

Appendix 4

A4 Bus Lane Scheme: Air Quality Monitoring Results

Background

In August 2020, Slough Borough Council announced that dedicated bus and cycle lanes in both directions on the A4 was to be trialled, running from Huntercombe Roundabout to Sussex Place (subsequently the section between Huntercombe Roundabout and Cippenham Lane was reduced to cycle lanes only). This restricted the use of the bus lane at all times except for buses, cycles and emergency vehicles. The scheme is funded by the central government's Emergency Active Travel Fund (EATF), introduced during the Covid-19 pandemic to encourage people to travel actively and sustainably, support social distancing measures for cyclists and pedestrians, and to prepare for the borough's recovery.

The experimental scheme was first in operation between 31 August and 3 December 2020. During this period, the Council received many consultation responses. Following a review of the responses during that initial consultation, operational changes to the experimental bus and cycle lanes were introduced from 4 December 2020. The experimental bus and cycle lanes now operate peak time only, from Monday to Friday during the hours of 7am-10am and 3pm-7pm (previously at all times).

The 6 month consultation period was due to end on 4 June 2021. As a result of the easing of Covid-19 restrictions, the consultation period was extended to finish on 31 August 2021, to give residents the opportunity to comment on the scheme with it being fully operational in normal traffic conditions. This consultation period has now ended and the impacts of the scheme are being reviewed, which will be taken into consideration when the Council makes the decision to either remove the scheme or make it permanent.

Air Quality Background

Slough currently has 5 Air Quality Management Areas (AQMAs), declared as such due to exceedances of the Air Quality Objective (AQO) for nitrogen dioxide (NO₂), predominantly caused by road transport emissions. Three of Slough's AQMAs are within close proximity to the A4, therefore air quality is one of the key factors being considered when reviewing the impacts of the bus lane scheme. There is risk that the congestion caused by the scheme may result in a worsening of air quality on the A4 and connecting roads, as vehicles are restricted to using one lane of traffic only, but conversely the scheme has potential to improve air quality by increasing the distance between the receptors and the main traffic flow, and allowing for greater increase of active travel and use of public transport, reducing congestion in the long term.

It should be noted that the bus lane was implemented at a time where traffic volumes were reduced far below typical levels, due to Government imposed lockdowns and a tiered system of varying restrictions, which had resulted in a positive air quality impact. This therefore makes the review of bus lane related impacts using monitoring data very challenging, as the effect of the pandemic is likely to mask bus lane related impacts. Nevertheless, the monitoring data available has been examined to draw out potential impacts the scheme may have.

Data from monitoring locations along the A4 and connecting roads have been reviewed and reported in this document. Figure 1 shows a map of the monitoring locations that have been considered in this review. The monitoring locations include:

- Windmill and Wellington Street continuous analysers
- Existing passive diffusion tubes along the A4 and connecting roads

- New passive diffusion tubes at 6 locations (Councillor requested) on surrounding roads

The impact of both the full scheme and the peak time only scheme are discussed below.

Continuous Monitoring Data

Slough currently operates 5 continuous analysers which report NO₂ data on an hourly basis. The data from two continuous analysers (Wellington Street SLH 10 and Windmill SLH 12) have been reviewed to determine the impact of the scheme both when first operational (August – November 2020) and with the new peak time only operations (December 2020 – August 2021). The respective graphs are shown in Figure 2.

The graphs demonstrate that the pandemic has resulted in much lower NO₂ concentrations during 2020, as these concentrations are much lower than monthly averages from previous years. It is therefore difficult to determine whether the bus lane has had a positive or negative impact on air quality during 2020, as any influence of the scheme is masked by the impact of the pandemic. It is clear however, that the bus lane had not caused emissions to exceed concentrations recorded in previous years, suggesting that the bus lane has not caused a worsening of air quality relative to previous data.

