinctive attributes at each site

It is anticipated that SDAs will contribute around 75% of the allocations for residential development across the County over the Plan period. The anticipated number of dwellings capable of being delivered during this period are summarised in the schedule, however the precise number will have regard to the site specific masterplanning to be undertaken in support of any future planning application. The number of homes specified for each residential led SDA are considered ceiling figures for the period up to 2025 that should only be exceeded if appropriate evidence is submitted to demonstrate a rise in numbers is justified and appropriate having regard to comprehensive masterplans.

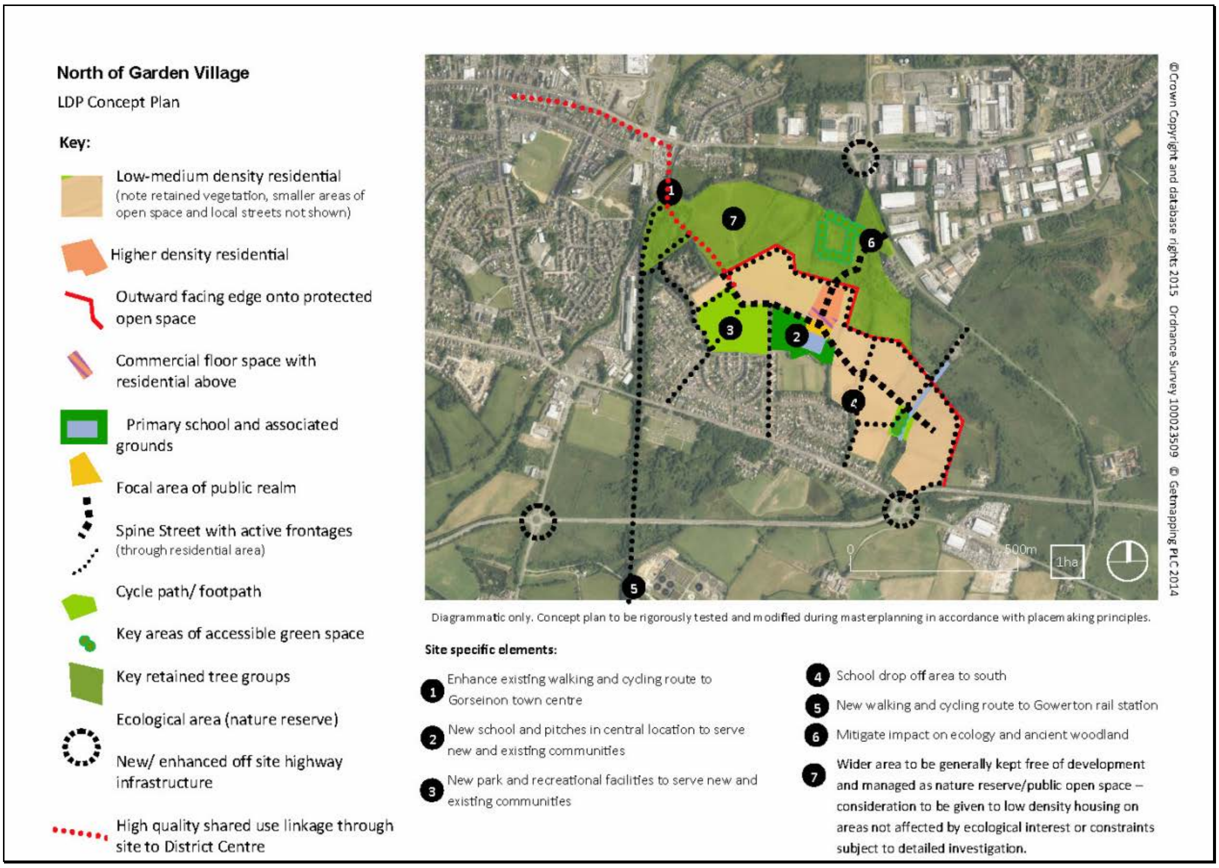
It is anticipated that SDAs will contribute around 75% of the allocations for residential development across the County over the Plan period. The anticipated number of dwellings capable of being delivered during this period are summarised in the schedule, however the precise number will have regard to the site specific masterplanning to be undertaken in support of any future planning application. The number of homes specified for each residential led SDA are considered ceiling figures for the period up to 2025 that should only be exceeded if appropriate evidence is submitted to demonstrate a rise in numbers is justified and appropriate having regard to comprehensive masterplans.

The Proposals Map defines the full extent of the SDA masterplan areas. In some cases sites are capable of delivering more homes than the numbers shown in the schedule, as highlighted in the Policy. However, it is expected that in such instances these sites will not be fully built out until beyond the end of the Plan period (i.e. after 2025). For the avoidance of doubt, the capacity for additional homes at these identified SDAs do not contribute to the housing growth figures for the Plan period, since evidence suggests that build rates are unlikely to exceed the numbers specified in the policy.

Proposals Map Site Reference: A



Proposals Map Site Reference: B



Proposals Map Site Reference: C

South of A4240, Penllergaer

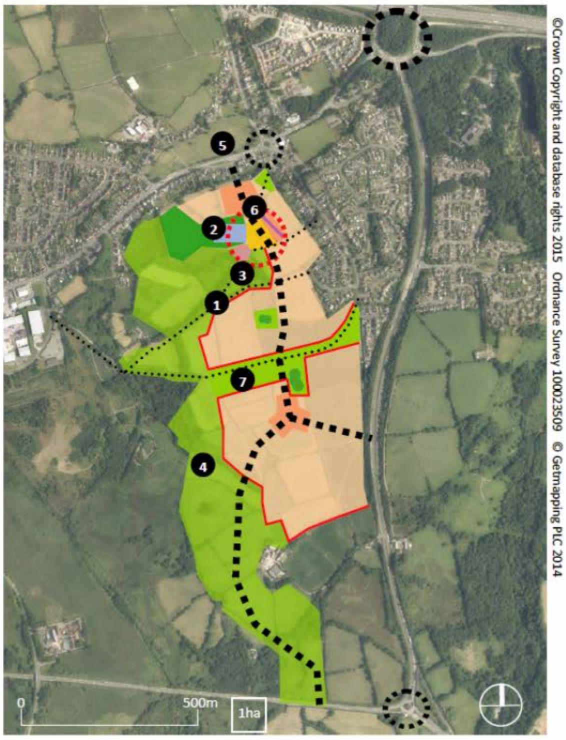
LDP Concept Plan

Key:

- Low-medium density residential (note retained vegetation, smaller areas of open space and local streets not shown)
- Higher density residential
- Outward facing edge onto protected open space
- Local centre
- Commercial floor space with residential above
- Primary school
- Focal area of public realm
- Retain and integrate existing farm buildings
- Spine Street with active frontages through development
- Cycle path/ footpath
- Key areas of green space
- Key retained tree groups Ecological area (nature reserve)
- New/ enhanced off site highway

Site specific elements:

1. Enhance existing walking and cycling routes
2. New school in central location to serve new and existing communities
3. Existing farm buildings retained and reused
4. Accessible green space and ecological areas along west side of site
5. Improve existing pitches
6. New local centre facilities and higher density development
7. Area for active play provision



Diagrammatic only. Concept plan to be rigorously tested and modified during masterplanning in accordance with placemaking principles.

Proposals Map Site Reference: D

West of Llangyfelach Road, Penderry

LDP Concept Plan

Key:

- Low-medium density residential (note retained vegetation, smaller areas of open space and local streets not shown)
- Higher density residential
- Outward facing edge onto protected open space
- District centre
- Commercial floor space with residential above
- Primary school
- Focal area of public realm
- Retain existing farm buildings
- Spine Street with active frontages
- Cycle path/ footpath
- Key areas of green space
- Key retained tree groups
- Ecological area (nature reserve)
- New/ enhanced off site highway

Diagrammatic only. Concept plan to be rigorously tested and modified during masterplanning in accordance with placemaking principles.

Site specific elements:

1. New spine street (approx. 1.5km long)
2. New district centre at key point on spine street, comprising supermarket, unit shops, café/pub, doctors surgery etc
3. New park, sports pitches and associated facilities in central locations
4. New primary school close to district centre to create 'heart' to the new place
5. Strong structure of green corridors following historic field boundaries
6. Positive elements of historic farms retained as focal points
7. Future street link to A48
8. Area to be kept free of development and managed as nature reserve/ linear park/ multi-functional open space
9. Green lane retained and enhanced as pedestrian/ cycle route
10. Significant improvements to J46

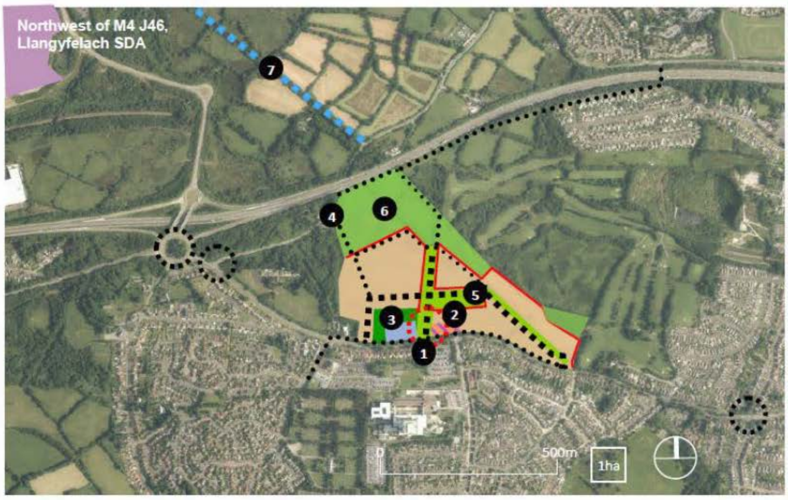
Proposals Map Site Reference: E

North of Clasemont Road, Morriston

LDP Concept Plan

Key:

- Low-medium density residential (note retained vegetation, smaller areas of open space and local streets not shown)
- High density residential
- Outward facing edge onto protected open space
- Local centre
- Commercial floor space with residential above
- Primary school
- Focal area of public realm
- Retain existing farm buildings
- Spine Street with active frontages
- Cycle path/ footpath
- Key areas of green space
- New/ enhanced off site highway



Diagrammatic only. Concept plan to be rigorously tested and modified during masterplanning in accordance with placemaking principles.

Site specific elements:

1. New street accesses off Clasemont Road
2. New local centre at site entrance on Clasemont Road
3. New primary school close to local centre to create 'heart' to the new place
4. Pedestrian and cycle link through site to Pantlasau Road
5. Strong structure of green corridor within the site following historic field boundaries
6. Area to be kept free of development and managed as nature reserve
7. Potential public transport link to Pantlasau Road from Northwest of M4 J46, Llangyfelach SDA

Proposals Map Site Reference: F

Cefn Coed Hospital

Concept Plan

Key:

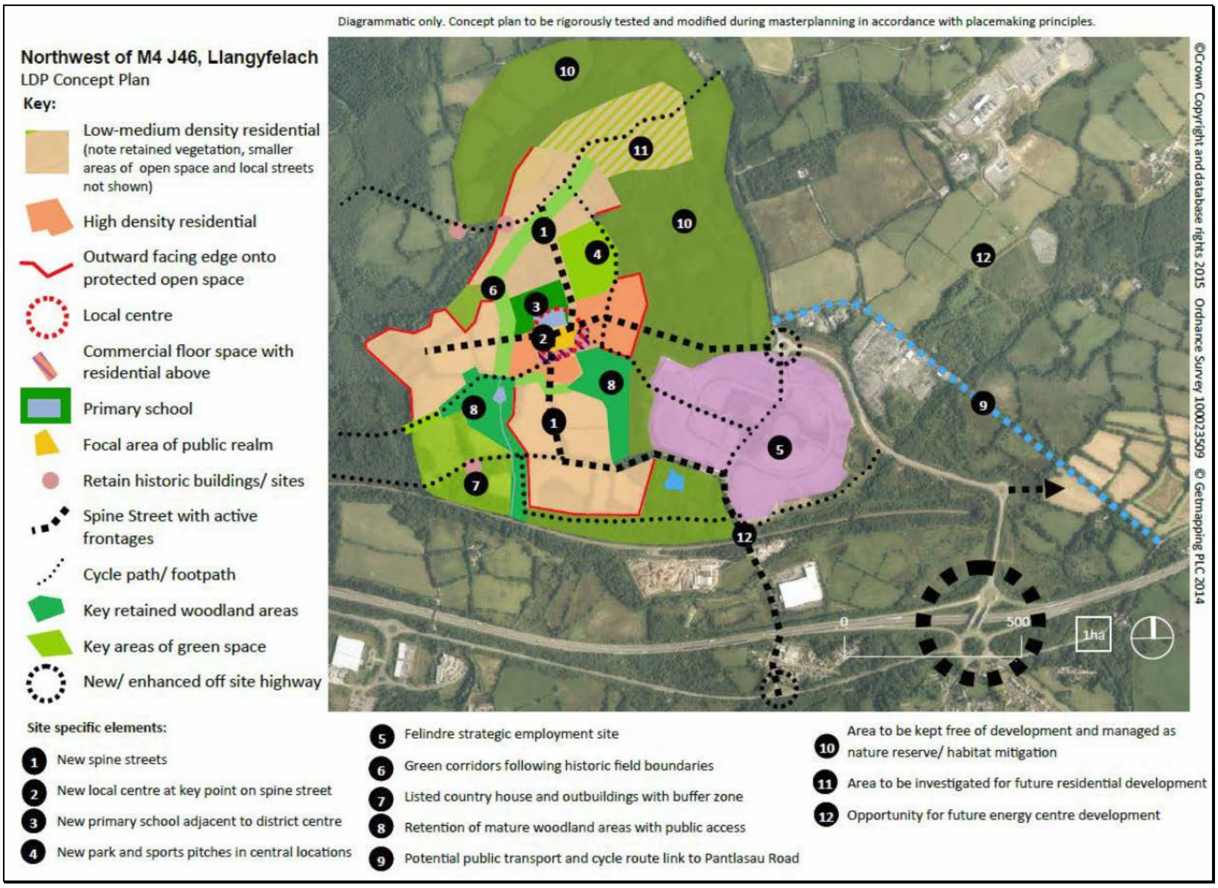
- Low-medium density residential (note retained vegetation, smaller areas of open space and local streets not shown)
- Higher density residential within selected retained hospital buildings
- Outward facing edge onto protected open space
- Existing health care uses retained
- Spine Street with active frontages
- Cycle path/ footpath
- Key areas of accessible green space
- Retained woodland
- New/ enhanced off site highway

Diagrammatic only. Concept plan to be rigorously tested and modified during masterplanning in accordance with placemaking principles.

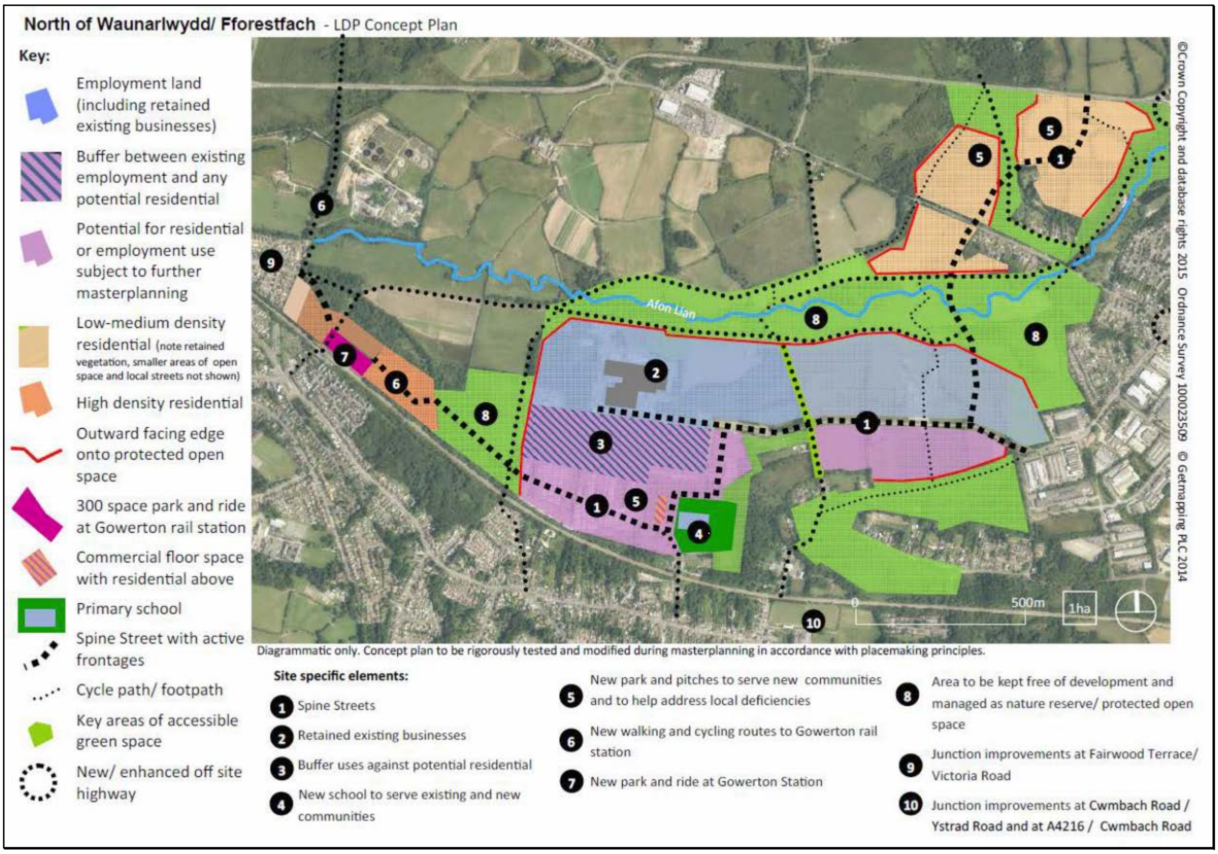
Site specific elements:

1. New street following original perimeter road
2. Selected historic buildings of local interest retained
3. Existing pitches enhanced for recreation to meet local deficiencies
4. Existing Ty Coch primary school
5. Pedestrian and cycle link through site to Llwyn Mawr Road
6. Green corridors within the site
7. Area to be kept free of development and managed as nature reserve
8. Limited vehicle access

