South Cambridgeshire District Council

Medium term air quality in Girton

July 2024

Executive Summary

Air quality was monitored in the South Cambridgeshire village of Girton using Zephyr monitoring technology between April 2023 and February 2024 as part of a study into the levels of particulate matter (PM) in the local area as concerns had been raised by local residents. Monitoring was carried out down Northfield Road, Girton, to specifically measure the pollutants PM_{10} and $PM_{2.5}$ as well as nitrogen dioxide (NO_2). Girton was chosen in particular due to residents' concerns about air quality and the effects that wood burning fires may be having on residents. It was found that concentrations of the main pollutants, nitrogen dioxide and particulate matter, were comfortably below the national objectives for annual mean concentrations and there were no exceedances of the short-term objectives, representing good air quality. This is in line with long-term concentrations measured across the South Cambridgeshire district and reflects the rural nature of the area. South Cambridgeshire District Council and Cambridge City Council have recently created a joint air quality strategy which sets ambitious targets for air quality based on the WHO (World Health Organization) standards.

Data from this study was on average below WHO guidelines for PM_{10}, but slightly above the guideline values for NO_2, and $PM_{2.5}$.

South Cambridgeshire residents can help to improve local air quality through actions such as reducing the idling of car engines, increasing walking and cycling, reducing domestic burning and only burning Woodsure Ready to Burn approved products were possible. This report can be read alongside the yearly Air Quality Annual Status Report (ASR) and the reports from other localised studies, which are available on our website.

Glossary

Annualisation – a calculation process used to estimate an average concentration for a full year from a shorter period.

Annual mean – the average concentration across a full calendar year.

AQMA – Air Quality Management Area – an area where air pollutant concentrations exceed or are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives.

Continuous monitor/monitoring station – instruments which measure air pollution all the time and therefore can give a concentration attributed to a specific time.

Diffusion tube – small plastic tube containing a metal mesh which is coated with a chemical that absorbs nitrogen dioxide. This is exposed to the air in a fixed location for a known amount of time, usually a month, and then sent to a laboratory for analysis. This provides an average concentration for the time it is exposed.

Nitrogen dioxide (NO_2) – a gas predominantly formed following the burning of fossil fuels, which can cause irritation of the airways and exacerbate symptoms of other conditions.

Particulate matter ($PM_{2.5}$ and PM_{10}) – the number refers to the size of the particulates in micrometres (one millionth of a metre) – a mix of solid particles and liquid droplets of various sizes and composition, the smallest of which can get into the blood and be transported around the body causing conditions such as heart and lung disease.

Real-time monitoring – see also continuous monitoring – monitoring which uses an instrument that takes readings at regular intervals (e.g. every 10 seconds or every hour) and therefore can give a concentration attributed to a specific time, typically with results available in real-time via remote connectivity

WHO – World Health Organization**.**

$\mu g/m^3$ – micrograms per cubic metre, the standard units of measurement of air pollutants including nitrogen dioxide and particulate matter.

Zephyr – a type of relatively compact and lightweight air pollution sensor that measures harmful gases and particle matter in real-time.

Update on Zephyr monitor in Girton

Introduction

Purpose of this report

This is a report to provide information on the medium-term air quality monitoring study undertaken in the South Cambridgeshire village of Girton using Zephyr monitoring technology. Monitoring was carried out in the period April 2023 to February 2024. The study was designed to be a medium-term study, monitoring air quality in the north residential cluster of Girton as part of South Cambridgeshire District Council's studies into air quality and the levels of particulate matter across the district. It also serves to create additional local awareness of air quality in our area and enable people to make informed choices about how they can improve air quality in their locality.

Air Quality in South Cambridgeshire

South Cambridgeshire is a rural district which enjoys generally good air quality, with both short-term and long-term pollution levels below the national objectives at all monitored locations. As part of our joint strategy with Cambridge City we are now striving to meet WHO air quality guideline values which are more stringent than that of the national objectives. This means we benefit from cleaner air to breathe and less pollution related health problems.

The area is undergoing significant growth with major developments to keep up with the increasing demand for housing, including Northstowe (10,000 dwellings), Waterbeach Barracks (6500 dwellings), Bourn Airfield (3500 dwellings) and Cambourne West (2350 dwellings), shown in Figure 1. As well as a large amount of future growth as announced by the governments Case for Cambridge[1] initiative.