Despite easing of restrictions towards the end of summer, travel restrictions were re-introduced from November to December 2020, with the third national lockdown implemented on 6 January 2021. This resulted in a large decrease in traffic volumes, causing the lowest NO₂ concentrations in January compared to previous years at both the Windmill and Wellington Street monitoring stations. After this period, traffic levels began to increase and have continued to do so up to August 2021. Although NO₂ concentrations are higher in 2021 than in 2020 at Windmill and Wellington, concentrations have not returned to pre-Covid-19 levels. When comparing to Pippins, Colnbrook (Sloughs background monitoring location), this is also the case here, suggesting that this may be natural meteorological variation rather than attributable to the bus lane scheme.

Passive Diffusion Tube Monitoring Data

The Council currently monitors NO₂ at 32 diffusion tube locations in close proximity to the A4. The majority of these locations have been in place for over 5 years, however diffusion tubes SLO 112-123 were introduced in December 2020 for the purpose of monitoring the bus lane impacts on surrounding roads. This section therefore reviews the impact of the bus lane on the long term monitoring sites to determine the impact of both scheme variations, and those introduced from December 2020, to determine the impact of the peak-time only operations.

All of the reported data has been bias adjusted in relation to the continuous analysers. As the continuous monitoring data is provisional at this stage, this bias adjustment factor may be amended in future. Typically, diffusion tube data is reported as an annual average due to reduce uncertainties caused by meteorological effects, however for the purposes of this study, the data has been corrected and reported for each month, to determine whether the bus lane has caused a monthly variation in the data.

Existing A4 sites

Figure 3 displays the data for long term diffusion tube monitoring sites along the A4 during 2020 and 2021. A colour scale has been applied to highlight high concentrations in red and low concentrations in green. Cells that are greyed out have either shown anomalous results or were not able to be collected, for example in May 2020, many diffusion tubes were not able to be collected due to Covid-19 restrictions. Due to the implementation of the third lockdown, this was also the case in January 2021, therefore the monitoring period was 9 weeks covering January to February 2021. As this exceeds the typical exposure period, data obtained during this period should be treated with caution.

Annual NO₂ concentrations vary naturally with seasonality. In winter, climatic conditions typically give rise to higher NO₂ concentrations when compared with the summer months. This is reflected in data shown in January 2020, with higher NO₂ concentrations across all monitoring sites in the borough. At monitoring locations which are close to an emission source, such as close by a major road, this variation is less distinct, such as concentrations shown at Yew Tree Road (SLO 29).

When the bus lane was introduced in August 2020, the increase in NO₂ concentrations from August to September and October was not significant and in some cases, saw an improvement in NO₂ concentrations (Princes Avenue SLO 5 -3.5µg/m³). The highest increase in NO₂ from August to September was observed at Windmill care centre, Bath Road by 5.2µg/m³, however it is expected that NO₂ concentrations rise as summer ends and the autumnal season begins, so it cannot be determined whether the introduction of the bus lane has added to this increase.

The highest concentrations recorded by month since the bus lane was implemented was November 2020. This increase reflects seasonal variation rather than an impact caused by the bus lane, as this trend is observed across all diffusion tube monitoring sites across the borough and mirrors trends from previous years. Comparing to 2019 data specifically, concentrations are much lower in 2020 across the majority of the diffusion tube sites. Locations which have seen an increase in NO₂ relative to November 2019 are distributed across the borough and therefore the increase experienced in 2020 cannot be attributed to the introduction of the bus lane. When comparing to traffic data obtained from ATCs on the A4, traffic levels are far greater in December 2020 than in November 2020, however this increase is not reflected in the monitoring data, further supporting that the November 2020 increase is due to natural seasonal variation.