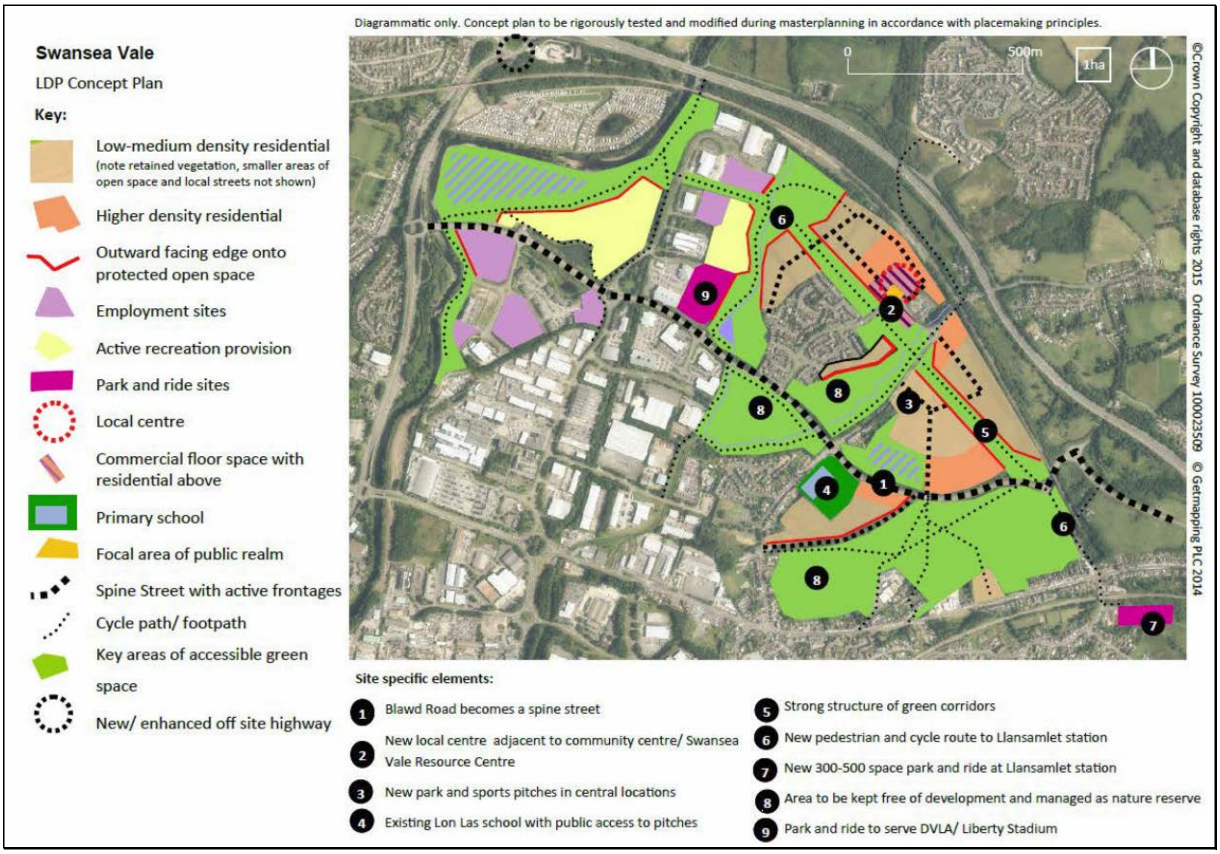
Proposals Map Site Reference: G



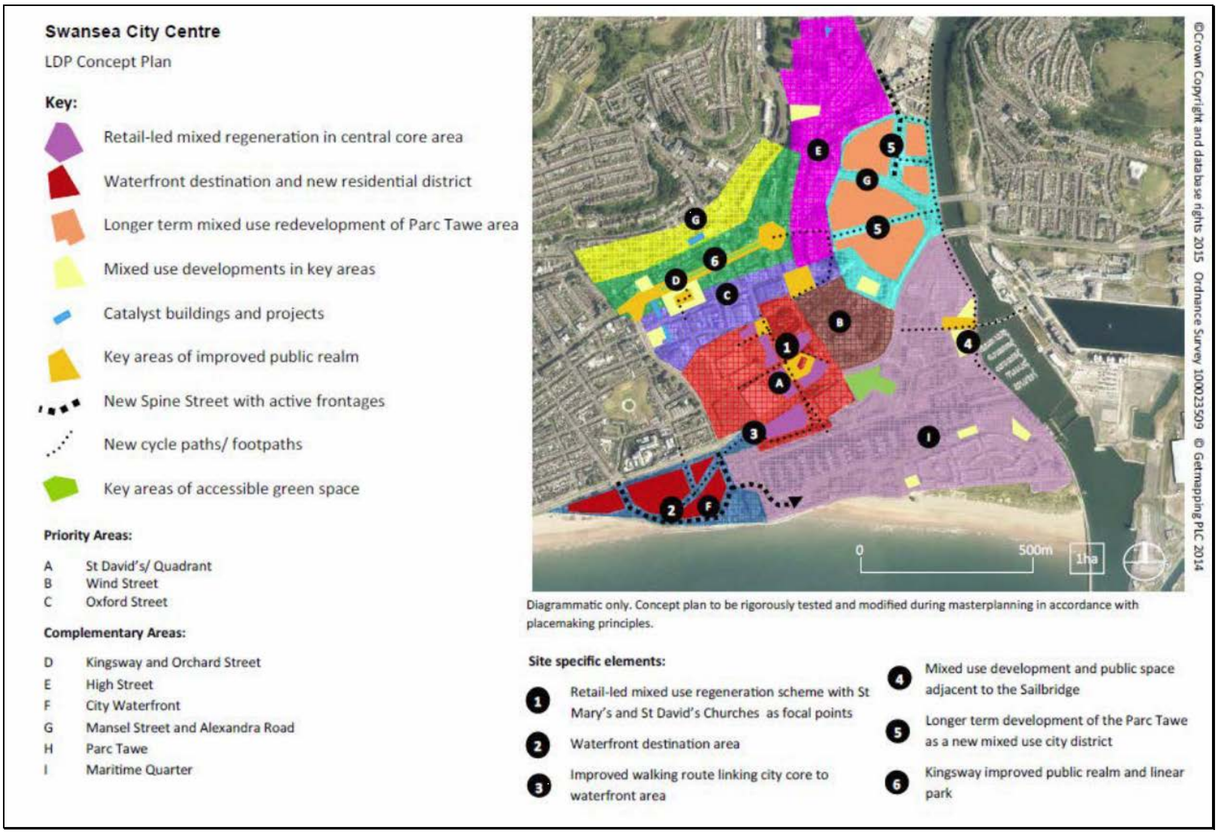
Proposals Map Site Reference: H



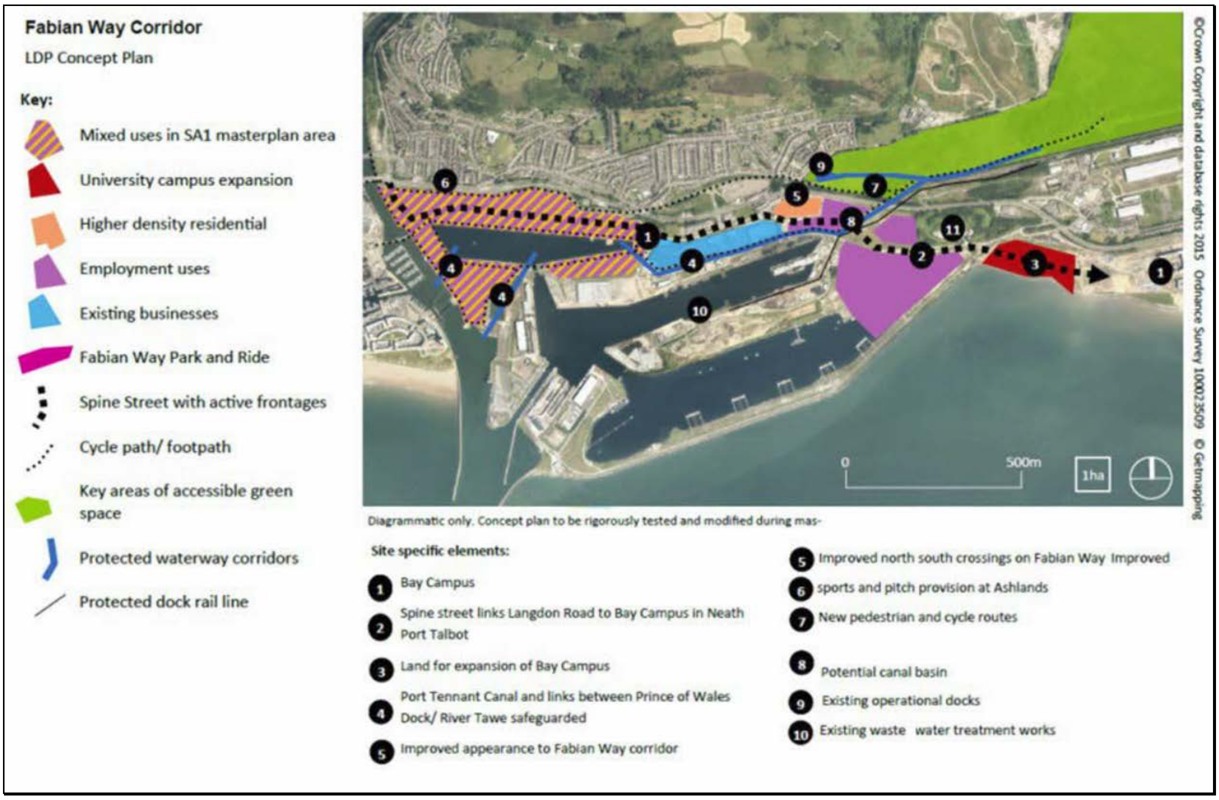
Proposals Map Site Reference: I



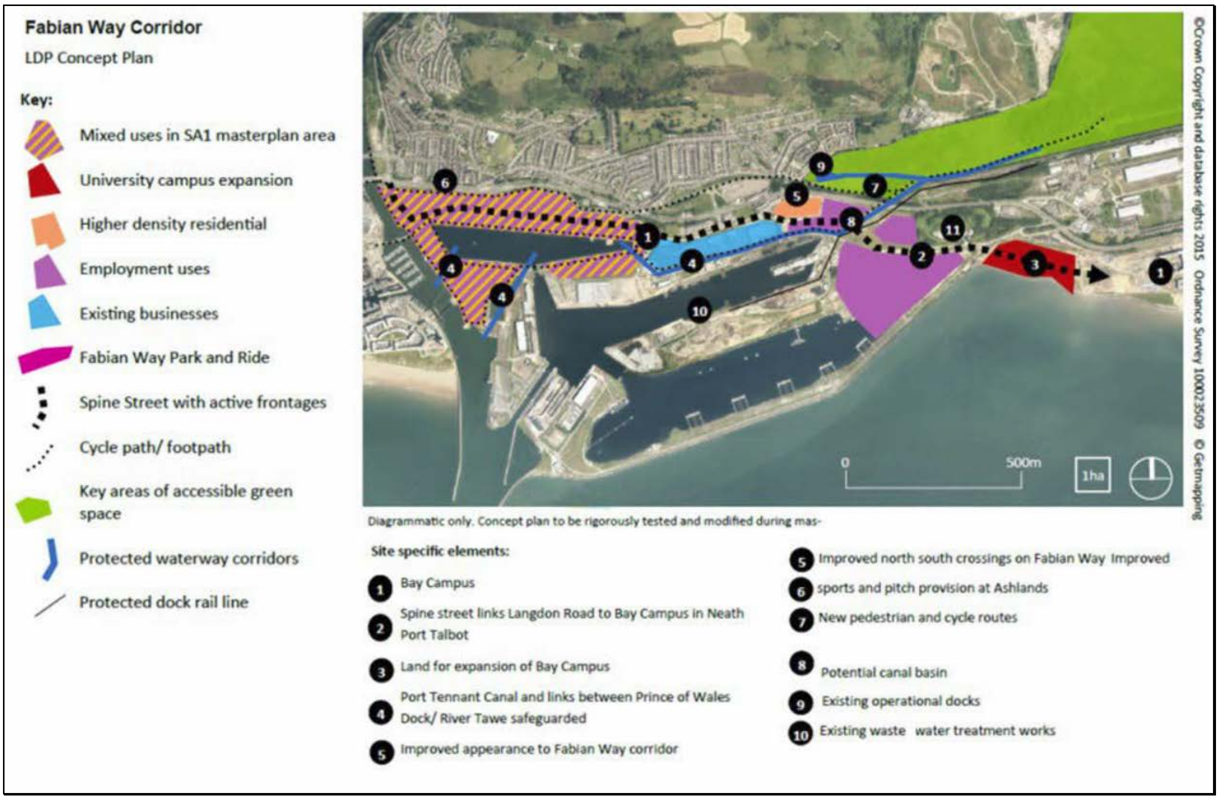
Proposals Map Site Reference: J



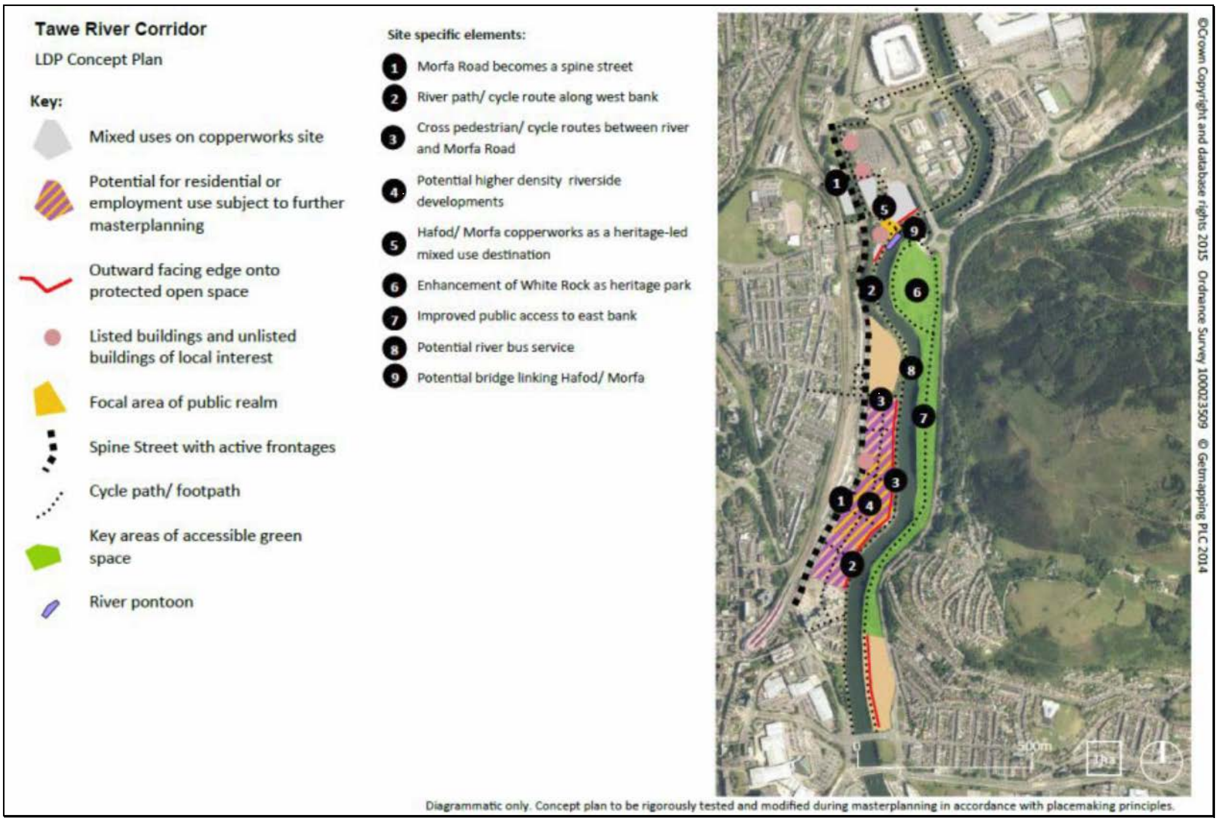
Proposals Map Site Reference: K



Proposals Map Site Reference: L



Proposals Map Site Reference: M



Section 2.5 of the deposited LDP on page 121 (http://www.swansea.gov.uk/media/17120/Deposit-LDP---consultation-document/pdf/Deposit_LDP_Consultation_-__FINAL_JULY_2016.pdf) lists Non-Strategic Housing Sites where additional land is allocated for the delivery of new homes. This table is not reproduced here as the capacity for new homes at these sites is generally (but not at all sites) below100 homes. The number of dwellings allocated under these Non-Strategic Housing Sites amount to an additional 2950 homes.

The scale of developments within the proposals maps A-M above are significant and certain development sites will have the capacity to influence local air quality over the coming years.

6 Air Quality Planning Policies

Policy EV40 has been inserted within the authorities Unitary Development Plan. In particular, sub policies within policy EV40 seek to clarify the authority's position with regard to air quality considerations.

1.8.8 Pollution may cause significant damage to human health, quality of life, residential amenity, and the natural and historic environment. This policy seeks to ensure that developments that would result in unacceptable high levels of noise, light or air pollution are appropriately located away from residential areas, other sensitive developments and areas of landscape, natural environment and heritage importance. The policy also seeks to ensure that incompatible development and land uses are not located close to existing sources of potential pollution.

1.8.9 The adverse effects of pollution are an important consideration when determining planning applications. When assessing new development proposals the Council will seek to minimise the impact of pollution of all kinds, and where possible planning conditions will be used to minimise environmental harm. The Council will look to the statutory environmental agencies to use there anti-pollution legislative powers to monitor and enforce against discharges, noise, etc.

Planning permission will not be granted for development that would be harmful to air quality by virtue of emissions from the development itself or the additional new traffic movements it would generate. Neither will permission be granted where a development is proposed that would increase the number of exposed individuals in an area likely to fail UK air quality objectives (proposed or in Regulations). This may be a declared Air Quality Management Area (AQMA), or an area that might become an AQMA if the application were to be granted.

7 Local Transport Plans and Strategies

LAQM.TG(16) paragraphs 4.30 – 4.31 indicates guidance on the inclusion within Progress Reports to those measures within the Local Transport Plan (LTP) that specifically relate to bringing about air quality improvements. Within Wales, the LPT had been replaced with the Regional Transport Plan (RTP). The South West Wales Integrated Transport Consortium (SWWITCH) was one of the four transport consortia in Wales which were required to produce a Regional Transport Plan. The SWWITCH consortia region relevant to the City & County of Swansea included a partnership with the neighbouring authorities of Neath Port Talbot County Borough Council, Carmarthenshire County Council and Pembrokeshire County Council. Unfortunately, the Welsh Assembly withdrew funding for the consortia from the end of the 2013/14 financial year. All staff had been redeployed following the withdrawal of funding. However, the Welsh Assembly Government reverted back to Local Transport Plans for 2015-2020. The new Local Transport Plan was adopted in January 2015. Details of the adopted plan can be found at http://www.swansea.gov.uk/localtransportplan
An annual progress report was submitted to the Welsh Government in January 2016, details of which are reproduced within Annexe 7.

8 Climate Change Strategies

Climate change was highlighted in the Swansea Environment Strategy: Time to Change, which was published by Swansea Environmental Forum (SEF) in 2006.

In 2008, both carbon management and climate change adaptation were chosen by SEF as two of the five issues which it believed were too difficult to progress without greater prioritisation and wider collaboration. In 2010, SEF initiated a carbon management task to develop proposals for a new project which would seek to measure and reduce the carbon footprint for Swansea, and promote low carbon initiatives.

The Low Carbon Swansea project was established in 2011 with the following aim:

To develop a coordinated, integrated and sustainable approach to reducing carbon emissions across all sectors in the City and County of Swansea area

The Project's primary goal was to see a measurable reduction of carbon emissions level to or exceeding national targets. The Project outputs included:

- the establishment of a new carbon management partnership that meets on a regular basis;
- an audit of existing low carbon activity in Swansea;
- a new energy or carbon management action plan for Swansea;
- a programme of seminars, training workshops and public events to raise awareness of climate change, to increase understanding of the opportunities for and benefits of reducing carbon emissions and to encourage greater collaboration towards a Low Carbon Swansea;
- a significant increase in the number of low carbon projects and carbon reduction activities in Swansea and
- a notable increase in inward investment for carbon reduction initiatives in Swansea.

The initiative was adopted as a Swansea Local Service Board project and received grants from Environment Agency Wales (now Natural Resources Wales) and the Welsh Government (EU-funding), which enabled SEF to employ a project manager for two years from April 2012. A Low Carbon Swansea Partnership was formed, initially involving representatives of LSB bodies and other major public sector organisations. Early on, the partners provided data for a carbon foot printing baseline study, which was commissioned in collaboration with Carbon Trust Wales.

The core activity of the partnership is the organisation of networking and training events (usually held on a quarterly basis) to facilitate information exchange and encourage collaboration between organisations. Low Carbon Swansea has also helped initiate working groups of its members to explore the promotion and expansion of electric vehicles in Swansea, support travel planning and to explore opportunities for district heating schemes in the area.

A second tranche of data was collected from partners in 2014 and an independent project evaluation undertaken (available from the website). As the grant funding drew to an end, key members of the partnership contributed funding as an interim measure to support a transition of the project to a membership funded initiative. Since April 2015, the project has been fully funded through membership fees and event sponsorship. The membership of the network was widened in 2014 to include large commercial organisations and subsequently opened-up fully to all organisations across a wider regional base. In 2016, it became Low Carbon Swansea Bay.

Swansea Environmental Forum continues to support the Low Carbon Swansea network and take the lead in encouraging collaboration between organisations and different sectors to address carbon management and climate change issues.

The Low Carbon Swansea Bay website is www.lowcarbonswansea.weebly.com

9 Implementation of Action Plans

The authority submitted its Action plan in relation to the Hafod Air Quality Management Area in December 2004. Delays were incurred in the formulation of the plan due to the extensive planning and consultation works that were thought vital to delivering a workable plan.

