# Lambeth and Southwark: Pollution changes during lockdown and pollution contribution from commercial activity

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This analysis examines pollution levels in the London boroughs of Lambeth and Southwark by evaluating data from the Breathe London monitoring network in the days before and after the government implemented restrictions to reduce the spread of COVID-19. The analysis also examines modelled data on pollution sources, created by Breathe London partners Cambridge Environmental Research Consultants.

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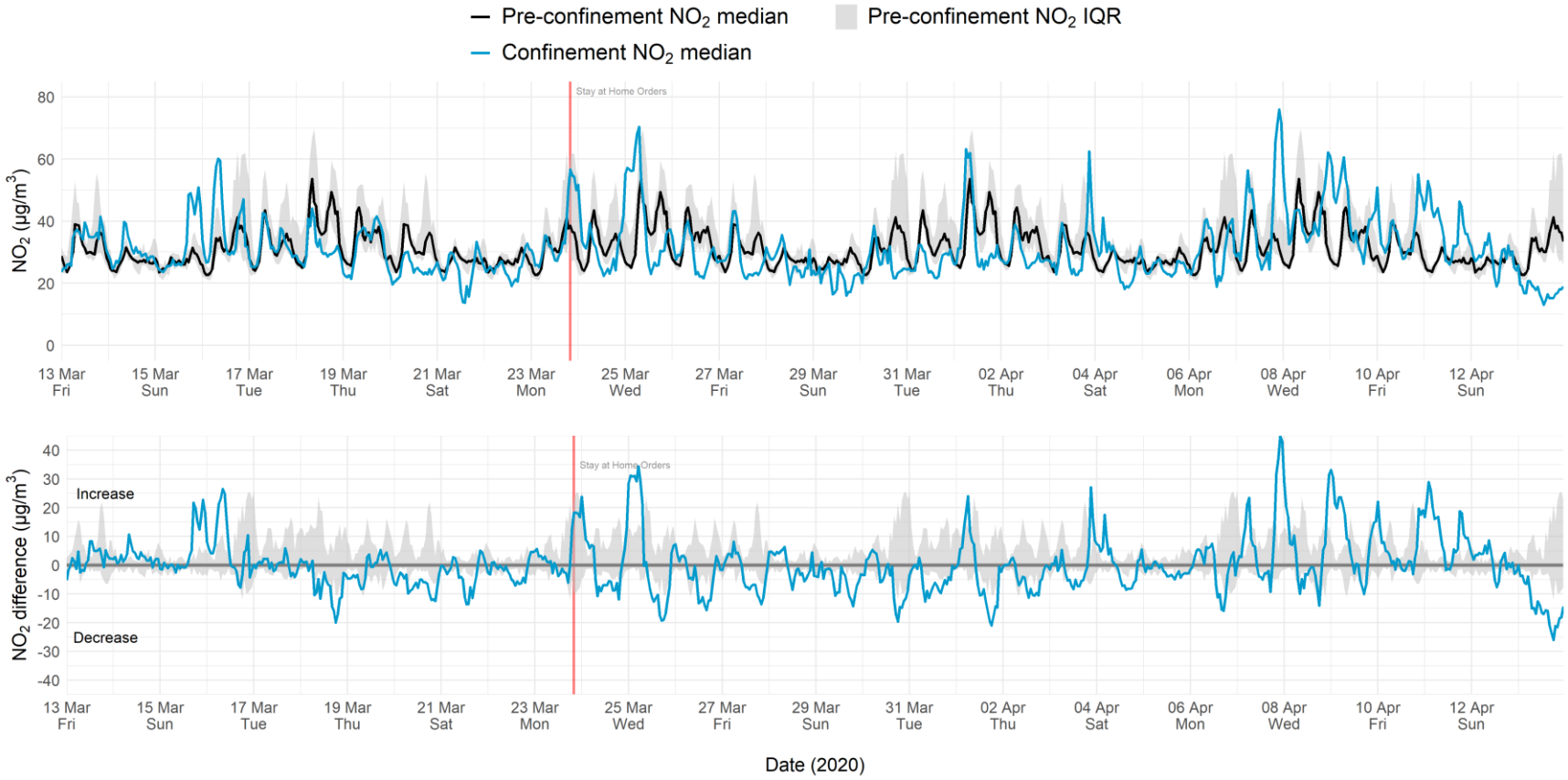
# 1. Borough Level Analysis