Concentrations recorded at monitoring locations close by the A4 have remained low throughout 2021, despite the increasing traffic levels, with the exception of Yew Tree Road (SLO 29). This suggests that the peak-time only bus lane is not causing a worsening of air quality at these monitoring locations. SLO 46 for example experienced concentrations above the AQO from 2015 to 2018, with 2019 being the first year of compliance. 2020 concentrations in comparison were reduced to <30µg/m³ and this trend has continued into 2021. It is not clear why SLO 29 continues to have high NO₂ concentrations and it is recommended that this location is investigated further.

Now that the impact of the pandemic is starting to reduce, the impact of the bus lane will become more evident. It may be that the bus lane has sustained the positive effect of the

pandemic into 2021, however meteorological conditions may also influence this. A longer term study would be needed to verify this conclusion.

New bus lane sites

Figure 4 shows the corrected diffusion tube concentrations from December 2020 to August 2021. This data only represents impacts of the peak time only bus lane scheme.

The highest concentration observed in December 2020 was at Elliman Avenue (SLO 115). This concentration is unlikely to be attributed to the bus lane scheme as concentrations recorded in the following months are much lower, therefore this may have been caused by a specific local source or be an anomalous result. The highest average concentration is experienced at Ledgers Road (SLO 121), however a higher rate of data capture is needed at this location to confirm if this site should be of concern.

The data collected to date does not suggest that the bus lane is causing a worsening of air quality at any of the new diffusion tube monitoring sites. It is expected that concentrations will rise into the autumn and winter months, and the pandemic's impact on traffic levels are expected to be much reduced by the end of the year, which will be more representative of a typical year, unless further restrictions are imposed. It is recommended therefore that further monitoring is conducted to provide further evidence of the bus lane impacts.

Summary

In summary:

Continuous monitoring:

- Data from Wellington Street (SLH 10) and Windmill (SLH 12) show NO₂ concentrations much lower in 2020 when compared to previous years and continue to be low despite the introduction of the bus lane on 31 August 2020, suggesting that the initial introduction of the scheme did not cause a worsening of air quality.
- NO₂ concentrations steadily increase from September 2020 onwards and peak in the winter months at both continuous monitoring sites. As this is experienced across the borough, this peak is likely to result from seasonal variation rather than due to the scheme. Despite the peak observed in November 2020, concentrations remain far below those observed for previous years, suggesting that the bus lane has not resulted in a worsening of air quality at these monitoring locations.
- After the implementation of the revised scheme in December 2020, concentrations remain low despite increasing traffic levels up to August 2021. This is experienced across the borough and therefore this improvement cannot be solely attributable to the bus lane scheme, however it may be a factor which contributes.

Passive diffusion tube monitoring:

- Existing A4 monitoring sites experienced variable concentrations when comparing month on month. The winter peak is most evident in November, which coincides with the introduction of the initial bus lane scheme, however it is unlikely to be the cause of the peak as this trend is observed borough wide. This is supported by traffic count data which shows a greater traffic volume in December than November, indicating that the increase in NO₂ in November is not linked to increases in traffic volume. Looking into 2021, concentrations continue to remain low despite increases in traffic levels, suggesting that climatic variation has a stronger influence on concentrations than traffic

levels and suggests the scheme is not causing a worsening of air quality at these monitoring locations. SLO 29 is the only monitoring location that has shown continued high concentrations (neither a worsening or an improvement).

- Monitoring data from the new bus lane sites show low NO₂ concentrations and do not suggest that air quality is worsening at any of these monitoring locations. The highest concentrations are recorded at Ledgers Road (SLO 121) however further data is required to determine whether this is a site of concern.

In conclusion, the data suggests that neither of the bus lane schemes have caused a worsening of air quality at monitoring locations in close proximity to the scheme or on connecting roads.