The Action Plan detailed 10 action points to be taken forward by the authority. The authority intends to take these action points forward with the now Swansea Air Quality Management area 2010. Progress against each of these action points are briefly summarised within the table below and each action point expanded on below.

As a result of the considerable testing and development works that have taken place, coupled with ever dwindling resources, progress, it has to be admitted, has been slow.

It is imperative that it is recognised and understood, that further expansion and development of the system will be severely restricted if not cancelled, by a combination of the existing budgetary constraints, and the further impending and likely severe cuts in local government funding following spending reviews.

Summary of Action Plan Progress

No.	Measure	Focus	Planning phase	Implementation phase	Indicator	Progress to date	Progress in last 12 months	Estimated completion date
1	Traffic management on Neath Road	Improve safety, environment and facilities for pedestrians, cyclists and bus users	2005	Ongoing – dependent upon funding for the Hafod Integrated Transport Study		Provision of some bus stops and shelters. Gateway treatment undertaken	none	unknown
2	Park & Ride Provision	Effect modal shift	2004-onwards	2005-2007	Increased uptake in Park & Ride	3 site completed and operational along with dedicated express bus routes	Consider 4th site to west of city	3 sites completed by 2007
3	Improved Bus Provision	Effect modal shift	2004	2004 – to date	Increased patronage figures	Achieved	Ongoing provision	N/a
4	Bus Corridor Enhancements	Effect modal shift		2004-2009	Increased patronage figures	Achieved		N/a
5	Enhancement of Bus and Rail Stations	Effect modal shift		2004-2009	Increased patronage figures	Swansea High Street Transport Interchange completed during 2004. Quadrant Bus station redevelopment completed	Quadrant Bus station redevelopment completed	
6	Safe Routes to School	Reduce car usage around school sites				Numerous schemes implemented	none	Achieved
7	Vehicle Emissions testing	Reduce number of polluting vehicles	2005	2005		None due to costs/manpower to be incurred	None	N/a

No.	Measure	Focus	Planning phase	Implementation phase	Indicator	Progress to date	Progress in last 12 months	Estimated completion date
8	Quay Parade Bridges Improvements	To make more effective use of the existing highway network by improving traffic flows/reduction in congestion around bridges/junctions	2005		Reduced congestion		Scheme completed	
9	City & County of Swansea Vehicle Fleet							
10	Traffic Management Systems with Air Quality Monitoring Feedback	Development of computer modelling/forecast system that will aid management of traffic flows before/during/after forecasted pollution episodes	2004-12	2004 - 2014	Reduced Congestion/Modal shift/Improved air quality within areas	Considerable but certain items remain outstanding	Additional 3 Variable Message Signs installed – grant funding provided by Welsh Assembly	Unknown

Table 41 – Summary of Action Plan Progress

- **Action Point 1 - Traffic Management measures on Neath Road**

The majority of measures identified for this action point depend upon funding being made available to undertake the recommendations of the Integrated Hafod Transport Study. Some identified action points have been completed and have been undertaken as part of phase 1 works in relation to the Landore Park & Ride Express Bus Route scheme. Items completed as part of this scheme include:

- Provision of some bus stops and shelters
- Gateway treatment to entrance to Neath Road from the Normandy Road roundabout
- Creation of traffic control point

All other identified action points within the Action Plan remain outstanding at present. The recommendations of the Hafod Integrated Transport Study are to be phased in after the renewals program being undertaken along Neath Road as part of the Hafod Renewals Program if funding can be established. This program is undertaking complete renovation of both domestic and commercial properties within the Hafod. As these works entailed extensive building works taking over part of the footway/highway with scaffolding, skips etc. along Neath Road, it has been decided to undertake the Hafod Integrated Transport Study works after the renovation works are complete, as to do so earlier would result in the damage of any finished surfaces.

However, identification of the relevant funding is now proving a major issue in taking this action point forwards. It is unknown at present if the Transport Study recommendations will ever be implemented. The Action Plan initially indicated a target of December 2005.

- **Action Point 2 - Park and Ride provision**

Provision of Park & Ride is seen as a fundamental element of Swansea's Transportation Strategy. Significant progress had been made in respect to this action point:

- Landore and Port Tennant Park and Ride sites are now fully operational.
- Fforestfach Park & Ride was opened during November/December 2006 and with the site becoming fully operational during February 2008. Map 35 below shows the location on the A483 Carmarthen Road.

Map 36 Location of Fforestfach Park and Ride Site

It is anticipated that the Fforestfach Park & Ride site will close in the near future.

Patronage statistics for 2008-2013 show the continued popularity of the park and ride provisions provided by the authority but overall, the figures for 2013 continue to show a drop in previous year's usage. Since removal of the ATC counters at all Park & Ride sites during 2014/15 it has not been possible to update table 43 post 2013.

Table 43 shows the total vehicles using the facilities at the 3 sites during 2008-2013.

Site	Total Spaces	2008	2009	2010	2011	2012	2013
Landore	550	133,025	137,232	121802	131101	116839	109105
Fabian Way	550	125,737	116,954	107043	123732	104915	95948
Fforestfach	449	64,134	66,581	67,241	66890	60445	60712

Table 43 Park & Ride Vehicle Usage Figures 2005-2012

- Phase 1 of the dedicated express bus route serving the Landore Park and Ride site has been completed. Phase 2 was due to commence during September 2005 but did not commence until April 2008 and is now complete.
- The construction of a new dedicated express bus route into the city centre from the Fabian Way Park and Ride site was completed during 2007/early 2008. Phase 1 of the express bus route crossed over the A483 Fabian Way at the site of an old railway bridge, which has now been removed. This crossing has been replaced with a "sail-bridge" during 2007. The express bus route then runs parallel at ground level, adjacent to and parallel with the inbound carriageway of the A483 to Quay Parade Bridges.
- There are proposals for the provision of a fourth park and ride site to serve the west of the city including the Gower. These plans are at a very early stage with identification of and acquisition of land now taking place with the aim of easing the pressure on the additional western AQMA's.

All other identified action points within the Action Plan remain outstanding and were not complete by the indicated target of December 2005.

- **Action Point 3 - Improved Bus Provision**

The action points contained within the Action Plan were to the main being achieved upon submission of the Action Plan. However, in order to continue to achieve these aims, the authority continues to:

- Use its revenue budget to ensure that most areas have at least a minimum level of service.
- Make use of the National Assembly's Bus Subsidy Grant to ensure breaks in service are kept to a minimum
- Promote bus priority routes
- Fund a local concessionary bus fares scheme for certain categories of people
- Provide free unlimited bus travel within the authorities area for elderly people

The identified action points within the Action Plan are being achieved now but ongoing provision remains desirable.

- **Action Point 4 - Bus Corridor Enhancements**

Progress made to date includes:

- Transport Grant funded improvements to A48 Bus priority Demonstration Corridor completed during early 2005
- Bus priority proposals for Neath Road being reviewed. Works have been completed during 2009 for a new concept Metro service linking Morriston Hospital with the city centre and Singleton Hospital. The aim is to provide advantages of modern tram at modest costs. The service uses the Landore express bus route, thereby avoiding much of Neath Road. Bus priority has been introduced at key junctions along the route.
- Variable Message displays installed along a number of trial routes to improve dissemination of travel information to passengers. These trials have been abandoned due to vandalism issues.
- Accessibility to bus services for residents who are disabled or who suffer from limited mobility increased, following Transport Grant funding to raise kerb levels along with the provision of road markings and bus clearway orders at bus stops.
- Bus shelters upgraded on a number of routes

The identified action points within the Action Plan are being achieved now but ongoing provision and enhancements remain desirable.

- **Action Point 5 - Enhancements of Bus and Rail Stations**

Progress made to date includes:

- Swansea High Street Transport Interchange was completed during March 2004. Funded through a combination of Transport Grant and Objective 1 funding, this scheme has provided improved access to the railway station by bus, taxi, and on foot, together with a new public realm, improved security and improved parking facilities.
- Discussion ongoing with network rail and Arriva Trains Wales on how to improve passenger facilities at the station itself.

Quadrant Transport Interchange

The City and County of Swansea has completed a scheme to replace the existing Quadrant bus station with a modern Transport Interchange to cater for both buses and coaches, including Swansea Metro vehicles, on a larger footprint. The previous bus station was outdated in terms of passenger convenience, comfort and security. The Council's aspiration was for a modern transport interchange with high standards of cleanliness and security. The refurbishment of the Quadrant bus station was identified as a high priority in the Swansea Local Transport Plan 2000 – 2005. However, delays were encountered with not only procedures involving the compulsory purchase of land but also with ensuring the necessary funding was fully in place prior to commencement of works.

The main components of the scheme comprised the following elements:

- 20 bus bays,
- 3 coach stands
- 2 Swansea Metro "stations" on Westway.
- 12 lay-over spaces
- Modern coach station facility to serve the long distance services,

- Enhanced passenger concourse with support facilities.
- Safe access to and from West Way
- New staff and office facilities
- Travel Shop (Information/ticket sales area.)
- Shop mobility Facility. In the Garden Street tunnel area
- Associated Retail Units.
- Enhanced links into the Quadrant shopping area.
- Improved access to the Grand Theatre and Wilkinson's service areas
- Taxi rank for 9 vehicles
- Short stay parking for 5 cars (Passenger pick-up) adjacent to the coach area
- Passenger drop-off area

- **Action Point 6 - Safe Routes to School**

Safe Routes to School has been delivered in Swansea for the last several years with numerous schemes undertaken.

- Currently, Safe Routes to school schemes have been developed at:
  - Clydach,
  - Brynhyfryd,
  - Pennard,
  - Birchgrove.
  - Gowerton Comprehensive and its Primary feeder schools
  - Penllergaer
  - Whitestone Primary
  - Oystermouth Primary
  - Newton Primary

The aim again, is to encourage more pupils to walk and cycle to school through improved facilities, the introduction of traffic calming measures, together with complementary educational work and road safety training.

The focus of this work with schools is now based on the development of school travel plans. These have previously been prepared for YGG Bryniago (Pontarddulais), Penllergaer Primary, Penyrheol Primary (Gorseinon), Whitestone Primary (West Cross), Oystermouth Primary and Newton Primary. In addition, travel plans are in the process of development for Manselton Primary, Plasmarl Primary, Crws Primary, Cwmbwrla Primary, Hafod Primary, Pentrepoeth Juniors, Bishopston Primary, Knelston Primary, Mayals Primary, Sketty Primary. These travel plans will provide the basis for both infrastructure and educational work.

- ## Action Point 7 - Vehicle Emissions Testing

No additional progress has been made with respect to this action point. The equipment had, until recently, been kept serviced and calibrated until budgetary pressures forced a review, ultimately resulting in the disposal of the equipment. The primary reasons for the lack of progress were:

- No funding for Policing costs
- Lack of staff resources due to the labour intensive nature of the work.
- The Welsh Assembly Government fund for this purpose was not offered to the City & County of Swansea.

- ## Action Point 8 - Quay Parade Bridges Improvements

Savell Bird & Axon (SBA) was commissioned to develop traffic models and to investigate highway and transport solutions in the City Centre. This commission was designed to test the Boulevard proposals and key findings indicate that significant public realm and pedestrian connectivity benefits can be achieved without affecting the existing capacity for drivers.

The Tawe Bridges poses a significant capacity constraint to the strategic highway network, which is clearly largely due to the severance imposed by the River Tawe. SBA identify that the current Tawe Bridges are a significant impediment to free flowing traffic during peak hours which occur largely because of:

- **long and inefficient traffic light cycle time of 144 seconds;**
- **poor pedestrian crossing facilities;**
- **Congestion problems particularly along the northern bridge to/from Pentreguinea Road where there is uneven lane usage.**

The City Centre Transport Model recommends that the reconfiguration of the existing infrastructure, including the two bridges, can produce significant highway capacity improvements including significant reductions in existing overall delay. These capacity improvements are not only necessary to improve the present operation of the bridges but also to accommodate future planned development within the city centre area. The improvements to the bridges are critical to the delivery of the Boulevard concept, and without it the Boulevard scheme is unlikely to be able to achieve the ambition of improving pedestrian movement and upgrading the environmental setting whilst not significantly affecting vehicular flows.

The capacity of a junction is commonly measured by ‘degrees of saturation’, this is a measure of how much demand it is experiencing compared to its total capacity. A value of 100% means that demand and capacity are equal and no further traffic is able to progress through the junction. Values over 85% indicate that the approach to a junction is suffering from traffic congestion, with queues of vehicles beginning to form. Currently in the AM peak 8 out of the 11 links around the bridges operate above the 85% limit with 2 above 100%. In the PM peak, 6 out of the 11 sequences operate above 85% limit with 2 of these being above the 100% level.

At peak times therefore the river bridges are operating beyond their capacity. In terms of traffic growth, the development proposed around the City Centre will significantly increase demand at the river bridges. If no improvements are made, and the predicted growth in traffic to 2020 occurs, there will be severe congestion at peak times with long queues tailing back from every arm of the junction. Congestion on this scale would inhibit the city centre’s capability to function and attract inward investment.

Reconfiguration Options

The City Centre Transport Model considered many iterative options for reconfiguration of the Tawe Bridges eleven of which were tested in full. Of these fully tested options two were shown to operate most efficiently and provide the greatest capacity improvements.

Option 3 provides an arrangement which involves a two way section of traffic flow across the southern bridge deck with all remaining movements travelling clockwise around the remainder of the junction. This option delivers significant improvements to all users including motorists, pedestrians and public transport users as well as creating capacity to enable the future City Centre redevelopment. The proposed layout for Option 3 is included in map 37 below

Option 7 provides a full gyratory operation utilising both the north and south bridge within this movement. This option would require the provision of additional lanes to the Tawe Bridges junctions, but provides the best capacity benefits at the Tawe Bridges junction.

Comparison of Options 3 and 7

A Transyt model has been used to assess Swansea's city centre road network. Transyt is a software model to assess and optimise the performance of networks of road junctions by assigning 'cost' against vehicle stops and delays.

The following table compares the "total delay" for all vehicles in the network passing through the junction during a peak hour. This figure provides an aggregate position for the whole junction and allows a comparison to be undertaken to assess the implications of different scenarios. The 2009 base position figures reflect the current situation and indicate that at peak times the junction is saturated with significant congestion and long queues on most arms. The figures for Options 3 and 7 reflect the changes in the capacity and efficiency of the junction based upon projected increased traffic levels in 2020. The key results of the TRANSYT analysis for the AM and PM peaks can be seen in the table below.

Summary of Transyt Output

Total Delay	AM Peak Total Delay	PM Peak Total Delay
2009 - Base position	209	200
2020 - No improvement	242 (+ 16%)	248 (+ 24%)
2020 - Part Gyratory (Option 3)	109 (- 48%)	183 (- 9 %)
2020 - Full Gyratory (Option 7)	138 (- 34%)	268 (+ 34%)

In summary, the bridges are currently operating significantly beyond their capacity and congestion will worsen as traffic levels grow as a consequence of traffic generated by new developments. A do-nothing approach cannot be considered as by 2020 the AM peak delay will worsen by 16% and the PM peak by 24%.

As indicated in the table above, based on projected traffic levels in 2020 in comparison with the 2009 baseline position, Option 3 will produce a 48% improvement in the efficiency of the junction in the AM peak, and 9% improvement in the PM peak. Option 7 will produce a 34% improvement in the efficiency of the AM peak but would result in a 34% deterioration against the baseline position in its efficiency in the PM peak.

Option 3 therefore provides more capacity benefits and future proofing than Option 7.

Conclusion

The River bridges are currently operating significantly beyond their capacity in the AM and PM peaks which causes traffic congestion across the City. If nothing is done to address this then by 2020 the situation will worsen by between 16% in the AM peak and 24% in the PM peak.

Option 7 is the best of the full gyratory options identified. By 2020 this could bring improvements in the AM peak, but will make matters significantly worse in the afternoon. Most importantly Option 7 would create more congestion in the PM than if the bridges were left as they are now.

Option 3, the part gyratory, provides significant improvements in both the AM and PM peak hours.

This scheme has now been completed. Flows around the junction have improved. Latest air quality monitoring would appear to paint an improving picture but it is too early to form firm conclusions at present.

TRANSYT Output for Tawe Bridges (AM Peak: 0800-0900; 2020+ Development)

LINK	Option 6		Option 7		Option 9		Option 10		Option 11		Option 3		Base 2009	
	Cycle time 116s		Cycle time 106s		Cycle time 116s		Cycle time 110s		Cycle time 110s		Cycle time 78s		Cycle time 144s	
	DOS %	Q (Pcu	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)
Parc Tawe exit	92	14	91	12	85	11	89	12	95	13	54	11	102	20
New Cut Rd (southbound)	70	6	56	5	61	6	58	5	51	5	74	11	103	18
Northern bridge	89	16	81	16	66	16	75	15	64	14	68	23	88	18
Pentreguinea	144	97	92	15	94	17	112	35	102	24	55	16	87	34
Delhi St	84	5	77	4	-	-	80	5	-	-	47	2	90	9
Eastbank	85	15	85	7	82	8	67	4	60	12	89	26**	82	14**
Fabian Way westbound	99	34	93	25	104	44	90	25	76	20	87	21	98	64
South bridge westbound	71	11	86	16	92	17	92	17	94	18	87	35	76	41
South bridge right turn	60	13	56	12	56	14	54	13	58	12	90	31	-	-
New Cut Road northbound	68	8	59	9	59	10	58	10	59	9	59	10	99	28**
South bridge eastbound	-	-	-	-	-	-	-	-	-	-	94	23	93<<	31
Quay Parade eastbound	70	19	84	21	81	22	83	22	78	20	78	13	75<<	28
Total Delay pcu.hr/hr	**311**		**138**		**172**		**173**		**141**		**109**		**209**	

TRANSYT Output for Tawe Bridges (PM Peak: 1630-1730; 2020+

LINK	Option 6		Option 7		Option 9		Option 10		Option 11		Option 3		Base 2009	
	Cycle time 116s		Cycle time 106s		Cycle time 116s		Cycle time 110s		Cycle time 110s		Cycle time 84s		Cycle time 144s	
	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu	DOS %	Q (Pcu)	DOS %	Q (Pcu)
Parc Tawe exit	164	165	94	18	89	15	103	26	89	16	90	31	100	22
New Cut Rd (southbound)	92	8	58	6	53	5	51	5	54	5	89	14	100	15
Northern bridge	83	13	73	8	39	15	65	17	64	11	80	39	86	19
Pentreguinea	150	93	135	57	85	12	203	97	84	13	57	17	72	23
Delhi St	66	3	74	4	-	-	68	4	-	-	59	3	73	5
Eastbank	91	15**	85	13	94	17**	52	12	59	7	98	48**	51	18
Fabian Way westbound	104	39	101	34	213	203	150	148	225	229	100	46**	87	26
South bridge westbound	81	13	88	17	97	25**	93<<	20**	92<<	20**	98	60**	79	42
South bridge right turn	51	7	54	7	44	8	38<<	6	38<<	6	91	28	-	-
New Cut Road northbound	73	9	66	9	65	9	63	9	61	10	76	12**	96	28**
South bridge eastbound	-	-	-	-	-	-	-	-	-	-	89	19	85	44
Quay Parade eastbound	75	14	70	15	77	15	81	16	79	16	78	13	82	31
Total Delay pcu.hr/hr	**572**		**268**		**630**		**710**		**707**		**183**		**200**	

Map 37 - Option 3 Adopted layout now competed and operational

- An air quality monitoring station along Pentreguinea Road has been established with measurements commencing during September 2005. The system measures the pollutants nitrogen dioxide, sulphur dioxide, ozone, benzene, along a 280-meter open path. The system comprises of a transmitter and a receiver. The transmitter shines a xenon lamp along the path length to the receiver module where the light is focused and transmitted down a fibre optic cable and into a spectra analyser where the measurements take place. The system is now providing spatial data over the 280-meter path length.

Photo 8 - St Thomas DOAS Transmitter

Photo 9 - St Thomas DOAS Receiver Station

- ## Action Point 9 - City & County of Swansea Vehicle Fleet

Improvements are ongoing within the fleet of vehicles operated by the authority as the authority proactively manage down the environmental impact of a 750 vehicle fleet operation within the Council's area. Latest developments/initiatives include,

- A robust time based maintenance and inspection regime that specifies oil and filter changes twice a year
- A vehicle renewals programme that consolidates technological advancements within the fleet, and maintains an appropriate mechanical condition and age profile
- Detailed consultation with users on specifications to ensure maximised utility for the supplied vehicle
- A replacement component strategy that " builds in " disposal and recycling requirements for tyres, oils, batteries, cleaning products, asbestos free linings etc.