Figure 1.1: Comparison of confinement $NO_2$ concentrations to pre-confinement average – in Lambeth and Southwark




Note: *Pre-confinement period: 1st December 2019 - 29th February 2020. Confinement period: 17th March 2020 - 14th April 2020.*

The pattern of $NO_2$ concentrations during the pre-confinement and confinement period in Lambeth & Southwark is similar to that observed for London overall (see our preliminary COVID-19 assessment): the concentrations follow clear diurnal and weekly trends, and the effect of high pollution episodes around the 25th of March and 8th of April is also evident.

However, while the overall pattern is similar, the level of pollution is markedly lower in Lambeth and Southwark, trending largely between 20-40 µg/m3, compared to 30-50 µg/m3 for London overall. It is also clear that the reduction during confinement measured in Lambeth and Southwark is lower in scale than that of London overall. The bottom chart of figure 1.1 (showing increase / decrease in NO2 from the median pre-confinement period) illustrates that while there are clear decreases, these reductions don't drop very far below the historic inter-quartile range, and from early April the scale of these reductions is even lower, while there are more instances of levels above the historic median.

Calculating the average differences between these periods for both London overall, and Lambeth and Southwark gives the following figures.

London:

- **9-17%** drop in $NO_2$ across entire Breathe London network
- **17-24%** drop in $NO_2$ during waking hours (6:00-22:00)

Lambeth and Southwark:

- **2-15%** drop in $NO_2$ across all sites in boroughs
- **10-22%** drop in $NO_2$ during waking hours (6:00-22:00)
- Kerbside & Roadside sites exhibited a **2-17%** drop in $NO_2$
- Urban background sites exhibited a **3-11%** drop in $NO_2$

Of the sites included in the London-wide assessment, 68% are road or kerbside monitors, and 32% are urban background. For Lambeth and Southwark, 54% are road or kerbside monitors, and 46% are urban background. Due to road and kerbside sites being more likely than urban background to be higher in $NO_2$ pollution, this variation in the proportion of monitor locations included in each assessment may be one of the contributing factors to the difference in NO2 reductions observed in each area.

## 2. Monitor Site Level Analysis

Examining change in $NO_2$ concentrations at individual sites in the two boroughs shows there is considerable variation in the scale of the reduction in these different locations, with the greatest % change recorded at Borough High Street in Southwark