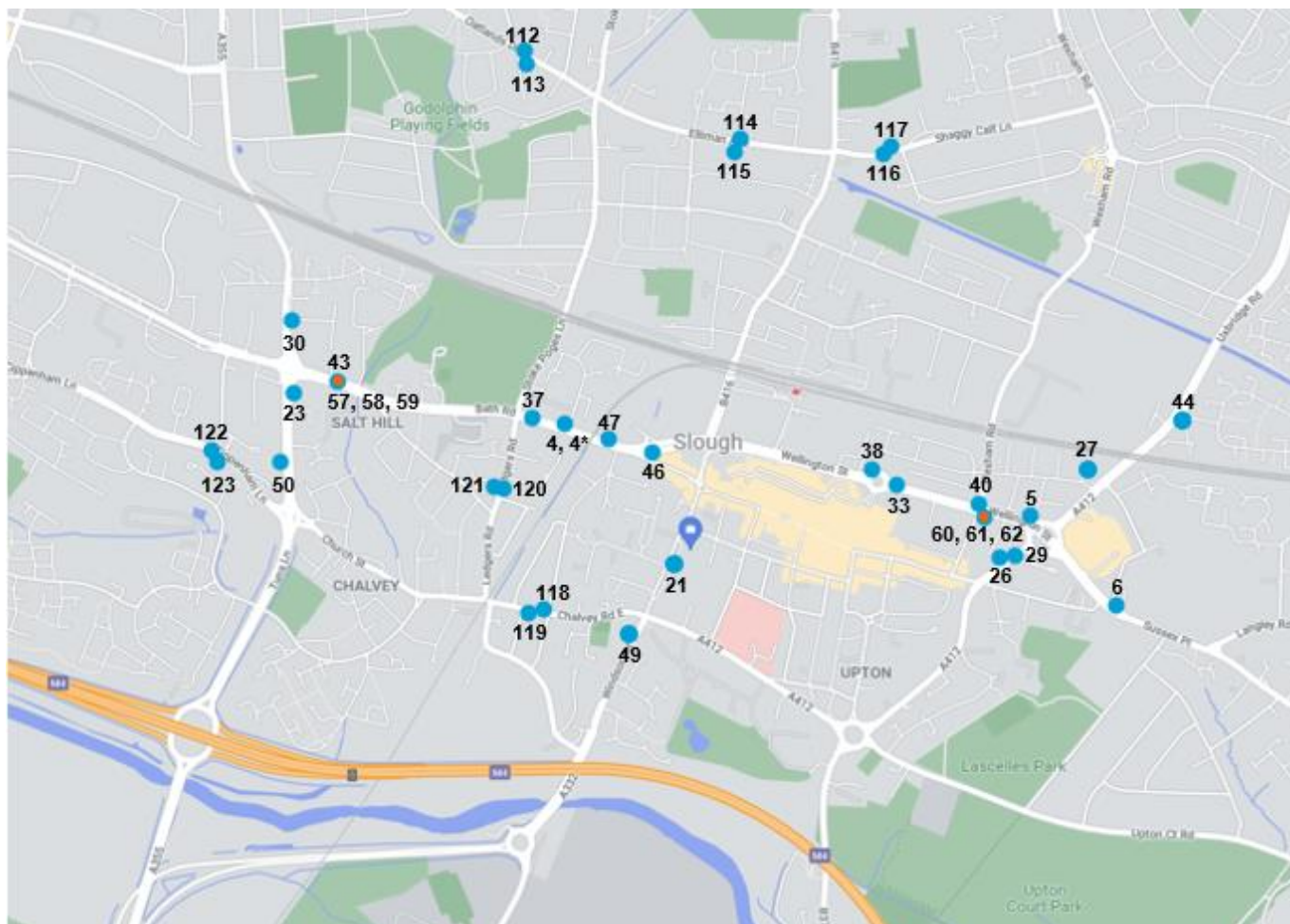
Due to the influence of the pandemic on traffic levels, it is difficult to ascertain the level of improvement that the bus lane has on NO₂ concentrations, as most impacts would be masked by the positive effect of the pandemic. When reviewing 2021 data, NO₂ concentrations across Slough have not returned to pre-Covid-19 levels, despite traffic volumes starting to return to typical levels. This may be due to climatic effects or could be due to schemes such as the experimental bus lane, however the data suggests that low concentrations of NO₂ are experienced borough wide, rather than just at locations in close proximity to the bus lane scheme. It may be that both factors are causing a positive impact on air quality, however to determine the full impact of the scheme, it is recommended that further monitoring is conducted to the end of 2021, to determine whether NO₂ concentrations continue to remain low as traffic levels continue to rise.