- Specifying Euro 5 compliant engines on new heavy commercial vehicles and Euro 4 on light commercials
- Specifying AdBlue nitrous oxide reduction systems for new heavy commercial vehicles
- Introduction of Bio Diesel to the Council's fuel stocks
- Introduction of vehicle tracking to monitor and improve vehicle utility and reduce mileage
- Trial of magnets to improve fuel system efficiency
- Establishing carbon footprint database to monitor and improve impact of vehicle operations

The authority actively enforces a "good neighbour "approach in terms of the Council's driver conduct, vehicle operations and parking arrangements.

- **Action Point 10: Traffic Management Systems with Air Quality Monitoring Feedback.**

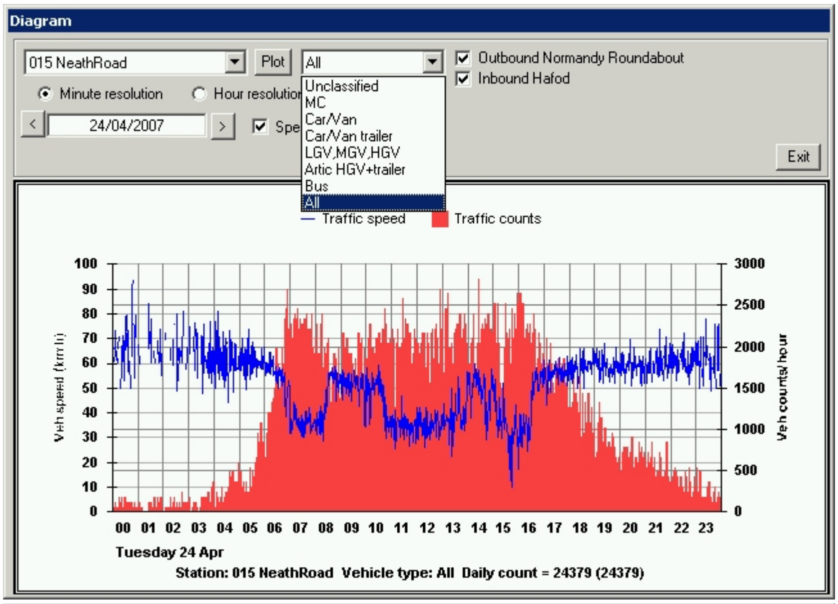
Considerable efforts are being made to ensure that all data feeds into the system under development operate reliably. The major data feeds are:

- Vehicle by Vehicle Traffic flow
- Ambient Air Quality Monitoring data
- Meteorological forecast

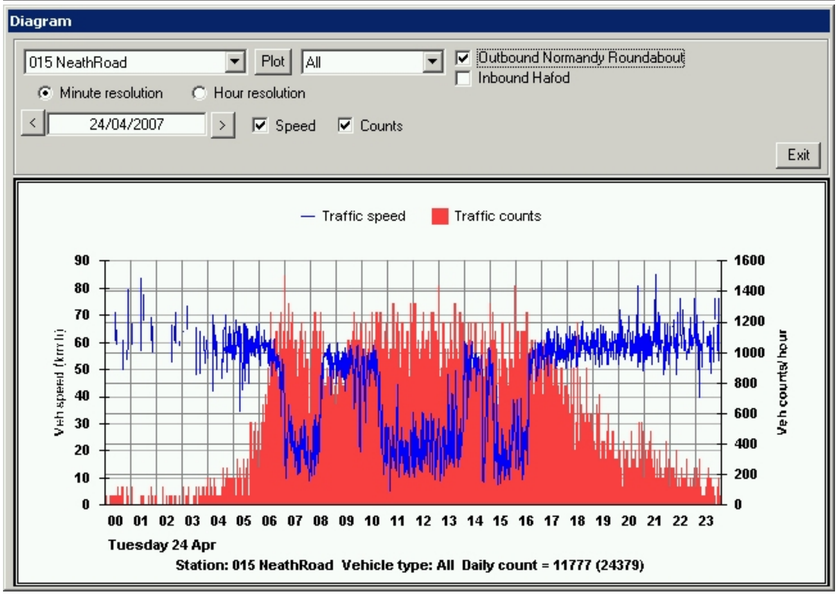
A total of 55 GPRS vehicle by vehicle (VbV) automatic traffic counters have been installed and commissioned and data quality is being assessed **-** see map 38 below for the location of the existing 55 GPRS traffic counters. Please not that ATC sites 45-49 located within the 3 Park & Ride sites have been removed. Operational site numbers are 1-35, sites 37-44 and sites 50-58. Additional temporary surveys are underway within "local streets" for a period of one week to establish basic flow information.

The GPRS automatic traffic counters transmit data to an FTP server every 5 minutes. The vehicle by vehicle data is compiled into 1 minute integration and stored within databases linked to the emissions database (EDB). An example of the information that is now available to both the models and for dissemination to local radio media traffic bulletins (i.e. detection of congestion forming) is given below.

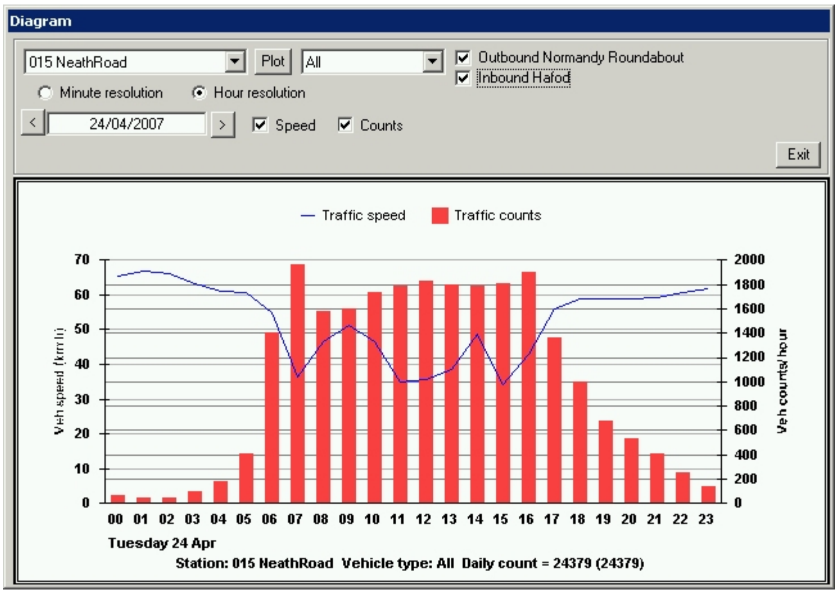
All vehicles are classified into the EUR6 classification scheme at point of detection as well as the speed of the vehicle. This information has again been provided for use within the modelling under development.



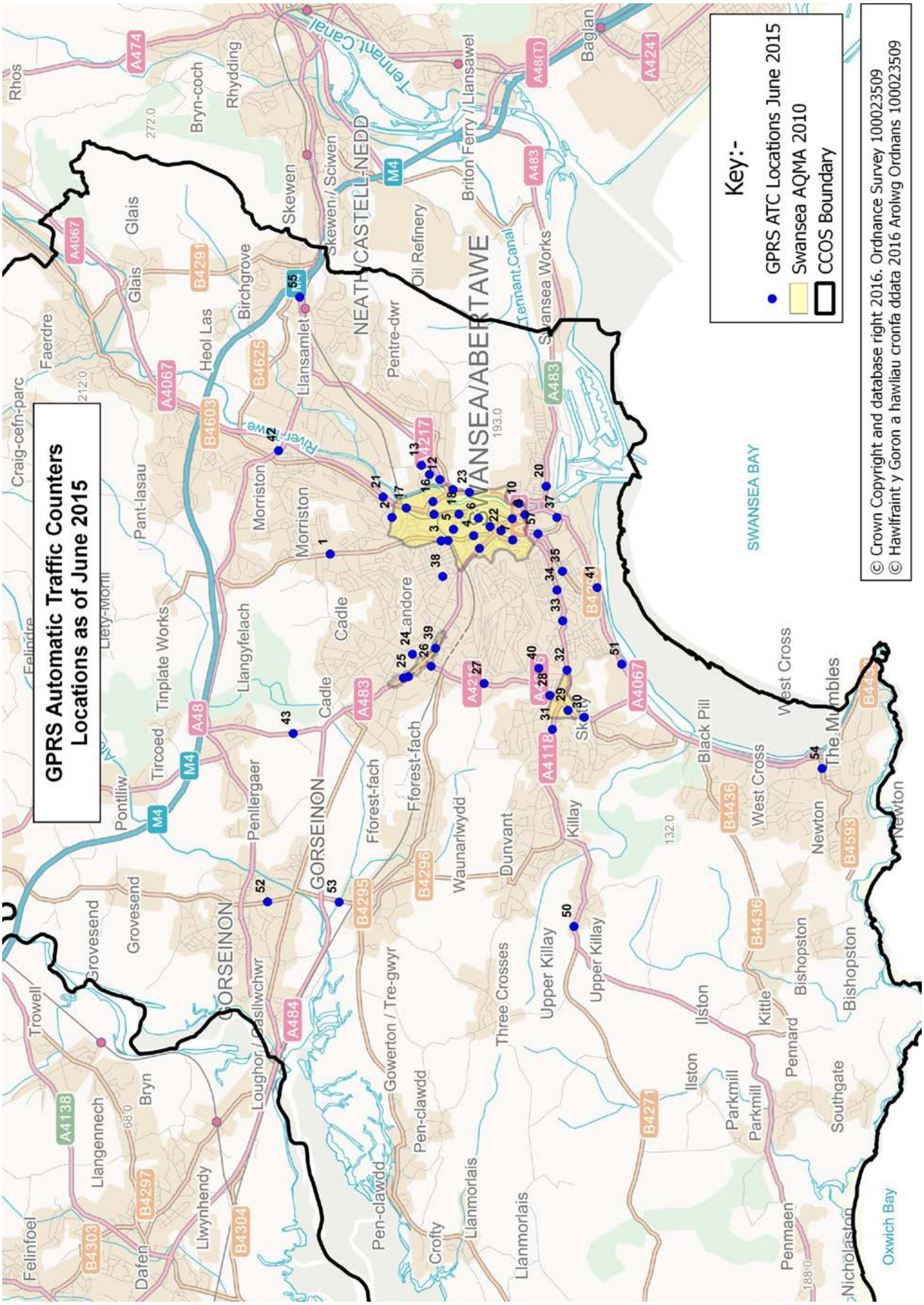
ATC 15 Neath Road is located opposite Morfa Terrace on the B4603. The AADT for 2006 is 20,544 with the AWDT being 21,864. 1 minute resolution traffic flow data enables detection of congestion in almost “real-time”.



The direction of formation of congestion can be established by separation of the directions. Here the congestion can be seen within the outbound lane. Notice the 3 significant periods of slow moving vehicles during the AM, midday and PM periods.



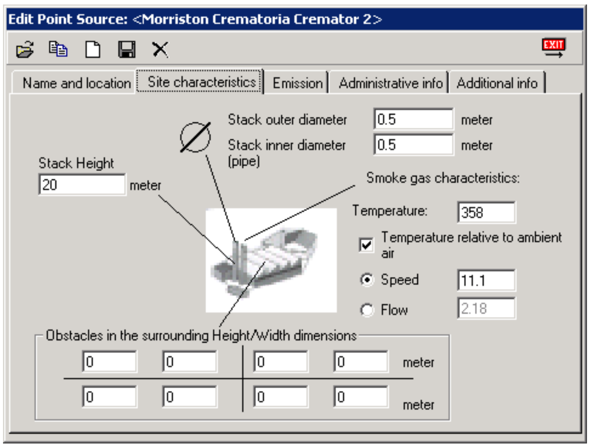
This 1 hour data integration view does not enable easy detection of these significant congestion periods

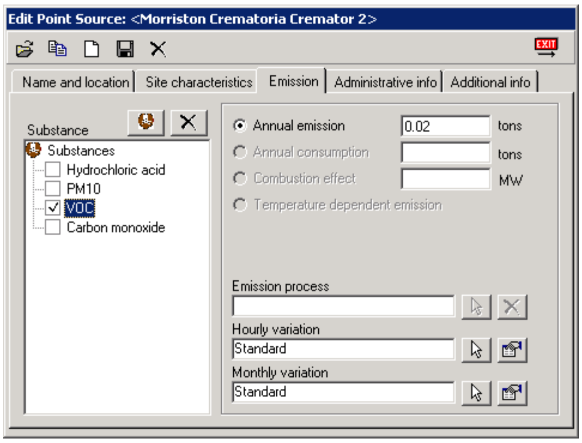


Map 38 - Location of GPRS Automatic Traffic Counters 2015

- Discussions have commenced to develop an interface to manage the dissemination of information to local media i.e. traffic bulletins and roadside signage. This system will receive output predictions from Nowcaster and will take logical decisions upon what messages are disseminated to the local news media as well as the variable message signs located initially within the lower Swansea valley. Discussions are ongoing with regard to the specification of the variable message signs.

- Emissions data is being collated and inputted into an emissions database (EDB) which will be central to the system. The information required is extensive and includes all point source /area/grid emissions sources.





Every road **link** is in process of being classified and the details inputted into the EDB in order that the model understands the local geometry and conditions influencing dispersion in that road link. Width of road/pavement and building heights are being provided as parameters into the emissions database.

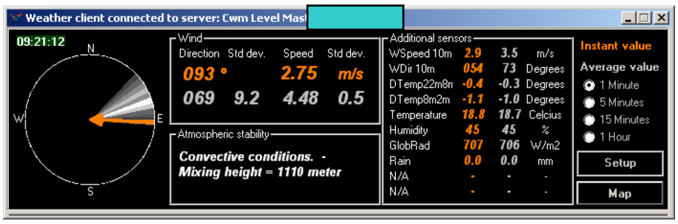
- Installation of a dedicated 30m meteorological mast at Cwm Level Park within the lower Swansea Valley to provide high quality temperature and wind profiles data in the lowest atmospheric layer in the valley into the models.

Meteorological parameters measured

- Wind Speed at 30m
- Wind Direction at 30m
- Global Radiation at 30m
- Wind Speed at 1Om

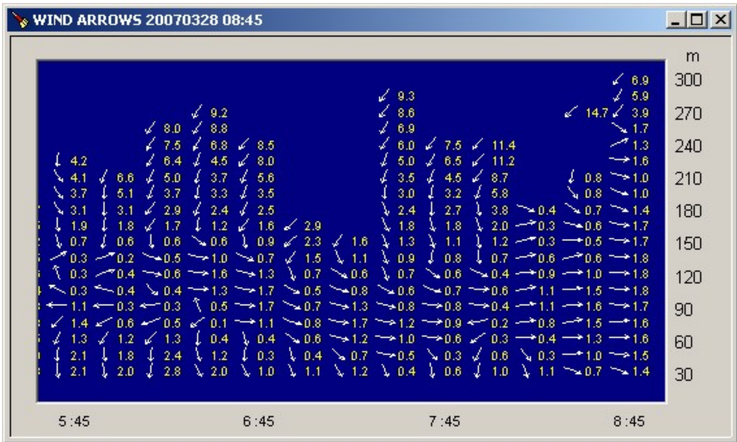
City & County of Swansea

- Wind Direction at 10m
- 22m Differential Temperature
- 8m Differential Temperature
- 2m Absolute Temperature
- 2m Relative Humidity
- Rainfall



- Installation of an AQ500 “Wind Profiler” within the lower Swansea Valley.

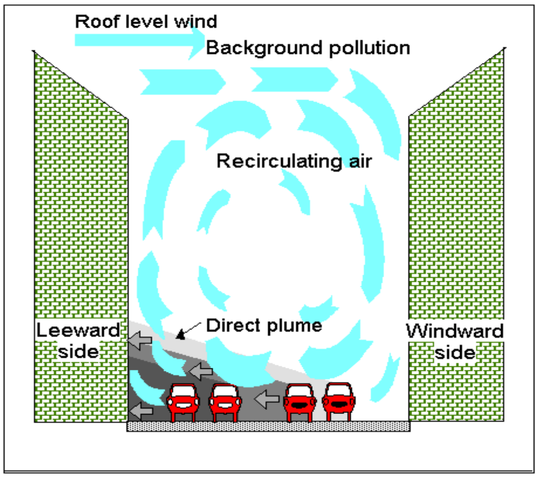
This equipment measures the wind speed and wind direction in 15m “layers” up to its maximum height range of 300m.

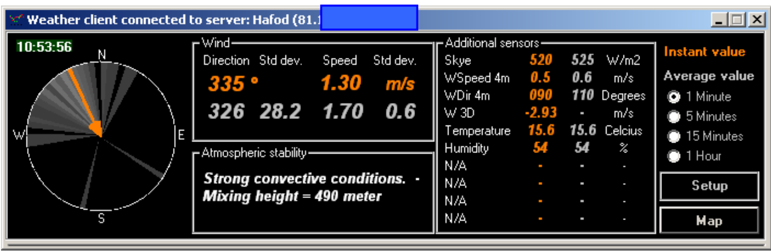


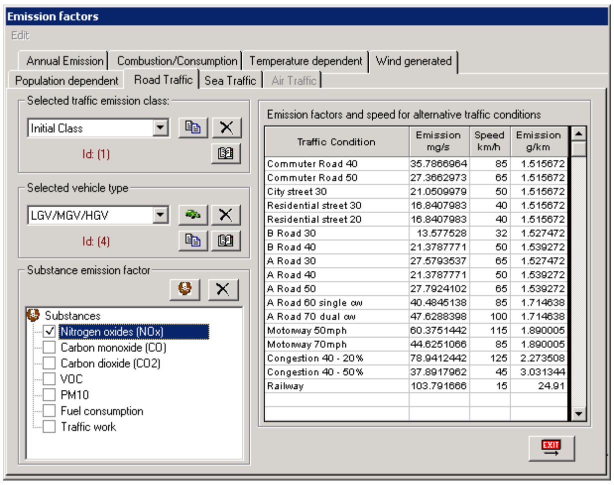
- Establishment of a street canyon meteorological station within Neath Road. This station has been fixed to the front elevation of the Hafod Post Office opposite the open path air quality measurements being undertaken by the Hafod DOAS. This station will supply the meteorological information to validate Nowcaster and other modelling output/predictions/forecasts within street canyon environments.