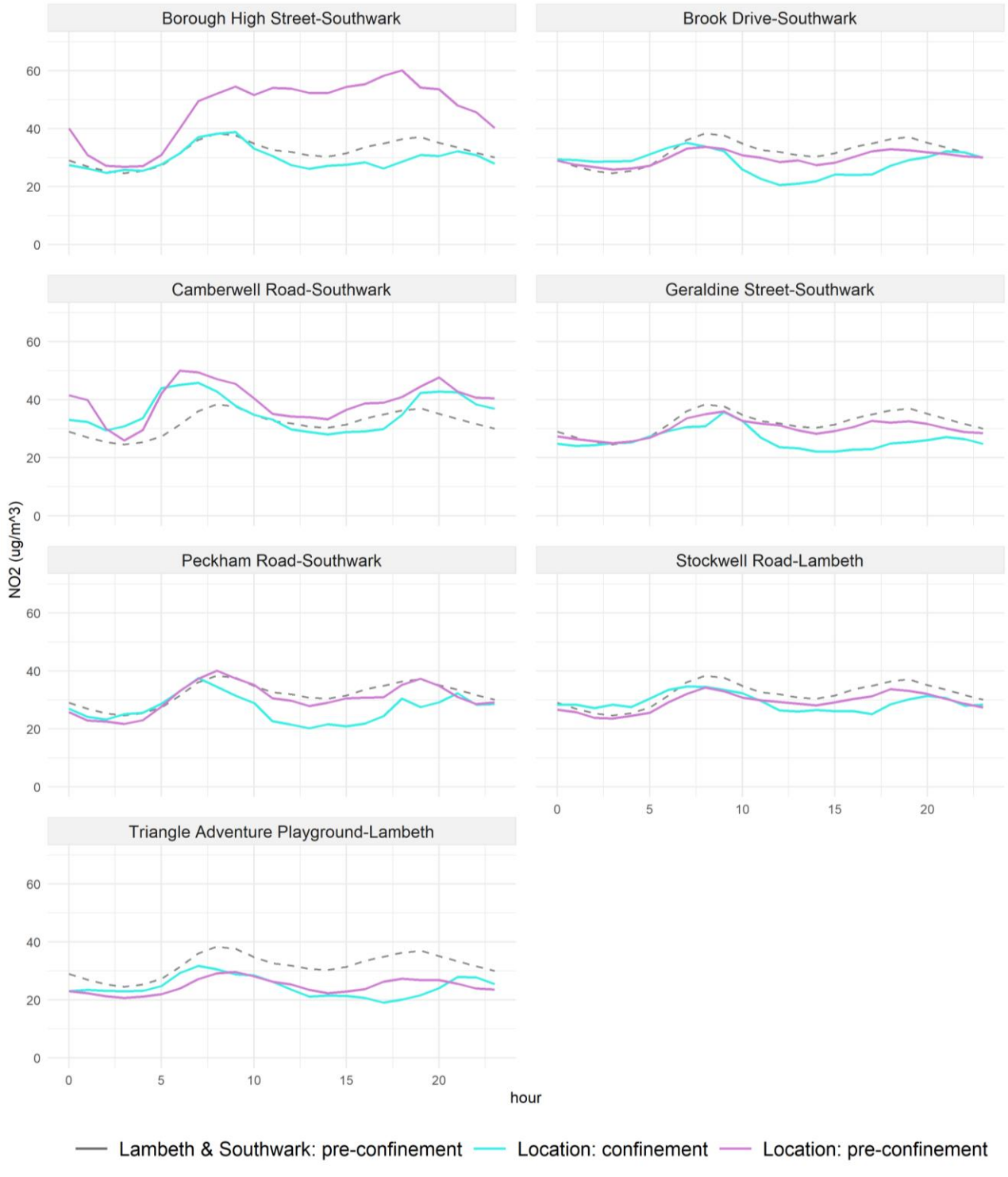
Table 2.1: $NO_2$ reductions at monitoring sites in Lambeth & Southwark

| Location Name | Site Type | % Change (overall) | % Change (daytime hours) |
|---|---|---|---|
| Camberwell Road-Southwark | Kerb or Roadside | -9.4% | -14.2% |
| Brook Drive-Southwark | Urban Background | -10.0% | -16.9% |
| Stockwell Road-Lambeth | Kerb or Roadside | -6.2% | -12.6% |
| Triangle Adventure Playground-Lambeth | Urban Background | -4.1% | -9.7% |
| Geraldine Street-Southwark | Urban Background | -17.4% | -20.9% |
| Borough High Street-Southwark | Kerb or Roadside | -33.0% | -38.7% |
| Peckham Road-Southwark | Urban Background | -16.4% | -23.6% |

Note: *seven sites removed here which don't meet data coverage threshold: Durham Street, Wandsworth Road, Tower Bridge Road, Cornwall Road, Blackfriars Road, Black Horse Court, Lollard Street.*

Plotting the average $NO_2$ throughout the day for the pre-confinement and confinement periods helps illustrate some of these variations.

Figure 2.1: pre-confinement and confinement diurnal comparison at Lambeth & Southwark monitor sites



Here it is clear how some sites - like Camberwell Road - have a clear traffic influence with peaks during the morning and evening rush hour periods, while others – like Triangle Adventure Playground – display a much flatter pattern of concentrations throughout the day. Borough High Street also stands out as a monitoring site with pre-confinement concentrations well above the Lambeth & Southwark average, and is relatively unusual in that these high concentrations remain elevated throughout the day, unlike most other sites which dip around the midday point. For this reason it has been made the subject of some further investigation.