Kind regards,

Sophia Norfolk
Principal Environment Officer

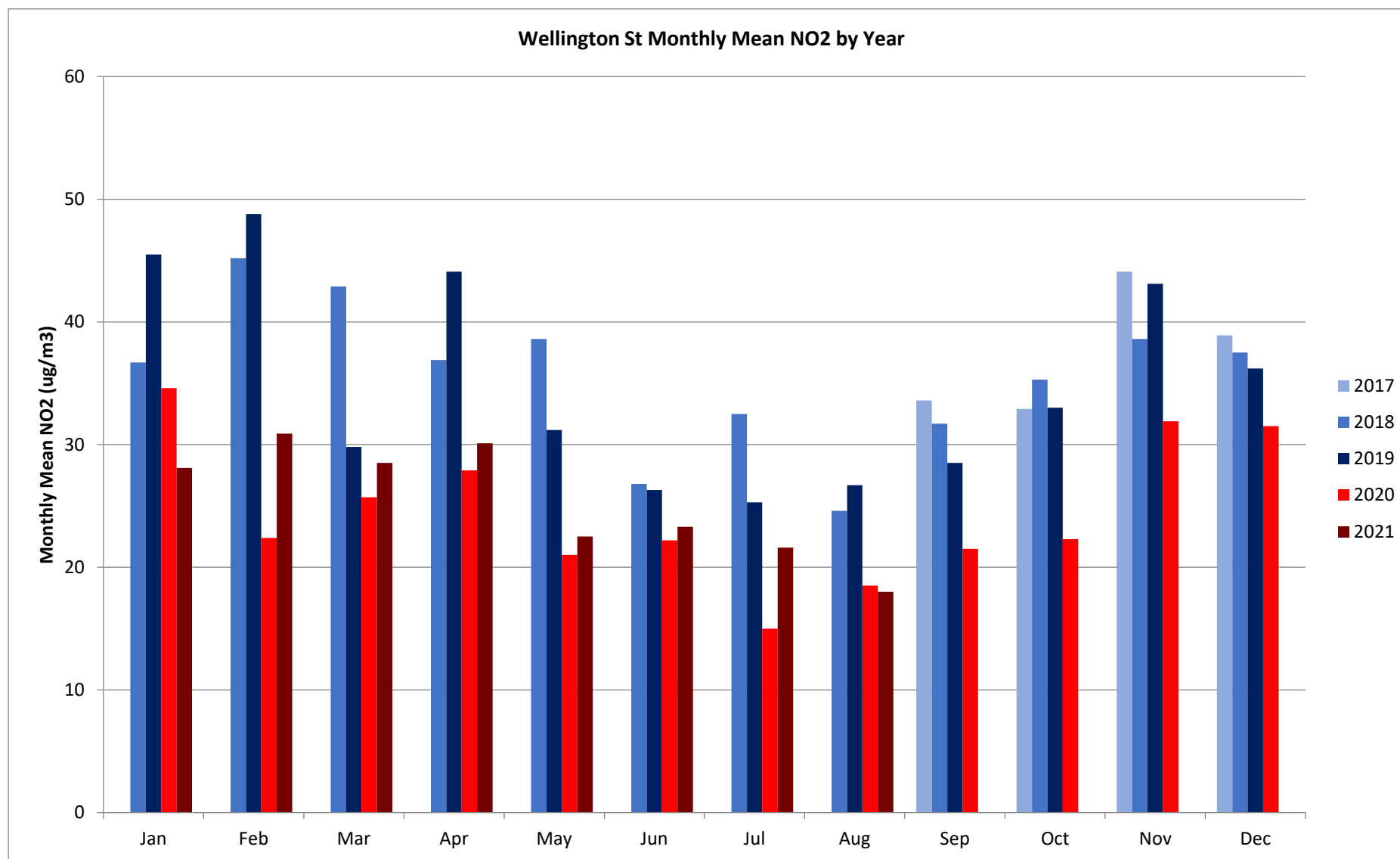
Figures

Figure 1: Map of Monitoring Locations



*Two locations marked in orange represent the two continuous analysers: Windmill (SLH 12) on the western end of the A4 and Wellington Street (SLH 10) in the central section of the A4.

Figure 2: Continuous Monitoring Data from Wellington Street (SLH 10) and Windmill (SLH 12)