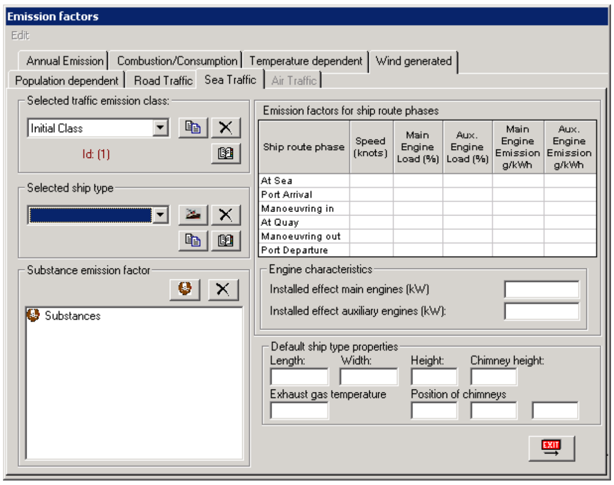
Meteorological parameters measured

- Global Radiation
- Wind Speed 5m above roof ridge level
- Wind Direction 5m above roof ridge level
- Horizontal Wind Speed at first floor level
- Horizontal Wind Direction at first floor level
- Vertical Wind Speed at first floor level
- Air Temperature at first floor level
- Relative Humidity at first floor level



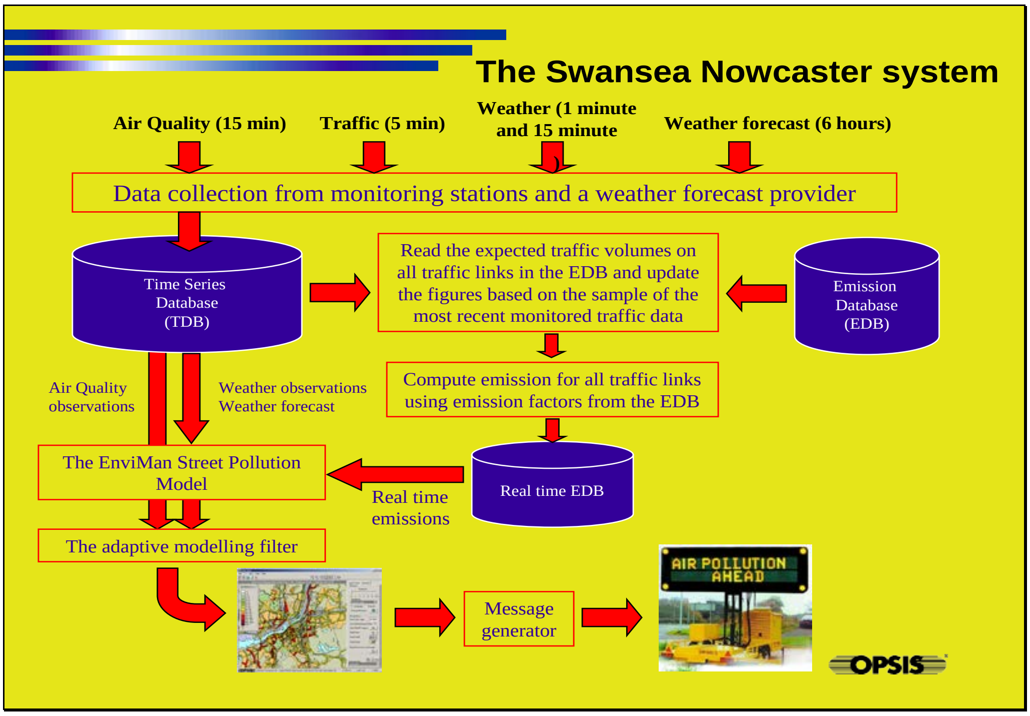






- Development of emission factors for all modes of transportation.

- A schematic of the system under development is shown below



Schematic 1 - Swansea Nowcaster Traffic Management System

- Additional air quality monitoring stations have been installed within St.Thomas (see action point 8 above)

- The Nowcaster model interface with the system under development is still undergoing customisation to allow unattended import of all required datasets and automatic operation and output of predictions. This is taking longer than anticipated and is dependent upon funding steams being made available.

- An interface is being developed to allow local media and the public to view the live Nowcaster mapping predictions – they will be able to view the statistics for the nearest traffic counter, look at the air quality forecast for the roads and even chart the data if they wish.
- The system will send emails to local media i.e. The Wave, Swansea Sound, Real Radio and even national stations (Radio 2,3,4 etc.) for use in their traffic forecasts. The system can detect traffic congestion in almost real time from the ATC network data and broadcast this information via email etc.
- In addition, messages will be sent to roadside signs to try and encourage a certain % of the traffic flow to divert from the failing area/ congested area and also to provide additional information regarding detected congestion/planned road works notifications etc. An example VMS sign is shown below

Swansea Traffic Info Sign
Layout example 090316-3

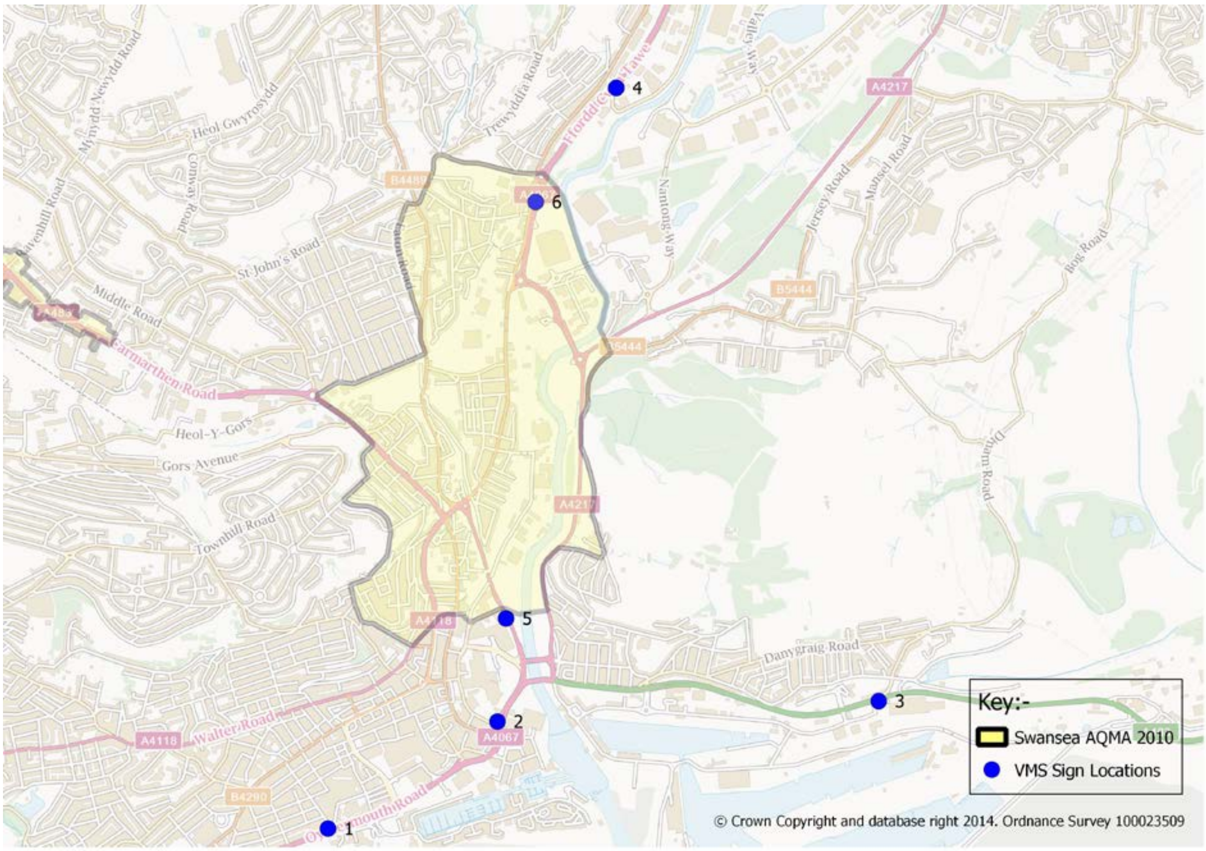
2200x1200

VENTIRO
Document: NSL2297 - Swansea_Signlayout_090316-3.ai
Jan Tuomi
Ventiro AB, 2009-03-16

- As of 2015, there are a total of 6 variable message signs physically installed that form phase 1 and phase 2 of the sign deployment at roadside locations within Swansea. Testing of communications has been undertaken. Their locations can be seen within map 39 below with their site locations detailed within table 44 below.

Site ID	Site Address	x-coordinate	y- coordinate
1	Glamorgan Street	265018	192414
2	Quay Parade	265930	192990
3	Bevans Row	267981	193100
4	Ffordd Cwm Tawe junc. of Beaufort Road	266569	196400
5	New Cut Road	265976	193545
6	Ffordd Cwm Tawe – near Liberty Stadium	266136	195786

Table 44 – Site Location details of variable message Signs



Map 39 – Location of Variable Message Roadside Signs

Typical view of installed variable message sign – site ID 6 Ffordd Cwm Tawe

As a result of the budgetary constraints, it is not known when the entire infrastructure previously identified as major and critical elements of the Action Plan (completing the deployment of roadside variable message signs etc.) will be funded. This "final hurdle" would have a capital cost in the region of £300,000 - £500,000 for the third phase of sign deployment.

Software developments have been under review in light of the need to achieve compatibility with the Windows Server 2012 R2 operating system. The whole of the Nowcaster model software suit including the data feed system/web service has introduced unwelcome delays into the launch and operation of the system. Extensive testing is and has been underway for several months which have identified additional modules that require attention to achieve a stable operating environment.

10 Conclusions and Proposed Actions

Proposals to develop the Tawe Riverside development Corridor may have air quality implications within a wide area of the lower Swansea valley. However, these concerns may be offset by provision of the Morfa Distribution Road and the improvements already being seen around the Quay Parade bridges area. Due to the continued economic downturn it may prove to be many years before the aspirations of the scheme as a whole are realised in full or part. Regular updates will be provided as and when significant developments occur.

The proposals by Vale to develop an energy from waste Pyrolysis Plant at its refinery at Clydach in the Swansea valley may have air quality impacts locally. Whilst Planning Permission has been granted and a permit issued for operation by the now Natural Resources Wales the project is on hold at present again, due to the economic downturn. Regular updates will be provided in future reporting.

Several planning applications have been received that may impact upon local air quality notably the Swansea Bay Tidal Lagoon development and the Liberty Stadium expansion.

10.1 Conclusions from New Monitoring Data

Nitrogen Dioxide Real Time Continuous Automatic Monitoring Data

Compliance with both the annual mean and hourly objectives were seen at the Swansea AURN, Morriston Groundhog and Cwm Level Park monitoring stations during 2015. However, real-time open path monitoring along Neath Road, Hafod (Hafod DOAS) continues to show exceedance of the annual mean objective. The annual mean for 2015 from the Hafod DOAS whilst above the objective level has shown a marked reduction to that of previous years. It is too early to determine if this is a real downward trend in the annual mean concentration. The situation is complicated given the result of the passive diffusion tube located at Hafod Post

Office continuing to mirror the elevated trend of recent years. During 2011, the annual mean objective was exceeded at the other open path monitoring location at the St.Thomas DOAS monitoring station along Pentreguineau Road. During 2012 and through to 2013 marginal compliance was observed but during 2014 and now during 2015 full compliance has been observed. This would tie into the results post 2011 obtained for site 35 (Delhi Street) which is within 75m of the DOAS path and is another indication of the probable success of the gyratory now operational at Quay Parade bridges.

The newly established monitoring location at Station Court, High Street has confirmed exceedance of the nitrogen dioxide annual mean during 2015. This site lies within the existing Swansea AQMA 2010.

Nitrogen Dioxide (Passive Diffusion Tube Data)

Exceedances of the annual mean objective continue to be seen within the existing Swansea Air Quality Management Area 2010 along the Neath Road corridor, Cwm Level Road (Brynhyfryd Cross Roads) and Carmarthen Road (Dyfatty area). Additionally exceedances continue to be seen within the Fforestfach and Sketty areas of the AQMA but these are now limited to a single exceedance within the Sketty area with a single exceedance and a single site with the potential to exceed the annual mean NO_2 objective within the Fforestfach area. These AQMA's will continue to remain valid until the areas are capable of demonstrating full compliance with the NO_2 annual mean objective. Additional monitoring within the AQMA area around the High Street Railway Station has highlighted the exceedance of the annual mean objective.

Monitoring from outside of the existing Swansea AQMA 2010 has identified areas that are failing the annual mean objective. Numerous locations within the city centre are failing the annual mean objective however the location of these sites are not at relevant receptor locations. Monitoring during 2015 has once again indicated that exceedances of the 1-hour objective have not been seen around the café type environments along the Kingsway and Dillwyn Street areas.

Previously it has been reported that site 75 within the Uplands area (at the junction of Brynymor Crescent and Uplands Terrace) had indicated exceedance of the annual mean objective during 2010-2012 but monitoring during 2013-2015 now confirms compliance with the nitrogen dioxide annual mean objective. This site is situated between the city centre and the Sketty area which forms part of the Swansea AQMA 2010. Similarly, continued monitoring along Newton Road within the Mumbles area has shown a continuing and improving picture. During 2015, the two previously identified failing sites closest to the junction with Mumbles Road now show compliance with the annual mean objective with only one site (site 206) showing the potential to exceed the annual mean objective. The situation along Newton Road is exacerbated by tourism traffic during the summer months. Table 14 indicates the annual means for sites 206-216 during 2010-2015 along Newton Road. A continued decline in annual mean concentrations can be seen with the likelihood that this trend will continue. Monitoring will continue for the foreseeable future to verify the trend in concentrations.

Other areas previously experiencing exceedances of the annual mean objective within the St Thomas area now continue to indicate full compliance. Site 35 within the St Thomas area (Delhi Street) indicated exceedance of the annual mean objective during 2011 but monitoring during 2012 -2015 has now shown full compliance. This may be due to the improvements made with the gyratory system around the Quay Parade bridge area. Site 291 (Vale of Neath Road) on the outbound A483 towards the M4 has shown exceedance of the annual mean objective during both 2012 and 2013 but monitoring during 2014 and 2015 has now indicated compliance with the annual mean objective. Transportation colleagues have altered the phasing of the signal controlled junction of the A483 with the SA1 junction. This area may become critical should the Swansea Bay Tidal Lagoon Development commence as this junction will see an increase in HGV traffic resulting from materials delivery to the project site. At present it is thought that the rock required to form the lagoon structure will be delivered via sea routes but there is a possibility that significant HGV traffic will be seen at the SA1 junction area should this sea delivery method not prove possible.

Sulphur Dioxide Real Time Continuous Automatic Monitoring Data

No exceedances of any of the objectives have been observed within Swansea for several years. Measurements are now only made from the St.Thomas DOAS due to budgetary restraints.

Carbon Monoxide Real Time Continuous Automatic Monitoring Data

No exceedance of the objective has been observed within Swansea since monitoring commenced. Monitoring ceased during 2009/2010 due to budgetary restraints

Particulate Matter PM_{10}

No exceedances of the annual mean objective were seen at any of the monitoring stations during 2015. Similarly, no breach of the 35 permitted exceedances of the 24 hour objective was seen, nor, where data capture was below 85% did the 90.4th percentile (given in brackets after the number of exceedances in table 16) exceed 50ug/m^3.

Benzene

No exceedance of the objective has been observed within Swansea since monitoring commenced.

Ozone

Compliance with the 8-hour mean UK objective (not set in regulation) has been seen during 2015 at all sites. Whilst ozone is considered a national rather than local problem it will continue to be measured for the foreseeable future.

Heavy Metals Monitoring

Significant changes occurred to the heavy metals monitoring network within Swansea during 2013 and the early part of 2014. Due to recurring issues with the equipment deployed at the Glais School site and the imposed budget constrictions the authority is operating under, monitoring ceased at Glais School on the 1st April 2013. In addition, monitoring at YGG Gellionnen ceased in January 2014 due to the costs of the heavy metals analysis. Future heavy metals monitoring will now only be undertaken from 2014 onwards at the two UK network funded sites located at Coed Gwilym Cemetery and Morriston Groundhog.

Monitoring results during 2015 have shown **nickel** concentrations to be below the 4th Daughter Directive annual mean target value following improved abatement at the primary release point. Newly identified release points within the Pontardawe area of Neath Port Talbot Borough Council have the potential to influence measured nickel concentrations within the Swansea area given certain meteorological conditions.

From the data available, it is clear that annual mean concentrations for **arsenic and cadmium** at all monitoring locations fall well below the 4th Daughter Directive Target Values**.**

Additionally, from the data available, it is clear that annual mean concentrations for **lead** at all monitoring locations fall well below the 0.25ug/m^3 required under the Air Quality (Amendment) (Wales) Regulations 2002 to be achieved by the 31st December 2008.

10.2 Conclusions relating to New Local Developments

Proposals to develop the Tawe Riverside development Corridor may have air quality implications within a wide area of the lower Swansea valley. However, these concerns may be offset by provision of the Morfa Distribution Road and the improvements already being seen around the Quay Parade bridges area. Due to the continued economic downturn it may prove to be many years before the aspirations of the scheme as a whole are realised in full or part. Regular updates will be provided as and when significant developments occur.

The proposals by Vale to develop an energy from waste Pyrolysis Plant at its refinery at Clydach in the Swansea valley may have air quality impacts locally. Whilst Planning Permission has been granted and a permit issued for operation by the now

Natural Resources Wales the project is on hold at present again, due to the economic downturn. Regular updates will be provided in future reporting.

Several planning applications have been received that may impact upon local air quality notably the Swansea Bay Tidal Lagoon development and the Liberty Stadium expansion.

10.3 Other Conclusions

It should be highlighted that within the Deposit Local Development Plan 2010-2025, Strategic Development Areas (SDAs) are allocated at 12 locations to provide new homes and opportunities for job creation and commercial investment at a strategic scale. Whilst the SDAs are outlined within the deposit plan (http://www.swansea.gov.uk/media/17120/Deposit-LDP---consultation-document/pdf/Deposit_LDP_Consultation_-__FINAL_JULY_2016.pdf
it is too early within the process to form a definitive view of the implications of development as outlined within the SDAs. However, the scale of development indicated within several SDAs are likely to have implications as the scale of development proposals are confirmed and brought forward through the planning process.

10.4 Proposed Actions

Due to the continued reduction in nitrogen dioxide annual mean concentrations being witnessed year on year, with 2015 now indicating compliance with the annual mean objective within the Newton Road and Fabian Way areas, it is not proposed to declare these areas as Air Quality Management Areas. However, it is clear from passive diffusion tube monitoring being undertaken within the city centre area that numerous sites within High Street, Orchard Street, The Kingsway and Dillwyn Street are failing the nitrogen dioxide annual mean objective, albeit at non-relevant receptor locations. Extensive new passive NO_2 monitoring sites were established during January 2015 along Dyfatty Street, Orchard Street, High Street, Castle Street, The Kingsway and Westway to inform the planning process. It has been previously mentioned that the city centre review is underway with the aspiration of increasing footfall within the area by the provision of more dwellings within the city centre coupled with major investment and rejuvenation of the economic heart of the city centre. This aspirational policy has been thrown into some doubt following the “Brexit” vote as certain elements of the project (i.e. the road infrastructure) were subject to receipt of EU funds. However, the majority of the proposals involve the creation of dwellings within the upper stories of former/existing commercial properties. The existing passive diffusion tube monitoring within the city centre is undertaken at a height of no more than 2.5m. This may not be representative of conditions experienced at the façade of the upper floors – especially so within the canyon type environments typical of the locations under review. **Whilst the outcomes of the city centre review are still not fully known in relation to the eventual road infrastructure, the authority intends to continue to monitor the nitrogen dioxide annual mean concentrations within High Street, Castle Street, Orchard Street, The Kingsway, Orchard Street, Dillwyn Street and parts of Mansel Street within the city centre area. This assessment will entail undertaking monitoring at various heights at the facades in areas with the increased gathering of vehicle flows; it is also proposed to obtain congestion data from Highway colleagues in order to compare with NO_2 concentrations as the city centre has been an area of change for some time.**

Discussions will continue on how best the desired provision of housing within the city centre can be achieved within the overall development proposals both in terms of the air quality implications and also exposure to noise for those residents.

No alterations to the existing Swansea AQMA 2010 are proposed at this time.