## 3. Spotlight on Borough High Street

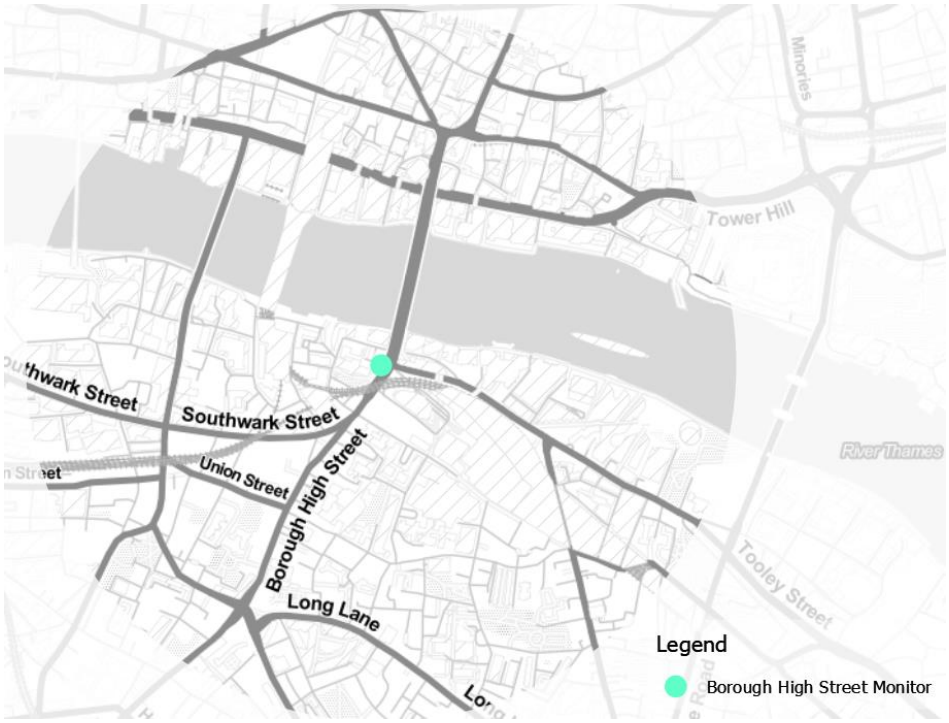
The reduction seen in $NO_2$ concentrations between pre-confinement and confinement periods at this location was well above average levels in Lambeth & Southwark, as well as London overall:

Table 3.1: Average $NO_2$ reductions by area

| | Average $NO_2$ reductions |
|---|---|
| Greater London | 9-17% |
| Lambeth & Southwark | 2-15% |
| Borough High Street* | 33% |

**This monitor is located at the intersection of Tooley Street and Borough High Street. Essential works on London Bridge began 16th March and the accompanying traffic restrictions may have impacted both the mix of vehicles and levels of traffic near the monitoring site at Borough High Street. The reduction observed at Borough High Street could be a combined result of traffic restrictions and COVID-19 restrictions.*

Figure 3.1: Map of Borough high street monitor location




*Map tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under ODbL.*

Figure 2.1 shows that confinement period $NO_2$ levels at Borough High Street only just reach below the pre-confinement average for Lambeth & Southwark, but because normal, pre-confinement levels are usually so elevated at this site this change is a very dramatic reduction. These high concentrations could possibly be due to the area's prominence as a major transport and tourist hub.

Table 3.2: Average $NO_2$ reductions during weekday rush hours by area

| | Morning rush hour (8-11am) | Evening rush hour (5-8pm) |
|---|---|---|
| Greater London | 15% | 33% |
| Lambeth & Southwark | 20% | 30% |
| Borough High Street | 37% | 47% |

## Weekend reductions

Borough High Street also stands out in terms of the reduction measured at the site over the weekend. This may be because of the high levels of transport and commercial activity in the area which normally continue over the weekend.