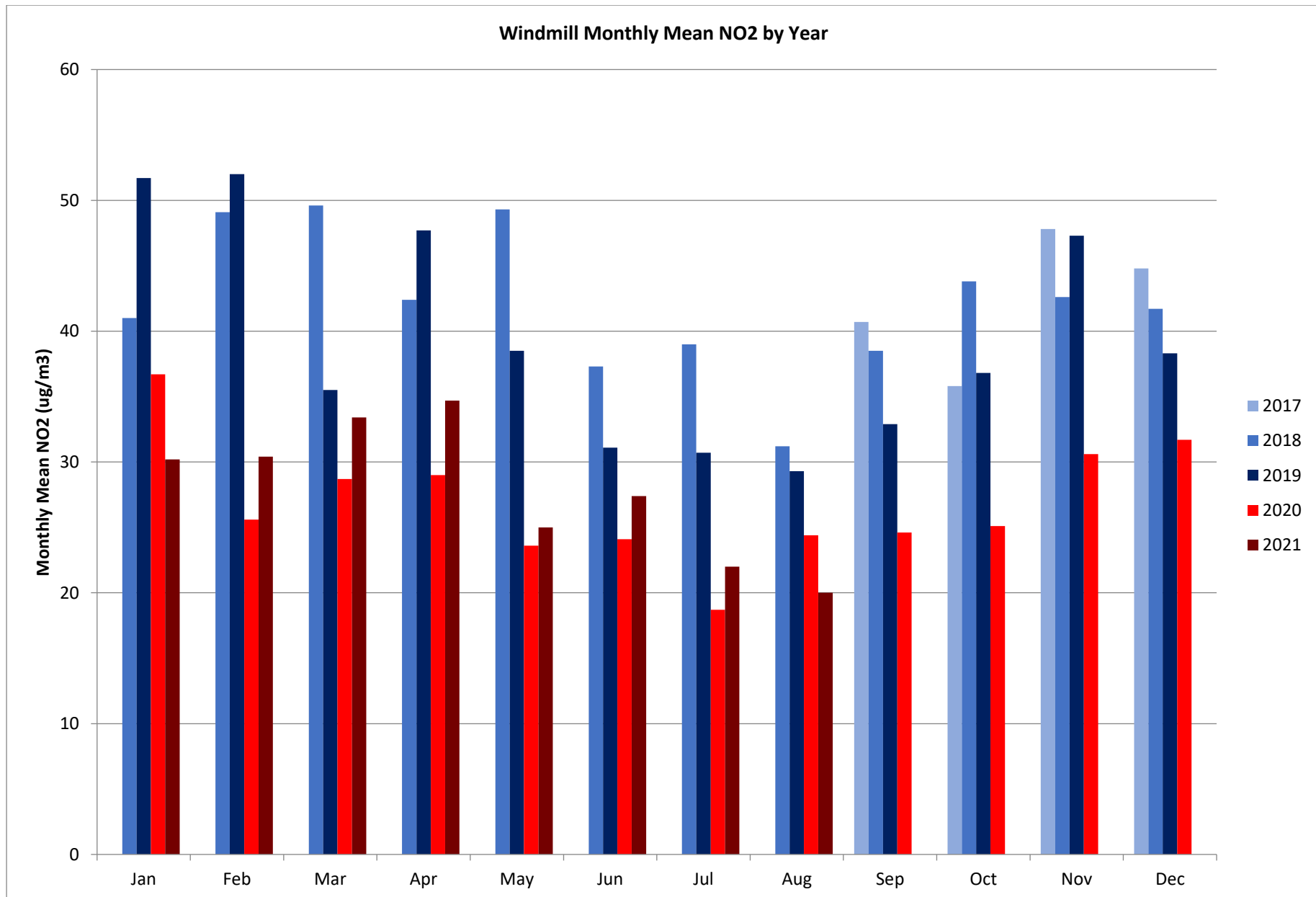


Figure 3: Diffusion Tube Data for Existing A4 Sites

		2020											
Site ID	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4	Lansdowne Avenue	34.18	28.89	26.63	21.37								
4*	Lansdowne Avenue										21.05	26.46	21.36
5	Princes Street	32.77	29.05	23.68	22.07		25.13	19.50	28.23	24.72	29.10	38.22	30.94
6	Sussex Place	29.52	23.48	19.09	15.48		17.59	15.78	17.25	21.36	19.79	28.87	24.93
23	Tuns Lane	27.00		19.80	20.97		19.43	17.27	22.37	22.15	21.49	27.88	21.15
26	Yew Tree Road (B)	27.44	22.04	24.57	26.02		22.14			30.61	25.35	35.81	25.98
29	Yew Tree Road (Ux Rd)	45.04	30.39	31.47	27.65	24.40	29.24	30.75	37.53	39.69	35.00	41.30	33.71
30	Farnham Road (2)	33.92		21.44	17.55		19.07	17.53	20.58	21.56	24.07	32.59	23.93
33	Wellington St - Stratfield	30.03	24.61	21.72	19.08			18.98	19.22	22.11	23.61	29.79	22.08
37	Blair Road	37.31	33.49	28.01	24.89		25.64	22.22	26.37	26.37	28.09	31.42	25.95
38	Wellesley Road	31.92	29.26	24.44	21.51		19.99	19.28	22.69	23.98	24.13	32.36	25.61