11 References

i. City & County of Swansea Progress Report 2006
ii. City & County of Swansea Updating & Screening Assessment 2006
iii. City & County of Swansea Progress Report 2007
iv. City & County of Swansea Progress Report 2008
v. City & County of Swansea Updating and Screening Assessment 2009
vi. City & County of Swansea Progress Report 2009
vii. City & County of Swansea Progress Report 2010
viii. City & County of Swansea Progress Report 2011
ix. City & County of Swansea Updating and Screening Assessment 2012
x. City & County of Swansea Progress Report 2013
xi. City & County of Swansea Progress Report 2014
xii. City and County of Swansea Updating and Screening Assessment 2015
xiii. Technical Guidance LAQM.TG(16)
xiv. Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138)
xv. Air Quality (Amendment) (Wales) Regulations 2002, No 3182 (Wales 298)
xvi. Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedances of the 1-hour mean AQS Objective AEAT/ENV/R/264 Issue 1 May 2008

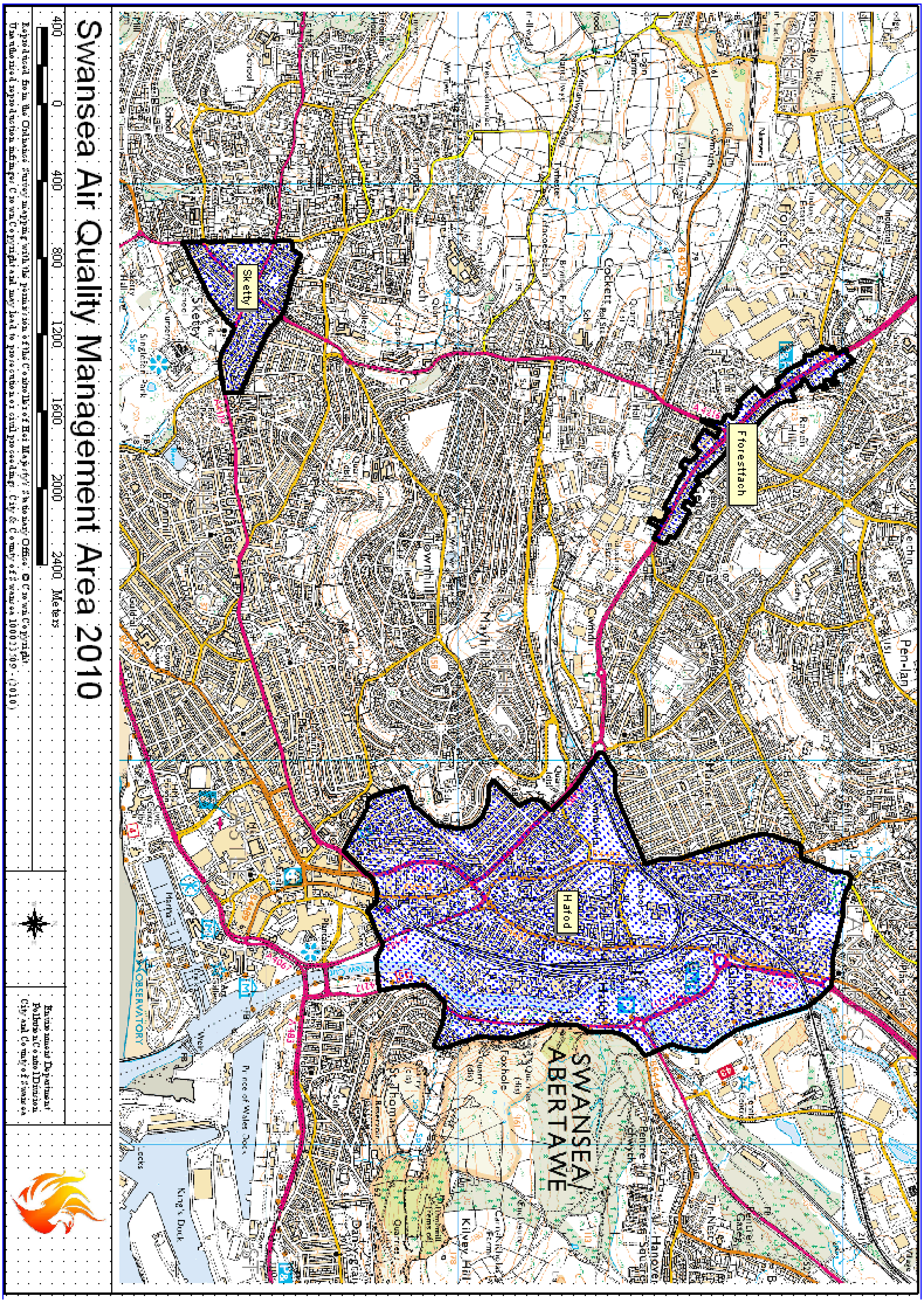
Appendix 1

Hafod AQMA


Hafod Air Quality Management Area
400 0 400 800 1200 Meters
Reproduced from the Ordnance Survey Digital map with the permission of the Controller of H.M.S.O. Crown Copyright.
City and County of Swansea Licence No. 100023509
Pollution Control Division
Environment Department
City & County of Swansea
SWANSEA/
ABERTAWE
Hafod
Landore
Glandwr
Manselton
Cwmbwrla
Mayhill
Townhill
Gendros
Brynhyfryd
St Thomas
Foxhole
Kilvey Hill
Hanover Square
Bon-y-maen
Pentre-chwyth
Tir-Nest
Cwmdu
A4067
A4217
A4118
B4489
B4603
B4444
A483

Appendix 2

Swansea AQMA 2010


Swansea Air Quality Management Area 2010
400 0 400 800 1200 1600 2000 2400 Meters
Sketty
Fforestfach
Hafod
SWANSEA/ ABERTAWE

Appendix 3

Environmental Scientific Group

WASP Results

Laboratory summary performance for WASP NO2 PT Rounds 121-124 and AIR NO_2 PT rounds AR001, 3, 4 and 6

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent WASP/AIR NO_2 PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of ≤ ± 2 as defined above.

WASP Round	**WASP R121**	**WASP R122**	**WASP R123**	**WASP R124**	**AIR PT AR001**	**AIR PT AR003**	**AIR PT AR004**	**AIR PT AR006**
Round conducted in the period	April – June 2013	July – September 2013	October – December 2013	January – March 2014	April – May 2014	July – August 2014	October – November 2014	January – February 2015
Aberdeen Scientific Services	100 %	100 %	NR [2]	75 %	100 %	100 %	100 %	100 %
Cardiff Scientific Services	100 %	100 %	100 %	100 %	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	75 %	100 %	100 %	100 %	100 %	100 %	75 %
Environmental Services Group, Didcot [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	87.5 %
Exova (formerly Clyde Analytical)	NR [2]	NR [2]	NR [2]	50 %	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	25 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Gradko International [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	75 %	100 %	100 %	100 %	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Lambeth Scientific Services	0 %	50 %	75 %	25 %	50 %	100 %	100 %	25 %
Milton Keynes Council	100 %	75 %	75 %	75 %	100 %	100 %	75 %	100 %
Northampton Borough Council	100 %	100 %	100 %	100 %	100 %	0 %	0 %	100 %
Somerset Scientific Services	100 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Staffordshire County Council	100 %	100 %	100 %	100 %	100 %	25 %	100%	100 %
Tayside Scientific Services (formerly Dundee CC)	100 %	100 %	100 %	100 %	NR [2]	100 %	100 %	100 %
West Yorkshire Analytical Services	100 %	50 %	100 %	75 %	75 %	100 %	75 %	100 %

[1] Participant subscribed to two sets of test samples (2 x 4 test samples) in each WASP/AIR PT round.
[2] NR No results reported
[3] Kent Scientific Services, Cardiff Scientific Services and Exova (formerly Clyde Analytical) no longer carry out NO2 diffusion tube monitoring and therefore did not submit results.

Appendix 4

Tube bias tri-location studies

- **Swansea Roadside AURN tri-location**

Tri located tubes were exposed on the sample intake, synchronised for exposure for the monthly period to match the exposure on/off timings as suggested by the Welsh Air Quality Forum exposure calendar (mirrors the old UK monitoring network). All results were entered into the spreadsheet provided by AEA Energy and Environment[48] to determine tube bias as well as checking the accuracy and precision of the diffusion tube measurements. The results can be seen below.

The derived bias correction factor of 0.88 (0.84-0.93) has been calculated with all diffusion tube data periods having a coefficient of variation below 20%. Accuracy (with 95% confidence interval) indicates a bias B factor using 12 periods of data of 14% (8% - 19%)

[48] http://www.airquality.co.uk/archive/laqm/tools/AEA_DifTPAB_v03.xls

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	14/01/2015	09/02/2015	38.2	43.2	42.4	41	2.7	7	6.7	34.5	94.6	Good	Good
2	09/02/2015	04/03/2015	39.7	30.9	41.4	37	5.6	15	14.0	33.9	99.8	Good	Good
3	04/03/2015	30/03/2015	41.3	35.3	39.8	39	3.1	8	7.8	36.9	99.6	Good	Good
4	30/03/2015	29/04/2015	33.9	31.9	30.9	32	1.5	5	3.8	32.7	99.5	Good	Good
5	29/04/2015	03/06/2015	20.8	20.9	19.5	20	0.8	4	1.9	17.30	99.6	Good	Good
6	03/06/2015	01/07/2015	21.6	21.3	22.1	22	0.4	2	1.0	20.90	99.7	Good	Good
7	01/07/2015	29/07/2015	20.4	23.5	21.6	22	1.6	7	3.9	17.85	98.9	Good	Good
8	29/07/2015	26/08/2015	26.1	26.6	25.8	26	0.4	2	1.0	22.52	95.39	Good	Good
9	26/08/2015	30/09/2015	28.4	33.4	30.6	31	2.5	8	6.2	26.34	99.6	Good	Good
10	30/09/2015	04/11/2015	45.9	46	46.7	46	0.4	1	1.1	41.40	99.5	Good	Good
11	04/11/2015	01/12/2015	26	29.9	26.9	28	2.0	7	5.1	21.32	99.5	Good	Good
12	01/12/2015	06/01/2016	30.4	28.1	33.8	31	2.9	9	7.1	24.80	99.6	Good	Good
13													

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Overall survey --> Good precision | Good Overall

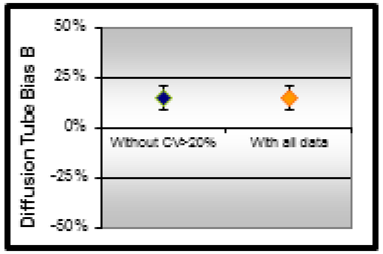
Site Name/ ID: Swansea AURN 2015

Precision 12 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.88 (0.84 - 0.93)
Bias B 14% (8% - 19%)
Diffusion Tubes Mean: 31 µgm⁻³
Mean CV (Precision): 6
Automatic Mean: 28 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 28 (26 - 29) µgm⁻³

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.88 (0.84 - 0.93)
Bias B 14% (8% - 19%)
Diffusion Tubes Mean: 31 µgm⁻³
Mean CV (Precision): 6
Automatic Mean: 28 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 28 (26 - 29) µgm⁻³



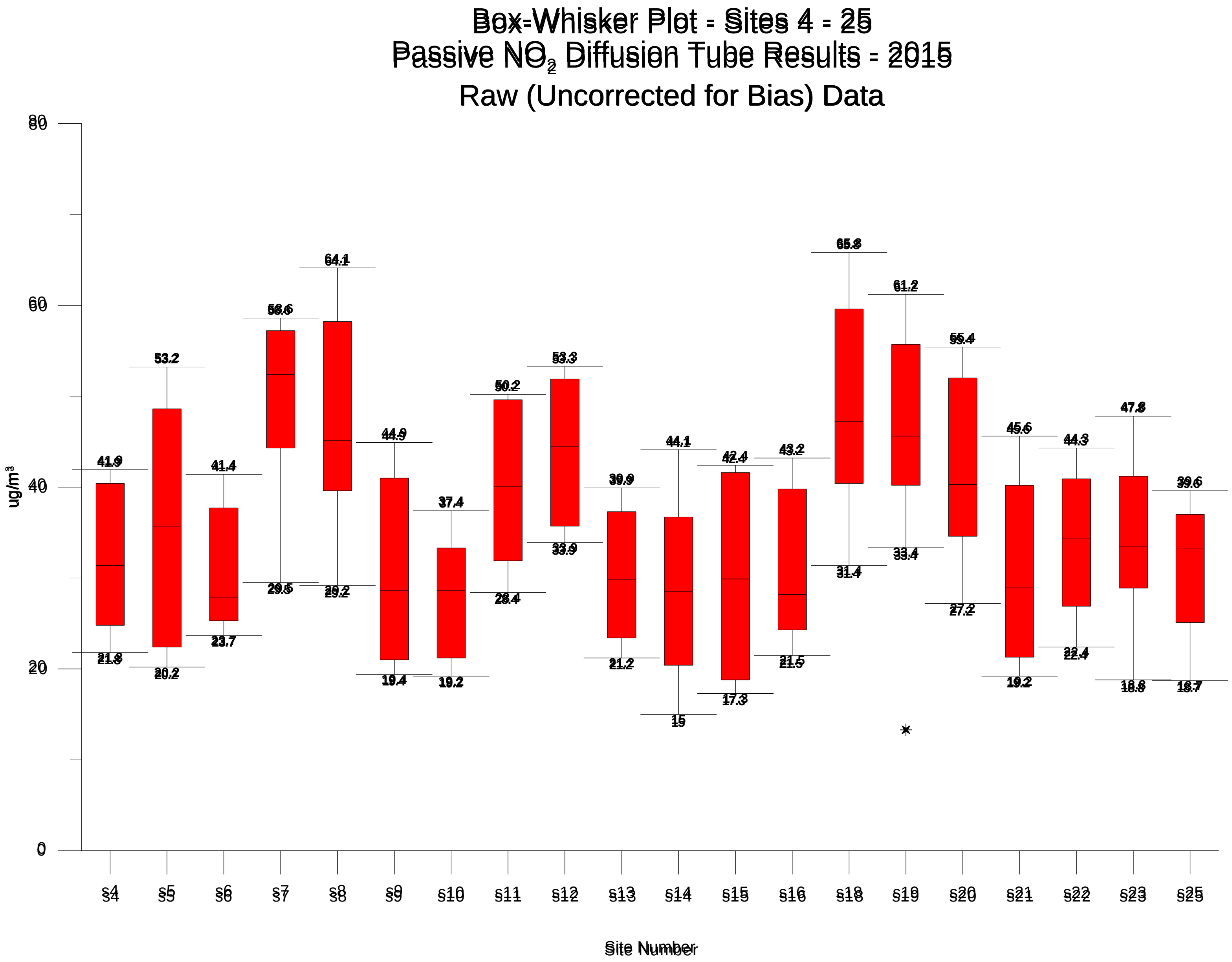
Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Appendix 5

Box-Whisker Plots 2015

Nitrogen Dioxide Passive Diffusion Tube Data (RAW – uncorrected for bias)

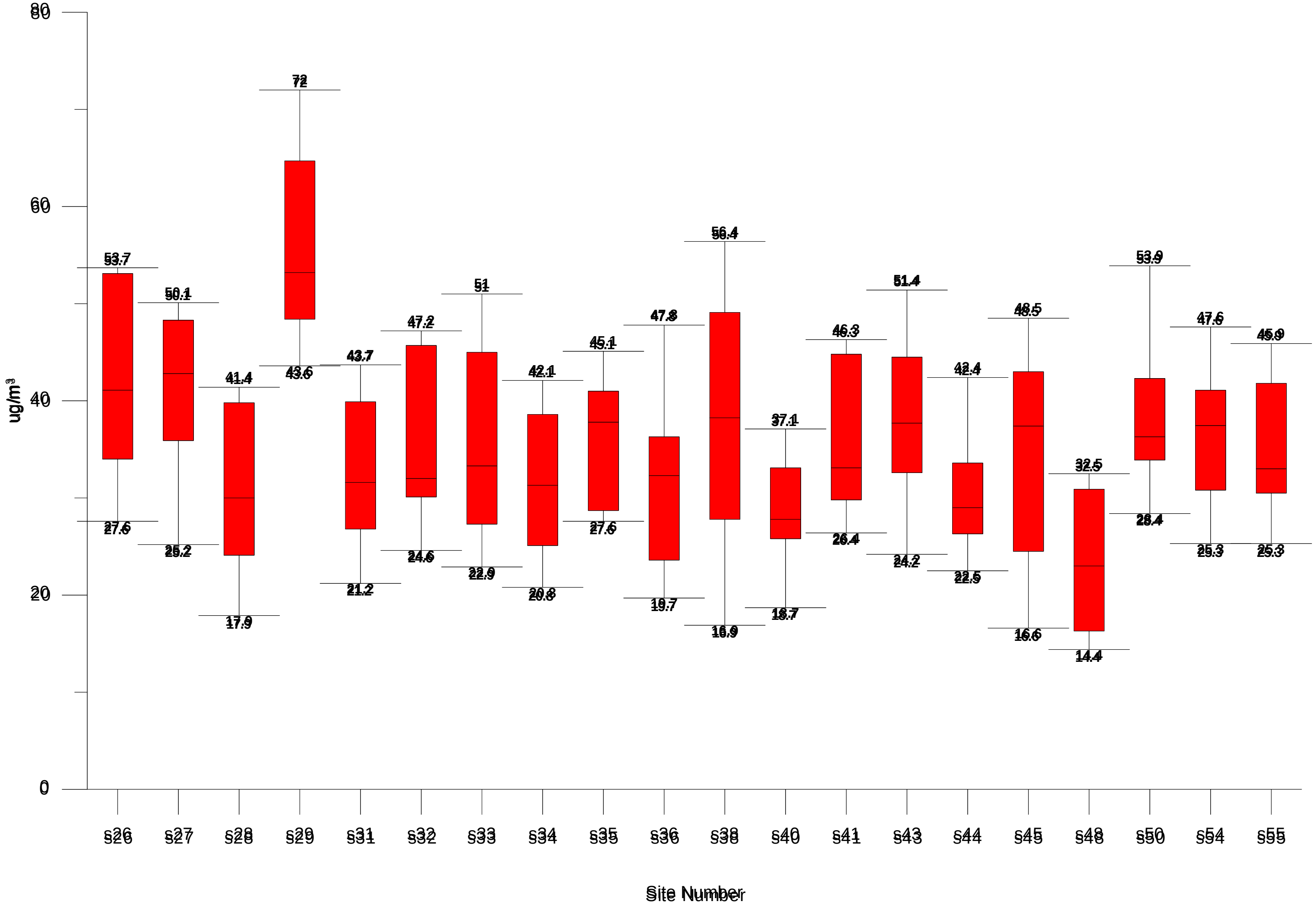

Box-Whisker Plot - Sites 4 - 25
Passive NO2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data
ug/m3
80
60
40
20
0
41.9
21.8
53.2
20.2
41.4
23.7
58.6
29.5
64.1
29.2
44.9
19.4
37.4
19.2
50.2
28.4
53.3
33.9
39.9
21.2
44.1
15
42.4
17.3
43.2
21.5
65.8
31.4
61.2
33.4
55.4
27.2
45.6
19.2
44.3
22.4
47.8
18.8
39.6
18.7
s4
s5
s6
s7
s8
s9
s10
s11
s12
s13
s14
s15
s16
s18
s19
s20
s21
s22
s23
s25
Site Number