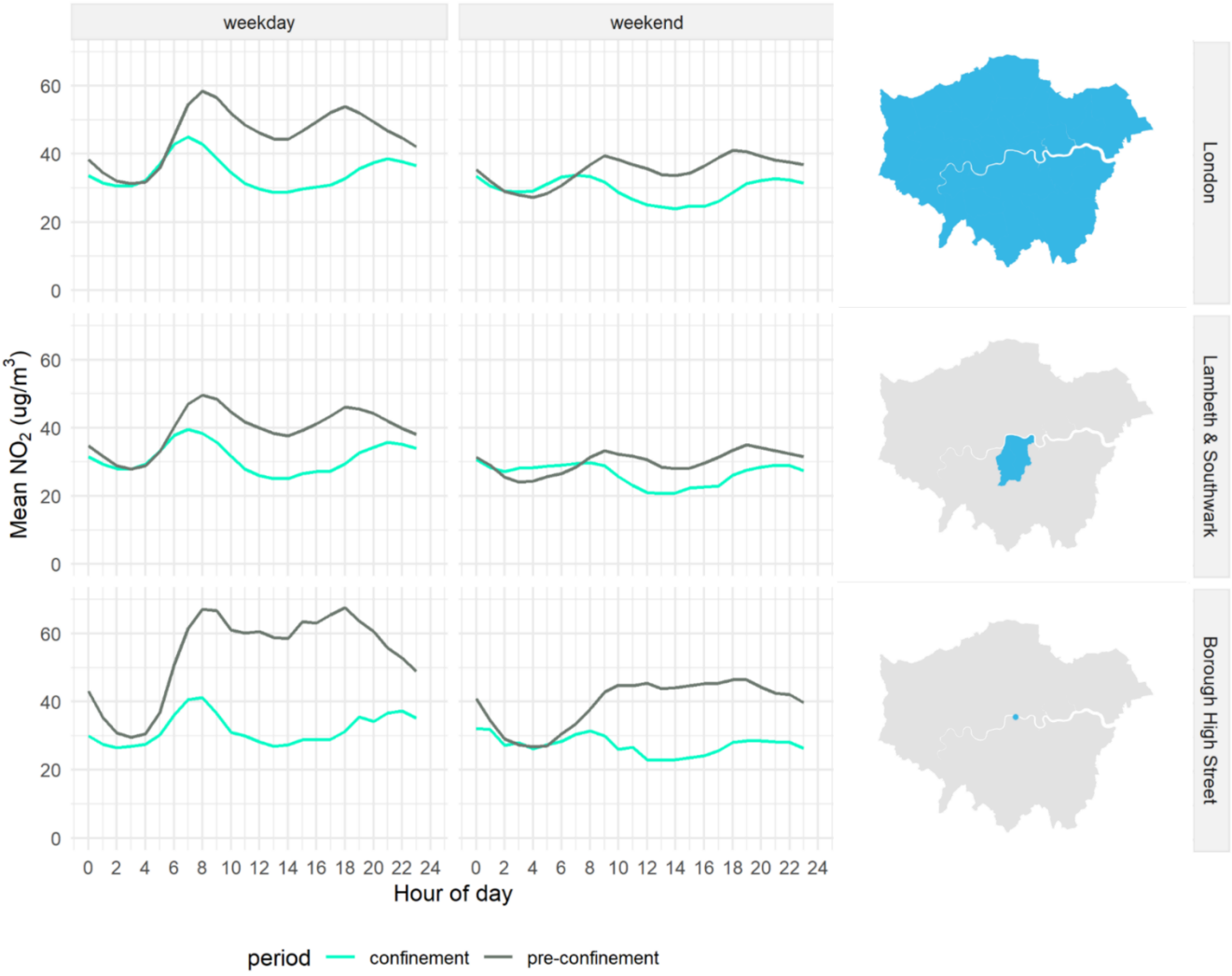
Table 3.3: Average $NO_2$ reductions during day of week by area

| | Weekday | Weekend |
|---|---|---|
| Greater London | 21% | 10% |
| Lambeth & Southwark | 17% | 5% |
| Borough High Street | 36% | 25% |

## Diurnal Patterns

Figure 3.1 shows the weekday and weekend average diurnal pattern of $NO_2$ concentration for the pre-confinement and confinement period at Borough High Street, for Lambeth & Southwark monitors, and all Greater London monitors. Although confinement $NO_2$ concentrations are generally comparable across all areas, the pre-confinement concentrations at Borough High Street during the weekday are dramatically higher, as seen in comparison to other Lambeth & Southwark monitor sites (figure 2.1). They also remain consistently high across the weekend, and it is at this time when the sustained concentration through midday stands in greatest contrast to the dip observed in other areas.