40	Wexham Road	38.08	32.86	27.63	24.91		23.03	22.10	29.82	30.52	29.43	37.56	31.15
43	Windmill (Bath Rd)	28.13	25.44	24.32	22.44		22.89	19.56	25.37	26.79	25.54	29.53	24.84
46	Cornwall House, Bath Rd	37.96	33.70	27.48	27.62	22.34	29.24	23.57	28.44	28.18	29.27	35.99	27.76
47	Princes House, Bath Rd		23.90	19.43	21.19		19.66	18.17	21.18	26.09	23.65	29.17	22.70
50	Tuns Lane (B)	39.72	29.98	29.81	27.40	22.55	26.39	24.56	30.36	33.33	31.54	39.16	32.94
57	Windmill Co-location	33.34	29.08	28.49	23.37	21.19	24.20	23.72	26.18	31.37	28.94	30.16	28.42
58	Windmill Co-location	34.38	29.24	25.68	25.51	22.03	22.52	21.88	27.35	29.18	28.40	32.35	27.11
59	Windmill Co-location	31.87	27.54	23.16	25.21	25.54	25.38	23.11	26.47	31.19	29.47	33.07	25.90
60	Wellington St Co-location	32.31	24.30	23.95	26.79	20.03	22.50	19.85	24.12	23.65	26.51	30.76	23.84
61	Wellington St Co-location	30.69	24.80	21.12	25.67	20.19	22.75	18.96	23.50	21.91	26.40	32.81	27.53
62	Wellington St Co-location	31.61	24.61	22.35	26.33	20.91	22.80	19.28	23.78	23.24	25.96	31.93	27.22