City & County of Swansea

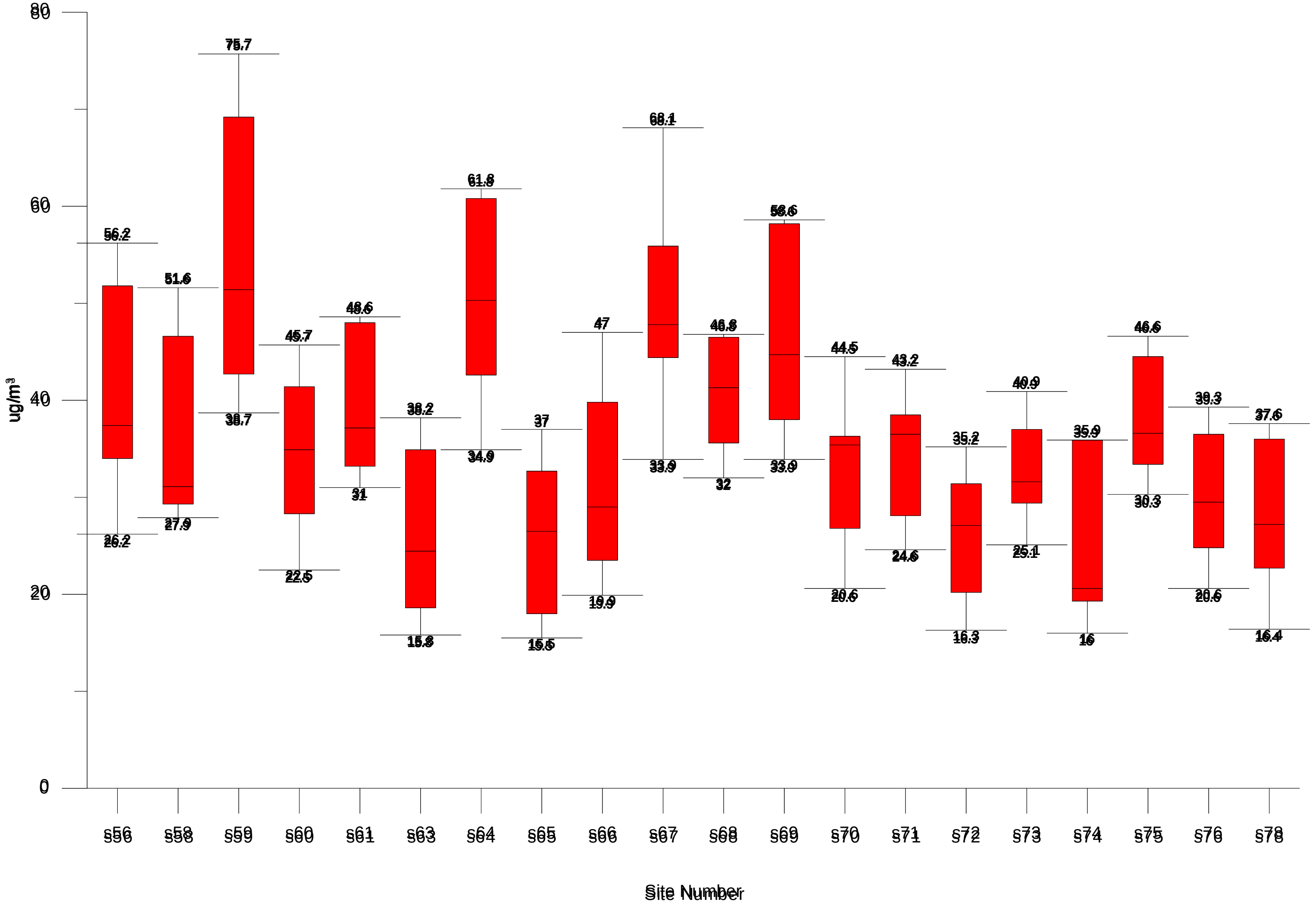
Box-Whisker Plot - Sites 26 - 55

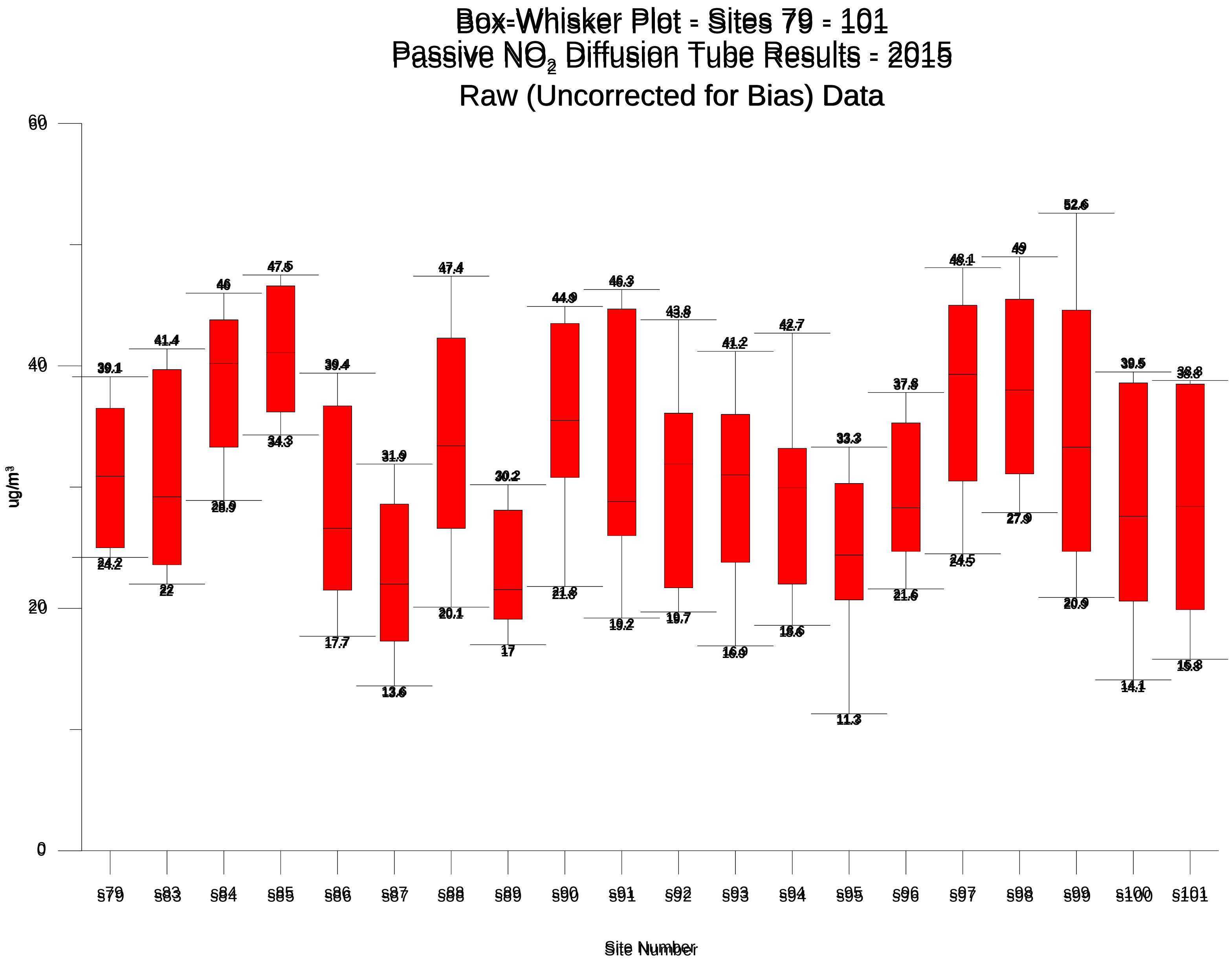
Passive NO_2 Diffusion Tube Results - 2015

Raw (Uncorrected for Bias) Data

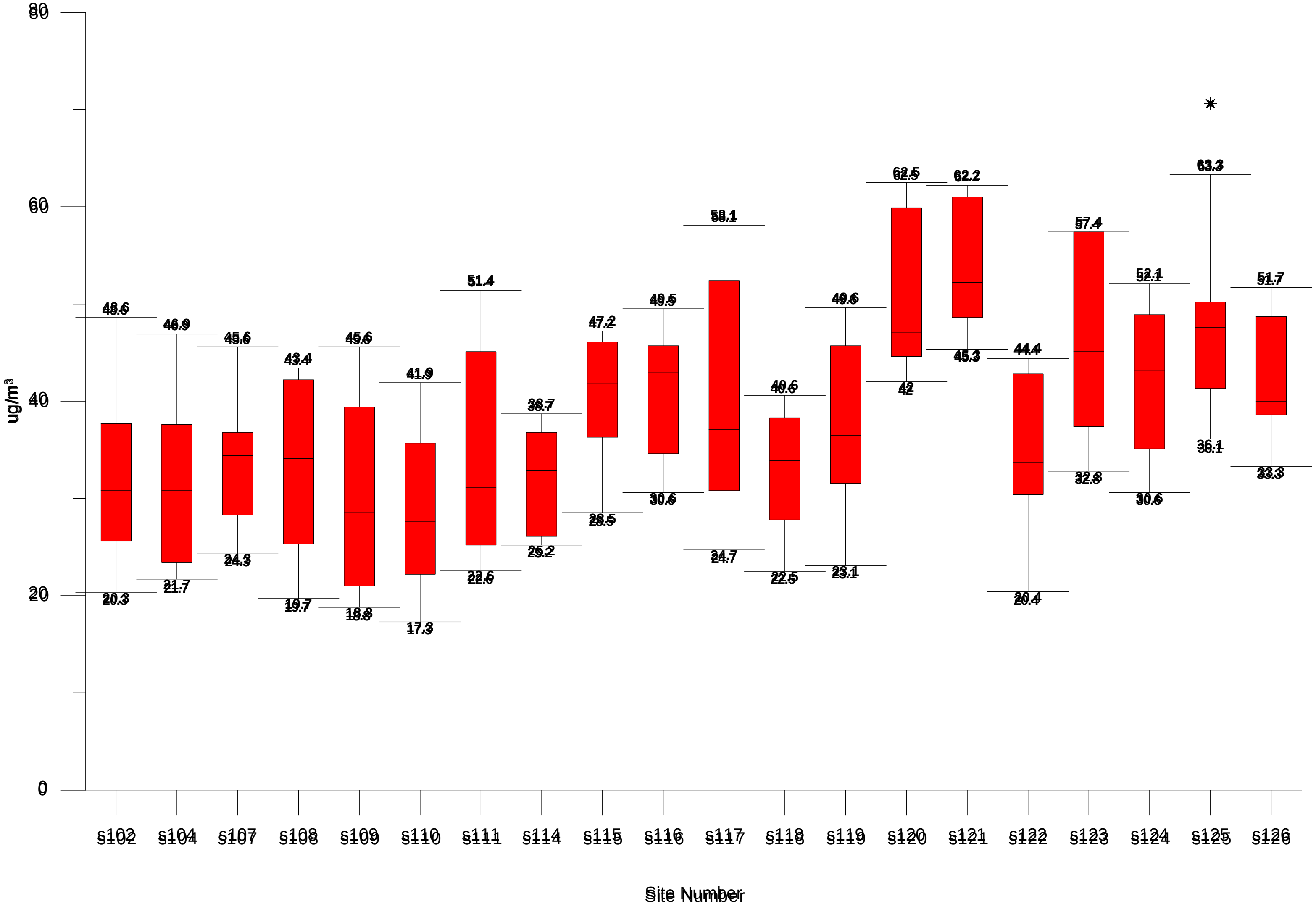


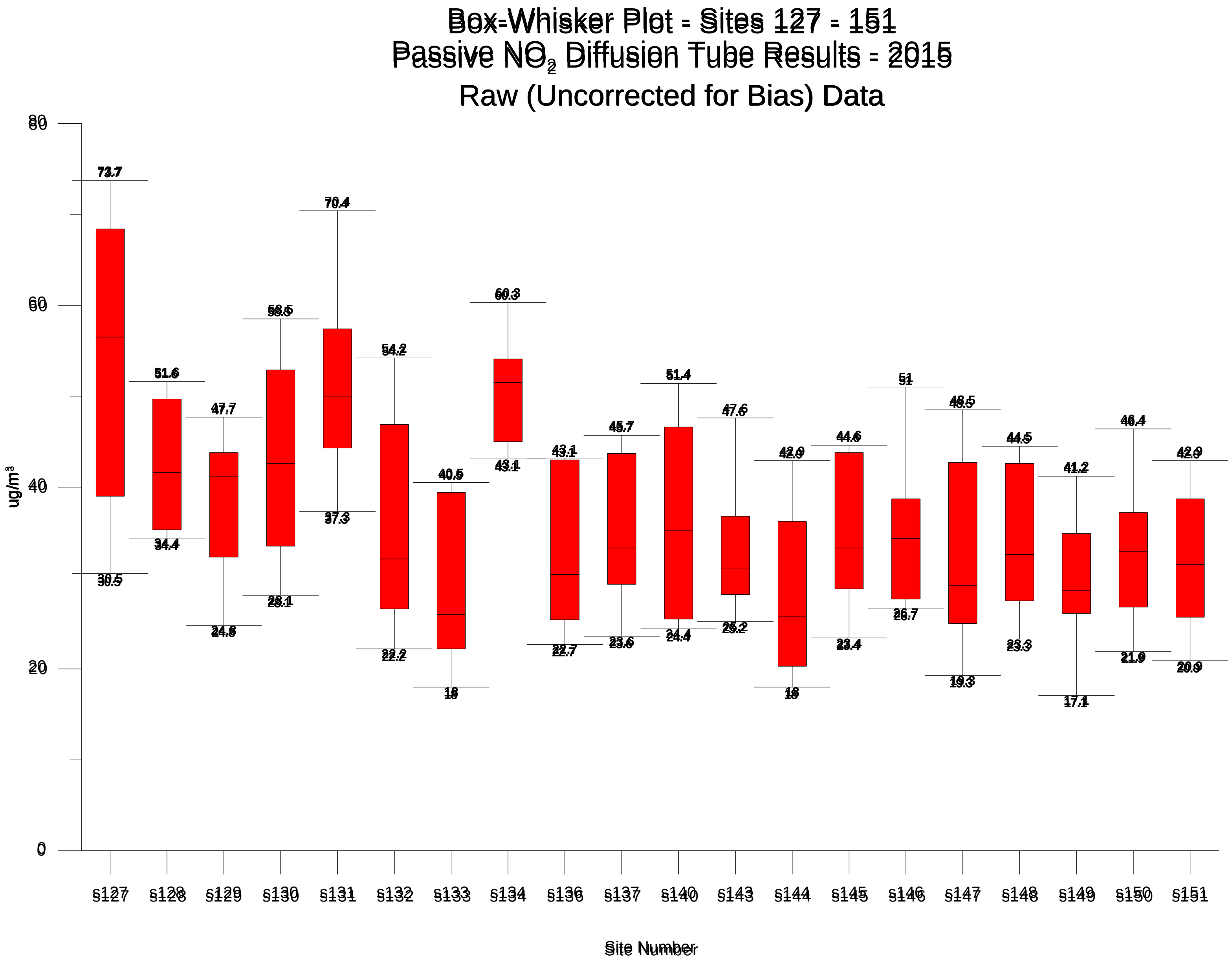
Box-Whisker Plot - Sites 56 - 78
Passive NO_2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data

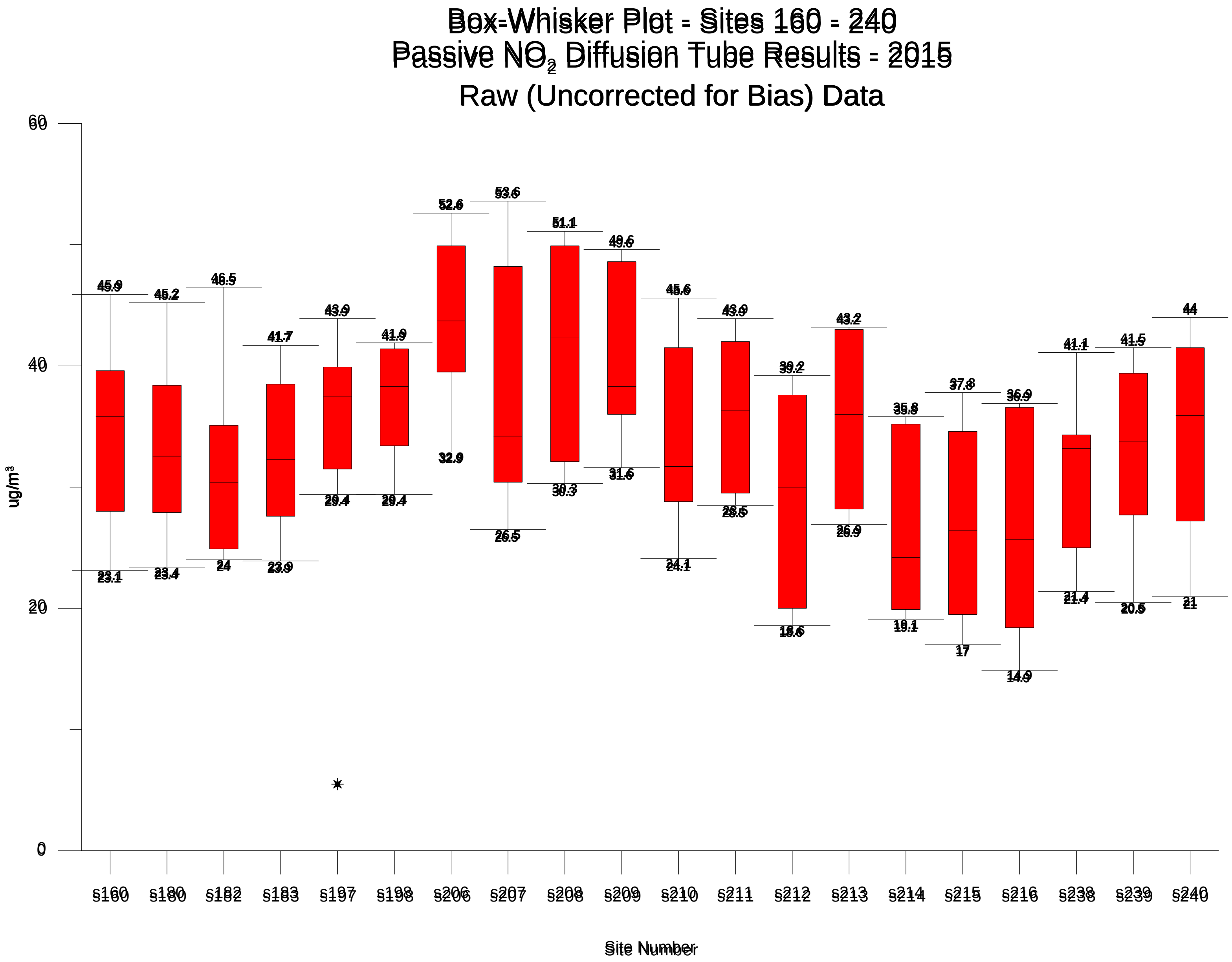



Box-Whisker Plot - Sites 79 - 101
Passive NO_2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data
ug/m³
0
20
40
60
39.1
24.2
41.4
22
46
28.9
47.5
34.3
39.4
17.7
31.9
13.6
47.4
20.1
30.2
17
44.9
21.8
46.3
19.2
43.8
19.7
41.2
16.9
42.7
18.6
33.3
11.3
37.8
21.6
48.1
24.5
49
27.9
52.6
20.9
39.5
14.1
38.8
15.8
s79
s83
s84
s85
s86
s87
s88
s89
s90
s91
s92
s93
s94
s95
s96
s97
s98
s99
s100
s101
Site Number

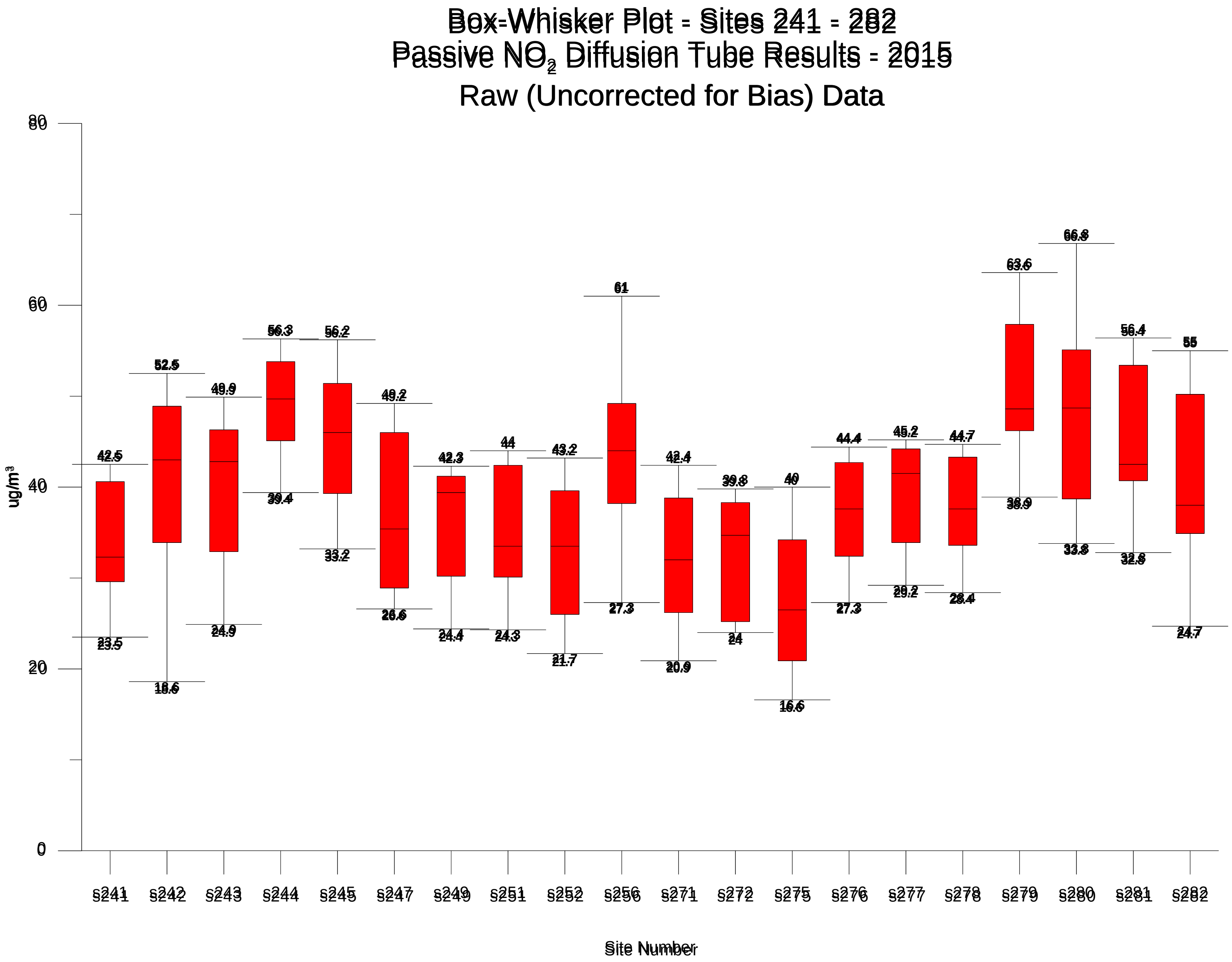
Box-Whisker Plot - Sites 102 - 126
Passive NO_2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data