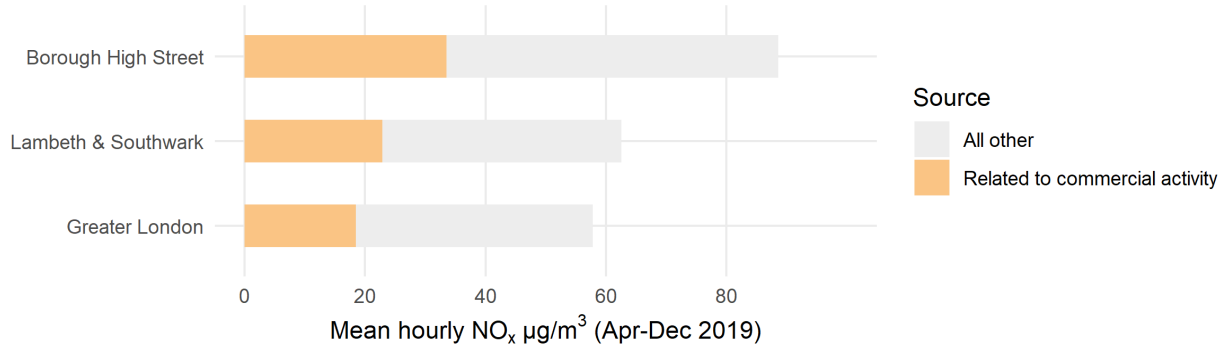
Figure 3.1: Weekday vs weekend diurnal $NO_2$ concentrations by area




## Source Apportionment Observations

The modelled data on source apportionment can shed some light on how much different emission sources contribute to measured concentrations. The source apportionment data reflects typical post-ULEZ 2019 hourly average concentrations of Nitrogen Oxides, $NO_x$ – i.e. the contribution of sources during normal, pre-lockdown conditions. Although we can't say what percent of the lockdown reductions came from specific sources, it can still be useful to examine how normal source contributions relate to the reductions observed in different areas.

Figure 3.2: Mean hourly $NO_x$ concentrations by source type for area monitors




Note: *commercial activity includes the following sources: petrol LGVs, diesel LGVs, HGVs, commercial gas, and commercial other. These average concentrations measurements for Lambeth & Southwark and London should be understood as the mean concentration for monitoring sites in those areas, rather than mean concentrations for the entire area.*

The 2019 data shows that 41% of nitrogen oxides ($NO_x$) pollution at Borough High Street is likely the result of commercial activity – including heating and powering businesses, as well as pollution from delivery vans and large goods vehicles driving to and through the area. The concentrations attributable to these sources are also higher than the average concentrations for those sources at monitoring sites across Greater London and in Lambeth & Southwark:

Table 3.4: Comparison of Borough High St. mean $NO_x$concentrations to areas

| Source type | % higher in comparison to Greater London average | % higher in comparison to Lambeth & Southwark average |
|---|---|---|
| Commercial heating and power | 123% | 45% |
| All road transport | 60% | 54% |
| Goods vehicles | 69% | 48% |

In other words, as a commercial hub, the Borough High Street location is more likely to have had a lot more of its pre-lockdown pollution coming from business-related activity, which suggests there is greater potential to reduce pollution at the Borough High Street location through efforts targeted at businesses.

# Data sources

All measures of $NO_2$ concentrations were made using data from the Breathe London AQMesh network, available as a download from the website, or through the Breathe London API.

Source apportionment observations of $NO_x$ were made using a modelled dataset produced by Breathe London partners Cambridge Environmental Research Consultants, which estimates the concentration of $NO_x$ attributable to 19 different sources at monitoring sites in London. For more information on this dataset refer to the methodology page of the Breathe London website.

# Methods

## Borough level time-series

To estimate the typical NO2 concentrations during the pre-confinement period by weekday and hour (black lines and grey strips in Figure 1.1), it was assumed that the behaviour across the network for the three months between December 2019 and February 2020 would be representative of March behaviour. This is not a perfect assumption because there is seasonal variation in monthly mean NO2 concentrations across the year, with the magnitude varying from year to year. In future updates to this analysis, the uncertainty introduced with this assumption may be evaluated.

The pre-confinement concentrations in Figure 1.1 (black line) were obtained by first determining the median from all network sites for each date and hour and then pooling these network medians for each day-hour combination (i.e., pools of 13 values, collected across the 13-week December-February period). The interquartile range of these distributions is shown as the gray shaded area. Note that the day-hour time series repeats every seven days. This analysis was also conducted using the mean of the pool of network means (instead of the median of medians as described above), to constrain the upper bound in the method.