		2021						
Site ID	Location	Jan/Feb	Mar	Apr	May	Jun	Jul	Aug
4	Lansdowne Avenue							
4*	Lansdowne Avenue	21.70	20.14	21.01	16.60	15.84	17.42	15.19
5	Princes Street	29.09	27.24	21.78	21.23	19.63	23.36	19.01
6	Sussex Place	23.43	22.76	19.99	17.63	15.95	19.49	15.28
23	Tuns Lane	23.54	22.51	24.95	19.69	20.04	20.74	16.79
26	Yew Tree Road (B)	27.34	29.12	34.00	26.00	31.56	29.89	26.47
29	Yew Tree Road (Ux Rd)	36.62	42.71	44.32	40.58	44.02	39.87	37.04
30	Farnham Road (2)			20.73		18.26		17.18
33	Wellington St - Stratfield	22.24	22.43	20.06	18.13	14.14	15.56	14.51
37	Blair Road	28.16	28.12	24.33	25.80	23.16	23.24	20.90
38	Wellesley Road	24.33	23.98	20.84	20.49	16.60	20.08	16.01
40	Wexham Road	28.29	28.72	28.02	29.30	27.61	28.49	23.80
43	Windmill (Bath Rd)	26.62	25.58	25.62	23.04	24.79	22.17	21.60
46	Cornwall House, Bath Rd	28.30	27.63	27.33	27.79	22.40	24.60	21.90
47	Princes House, Bath Rd	23.65	24.78		21.58	21.86	20.12	16.19
50	Tuns Lane (B)	29.10	30.55	30.01	30.73	30.80	29.12	25.69
57	Windmill Co-location	27.43	10.38	27.95	24.69	30.30	24.83	24.13
58	Windmill Co-location	26.62	27.45	28.50	26.28	28.59	25.89	24.57
59	Windmill Co-location	27.15	28.52	28.93	26.33	28.02	25.15	24.65
60	Wellington St Co-location	27.01	25.73	28.87	21.27	24.50	25.02	19.86
61	Wellington St Co-location	26.77	26.08	27.33	25.70	25.19	25.51	19.51
62	Wellington St Co-location	26.39	25.12	29.37	24.02	26.46	26.19	21.10

Figure 4: Diffusion Tube Data for New Bus Lane Sites

ID	Location	2020	2021							Average
		Dec	Jan/Feb	Mar	Apr	May	Jun	Jul	Aug	
SLO 112	Oatlands Drive (a)	29.33	26.57	23.60	24.59	24.16		25.13		25.56
SLO 113	Oatlands Drive (b)	27.34	25.48	21.33	22.79	20.69	19.36	20.81	17.72	21.94
SLO 114	Elliman Avenue (a)		30.46				23.94	25.41	22.72	25.63
SLO 115	Elliman Avenue (b)	40.30	29.01	22.29	20.74	24.62	21.02	24.19	18.28	25.06
SLO 116	Shaggy Calf Lane (a)	28.29	26.21	25.08	21.82	22.42	18.29	21.70	18.61	22.80
SLO 117	Shaggy Calf Lane (b)	23.03	22.53	21.70	17.07		17.69	20.25	15.57	19.69
SLO 118	Chalvey Road East (a)							22.65	17.84	20.25
SLO 119	Chalvey Road East (b)	30.34	28.53	28.52	22.80	26.82	21.44	22.80	19.61	25.11
SLO 120	Ledgers Road (a)		26.79	23.33	22.39	22.99	20.90			23.28
SLO 121	Ledgers Road (b)	33.76	29.40			30.17		29.01	27.69	30.01
SLO 122	Cippenham Lane (a)	29.32	28.50	27.82	24.09	18.62	21.12	22.50	17.31	23.66
SLO 123	Cippenham Lane (b)	26.40	25.59	21.32	20.31		16.56	17.89	13.15	20.17