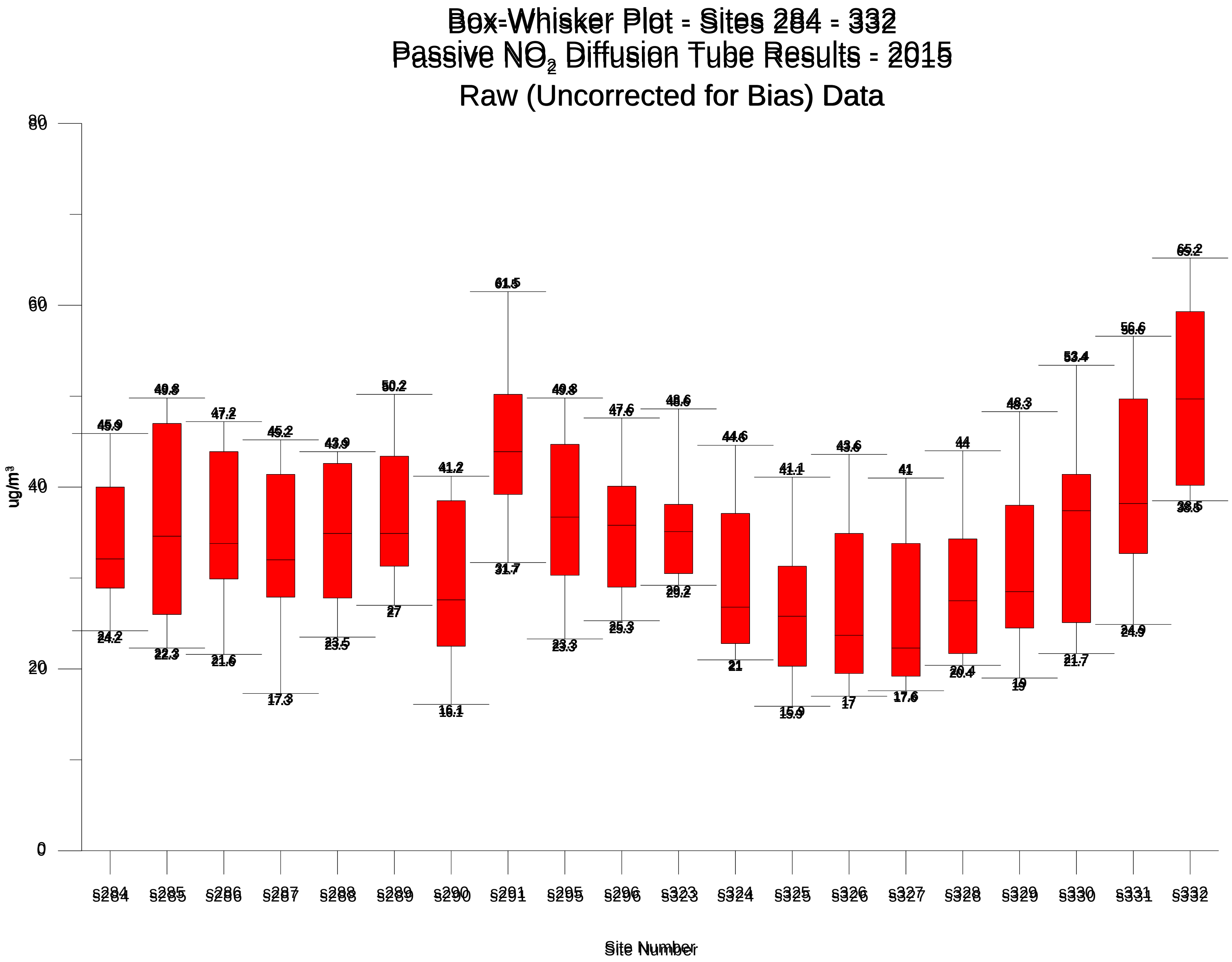



Box-Whisker Plot - Sites 127 - 151
Passive NO_2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data
ug/m³
Site Number
s127 s128 s129 s130 s131 s132 s133 s134 s136 s137 s140 s143 s144 s145 s146 s147 s148 s149 s150 s151
0 20 40 60 80
73.7 30.5 51.6 34.4 47.7 24.8 58.5 28.1 70.4 37.3 54.2 22.2 40.5 18 60.3 43.1 43.1 22.7 45.7 23.6 51.4 24.4 47.6 25.2 42.9 18 44.6 23.4 51 26.7 48.5 19.3 44.5 23.3 41.2 17.1 46.4 21.9 42.9 20.9


Box-Whisker Plot - Sites 160 - 240
Passive NO_2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data
ug/m³
0
20
40
60
Site Number
s160
s180
s182
s183
s197
s198
s206
s207
s208
s209
s210
s211
s212
s213
s214
s215
s216
s238
s239
s240
45.9
23.1
45.2
23.4
46.5
24
41.7
23.9
43.9
29.4
41.9
29.4
52.6
32.9
53.6
26.5
51.1
30.3
49.6
31.6
45.6
24.1
43.9
28.5
39.2
18.6
43.2
26.9
35.8
19.1
37.8
17
36.9
14.9
41.1
21.4
41.5
20.5
44
21

City & County of Swansea




Box-Whisker Plot - Sites 284 - 332
Passive NO2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data
ug/m3
0
20
40
60
80
Site Number
s284
s285
s286
s287
s288
s289
s290
s291
s295
s296
s323
s324
s325
s326
s327
s328
s329
s330
s331
s332
45.9
24.2
49.8
22.3
47.2
21.6
45.2
17.3
43.9
23.5
50.2
27
41.2
16.1
61.5
31.7
49.8
23.3
47.6
25.3
48.6
29.2
44.6
21
41.1
15.9
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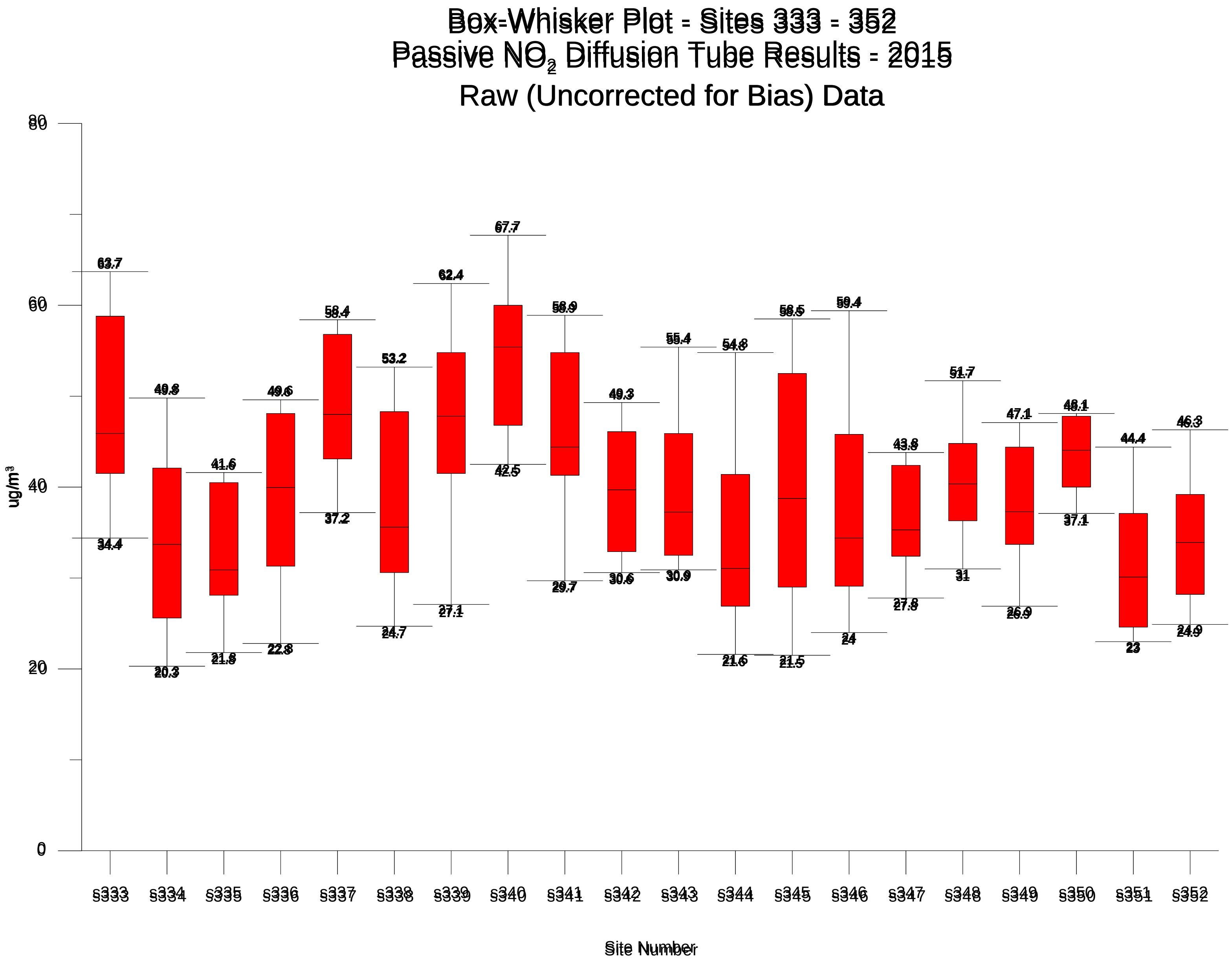
24.9
65.2
38.5


Box-Whisker Plot - Sites 333 - 352
Passive NO_2 Diffusion Tube Results - 2015
Raw (Uncorrected for Bias) Data
ug/m³
0
20
40
60
80
63.7
34.4
49.8
20.3
41.6
21.8
49.6
22.8
58.4
37.2
53.2
24.7
62.4
27.1
67.7
42.5
58.9
29.7
49.3
30.6
55.4
30.9
54.8
21.6
58.5
21.5
59.4
24
43.8
27.8
51.7
31
47.1
26.9
48.1
37.1
44.4
23
46.3
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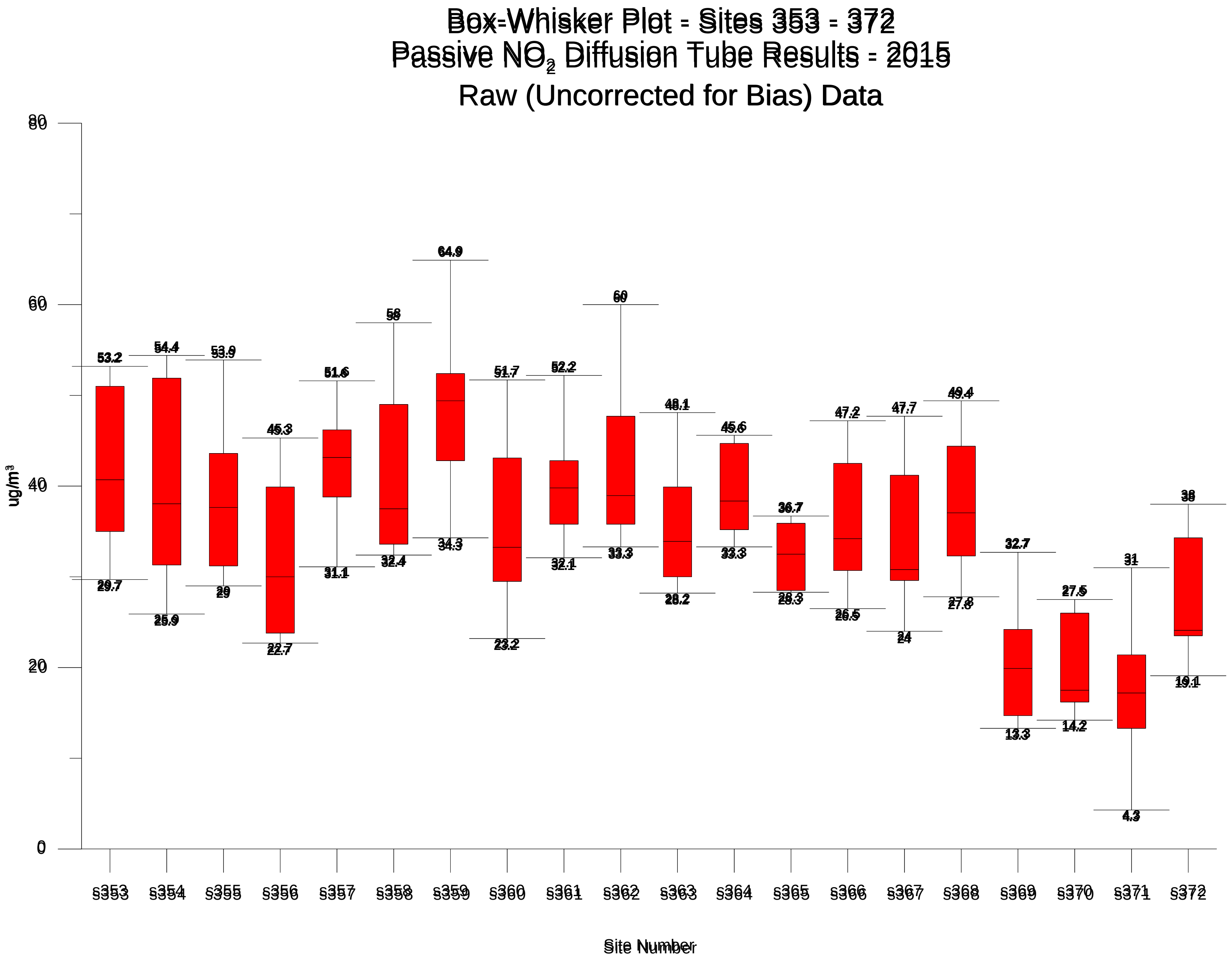
Site Number

City & County of Swansea



Appendix 6

GPRS Automatic Traffic Counter Locations 2015

Appendix 7

Local Transport Plan 2015-2020

Progress Report/Update January 2016

Table 1 – Local Transport Fund Contact information

Local authority	City and County of Swansea
Lead contact	Ben George
Contact telephone	01792 636343
Contact email	Ben.george@swansea.gov.uk

Scheme name	Description	Scheme Category *	Welsh Government Funding Allocation (2014/15)	Welsh Government Funding Claimed (2014/15)	Match Funding (2014/15)
Morfa Distributor Road	The Morfa Distributor Road will be 1.7km in length and will deliver a 3 metre shared use path along its length linking with and complementing the parallel riverside route which is expected to be delivered in its full extent in the coming years in accordance with the Tawe Riverside Corridor Strategy (2006).	Highways	£1,100,000 (originally £1.5m, but reduced allocation notified in letter dated 12/03/15)	£1,100,000	£120,000
Urban Cycle Network	The scheme will deliver an integrated network of cycle routes for Swansea City Centre. The routes will be off-road routes on non-segregated shared use paths in order to be appropriate for use by users of all abilities. This is part of the Council's work to promote the aims of the Active Travel (Wales) Act and will deliver a step-change for Swansea City Centre as a destination for bicycles.	Active Travel	£300,000	£300,000	£75,000

Table 2 – Local Transport Fund Scheme Spend 2014/15

Table 3 – Local Transport Fund Scheme Purpose 2014/15

Scheme name	Original Scheme Purpose	Summary of Scheme Progress	Reasons for any Changes during Scheme Delivery
Morfa Distributor Road	To provide a new arterial road, foot and cycle link for traffic travelling into and out of Swansea City Centre, bypassing the community of Hafod which has long been blighted by congestion and poor air quality. It will also provide strategic road access to land on the west bank of the River Tawe to allow redevelopment in line with the Tawe Riverside Corridor Strategy (2007).	The listed former canal boundary wall has been repaired and stabilised, These works have been introduced in conjunction with the adjoining Copperworks site, Advance knotweed remediation works have been undertaken to limit the risk of cross contamination during the main construction works. The third party land owner has secured its long-sought planning consent, thus allowing the land needed for the Morfa Distributor Road to be dedicated to the City & County of Swansea for the construction of the road.	Securing the land for Morfa Road was complicated by the industrial heritage which surrounds the location. The additional archaeological work that was required by planning consent to be undertaken upon the third party land has effectively ruled out the likelihood of Section 106 monies being received in the future. Nonetheless the land has now been secured allowing the scheme to progress albeit with a significant delay to its programme.
Urban Cycle Network	The City Centre cycling provision is of poor quality and fragmented, which results in poor levels of city centre cycling but higher levels at its fringe. There are a number of city centre developments which are driving an increase in city centre student residential developments. It is important that public transport and cycle networks are improved to provide a viable means of sustainable transport for this growing demographic. An off-road cycle link connecting Kingsbridge to the NCN route 4 formed part of the scheme.	The shared use path on Pleasant Street was completed in January 2015 and the Shared Use Path on Princess Way was completed in March 2015. The off-road cycle link via Kingsbridge could not be addressed due to land (and common land) issues which remain to be resolved.	The City Centre schemes were developed and delivered largely according to plan. However, some elements have not been finalised and may form the basis of a further LTF bid in 2016/17. The Kingsbridge cycle link was more problematic as there were difficulties with the registration of the land and a land swap that had taken place in the 1990s. In addition the land is partly registered as common land.

Table 4 – Local Transport Fund Scheme Key Benefits 2014/15

Scheme name	Context	Inputs	Outputs	Outcomes	Impact	Jobs
Morfa Distributor Road	Morfa is an ongoing scheme and the 2014/15 funding helped to progress the scheme and overcome some key barriers to overall delivery. The ultimate intention is to relieve congestion in the Hafod and area and for the local community there at the same time as opening up development land to support the economic regeneration aspirations of the Council and the City Region Board.	£1,100,000 of LTF and £120,000 of match funding.	• The listed former canal boundary wall was repaired and stabilised alongside the adjoining Copperworks site. • Advance knotweed remediation works has been undertaken. • The third party land owner has planning consent, after undertaking additional archaeological work and the land has now been secured.	The main construction works (on a section of wholly new road) commenced in January 2015. The 2014/15 outputs were necessary to allow outputs and outcomes to be realised as the scheme moves into delivery in 2015/16.	The main impact and benefits of the scheme will not be realised until the completion of the scheme in 2017/18. However, the first phase of the work will be complete in 2015/16 and some impact should be evident at that stage.	The project is currently supporting existing design, project management and construction jobs. In addition there is now access to a large housing development site (not possible prior to the road) which will also protect existing and support new skilled construction jobs.

Scheme name	Context	Inputs	Outputs	Outcomes	Impact	Jobs
Urban Cycle Network	The intention of the scheme was to create an environment in the City Centre which supported and encouraged Active Travel. This is to facilitate access by low cost and healthy means as well as improving the air quality, permeability and ambience of the City Centre.	£300,000 LTF and £75,000 of match funding.	The construction of 1.7km of shared use path in the City Centre.	As the scheme has not been finalised the proposed counter has not been installed at this stage. However, anecdotally it appears that more cyclists and pedestrians are using the City Centre network than was previously the case.	• Improved sustainable access for those living in the City Centre • Improved sustainable access for those wishing to walk or cycle to, from or around the City Centre.	The scheme supported skilled construction workers and labourers posts during the development stage and is now providing low cost access to employment and training in and around the City Centre.