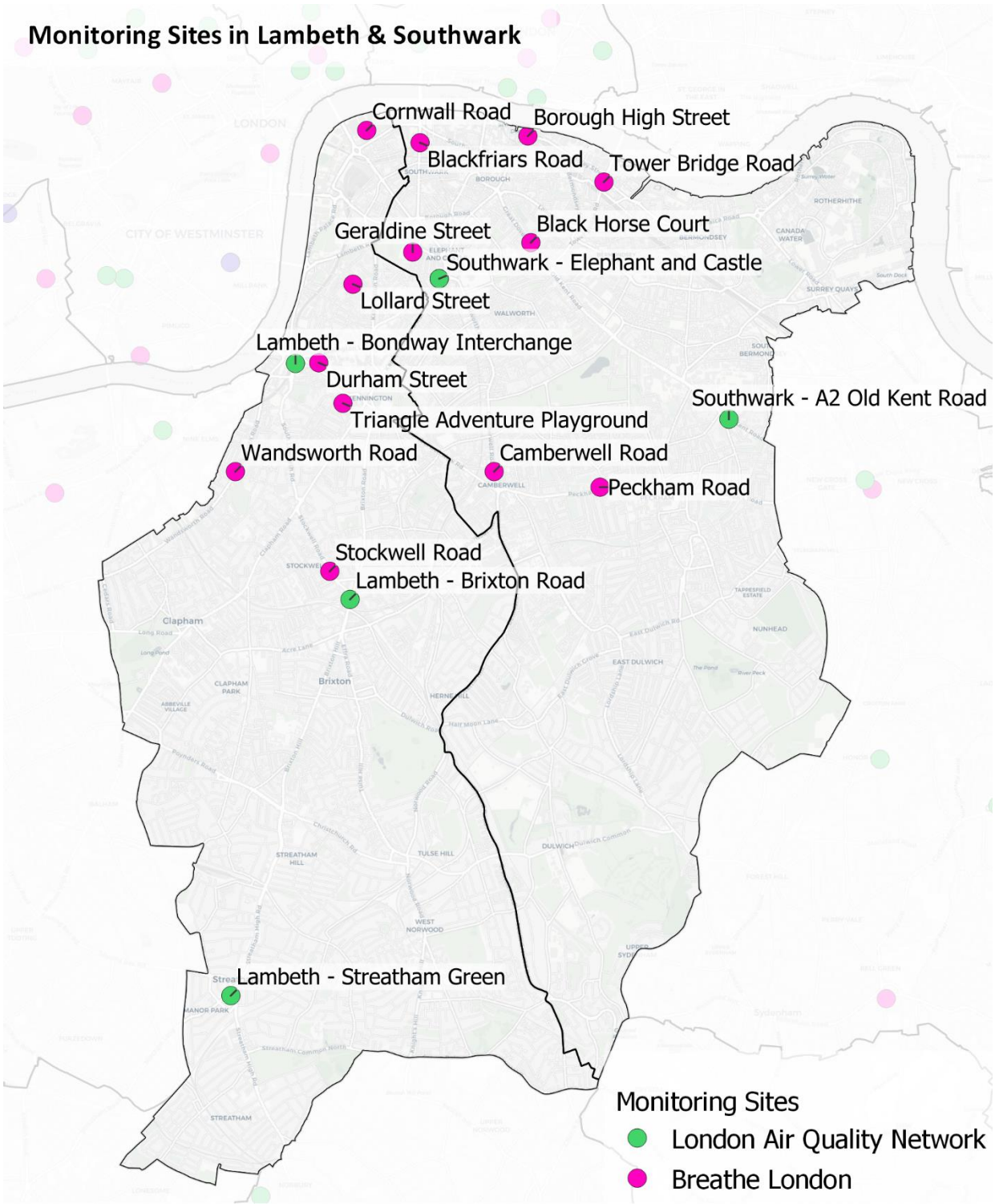
## Site level and area reduction measures

The % change for individual sites in Lambeth & Southwark was calculated by comparing the mean of all measurements at each site during the pre-confinement period and the confinement period. This same method was used to calculate reductions during rush hour times and at weekends by constraining the comparisons to just those time periods, for different areas and individual sites.

The diurnal plots use a similar methodology, by showing the mean $NO_2$ concentration measured in an area at each hour of the day for both pre-confinement and confinement periods.

# Appendix

Figure 6.1: Map of the monitoring sites of different networks in Lambeth & Southwark




*Basemap © OpenStreetMap contributors, © CARTO*

You can view the exact locations of the monitors on the Breathe London map.