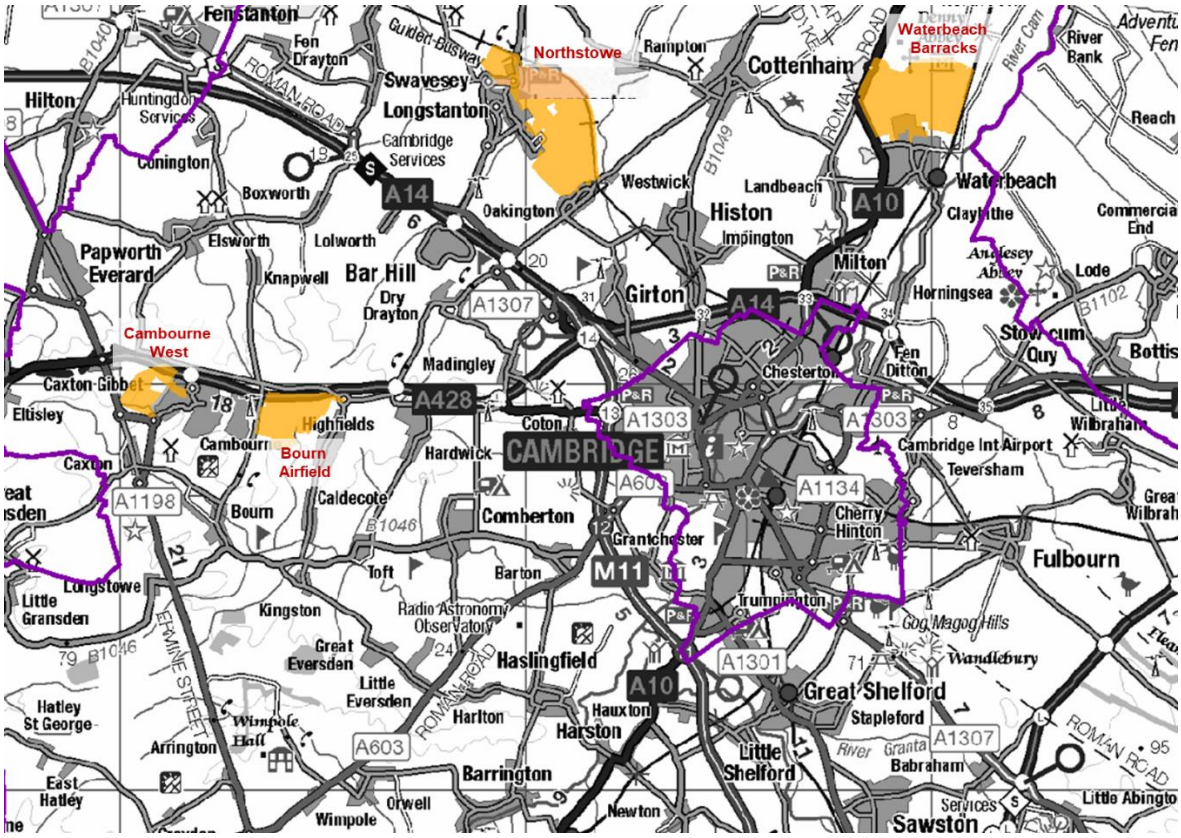
Air quality impacts in the district related to NO_2 are mostly in a few clusters including around the A14. We are also currently investigating the impacts that other busy

[1] The Case for Cambridge https://www.gov.uk/government/publications/the-case-for-cambridge

roads running through the district may be having on air quality including the A1307 (Linton) and A1198 (Kneesworth).

However, PM_{10} and $PM_{2.5}$ are more spread out across the district and this study is the first of several we have planned to better understand the spread of particulate matter build up in the area.

Figure 1 – Locations of Major Development sites in South Cambridgeshire



Air quality is an important topic as air pollution impacts our health, particularly effecting the most vulnerable, including children and those with underlying conditions. Air quality is monitored across the district using a network of diffusion tubes and continuous monitoring stations, which provide accurate air quality measurements in real-time, in addition to the Zephyr monitors used for short to medium term monitoring. For more information and detail on the importance of air quality and air quality in South Cambridgeshire, please refer to Appendix 1 – Air Quality Frequently Asked Questions or visit our website. Additionally, ideas on how

anyone can play a role in improving local air quality can be found in Appendix 2 – How to get Involved with Local Air Quality.

The 'Zephyr' Air Quality Sensor

Zephyr monitors are compact and lightweight air pollution sensors that measure harmful gases and particulates in real-time, including the main pollutants of concern (NO_2 PM_{10} and $PM_{2.5}$ particulate matter). Zephyrs can run off internal batteries or can be powered by a solar panel and can therefore be fixed in a specific location, most commonly a lamp post, or used as a mobile monitor. The sensors provide detailed air quality measurements in real-time to help identify pollution hotspots at a localised level, for example busy junctions. Other potential studies include investigating air quality around schools and looking into the impacts of wood burning stoves. Zephyr sensors can be used in isolation individually or deployed as a network of sensors across a wider area to build up a more detailed picture.[2]

The data from a Zephyr sensor cannot be treated with the same confidence as that from one of our continuous monitor stations, where the data is 'ratified' after checks, however it has been shown to provide accurate indicative measurements and is therefore appropriate for a wide range of studies, including this.

Monitoring Location

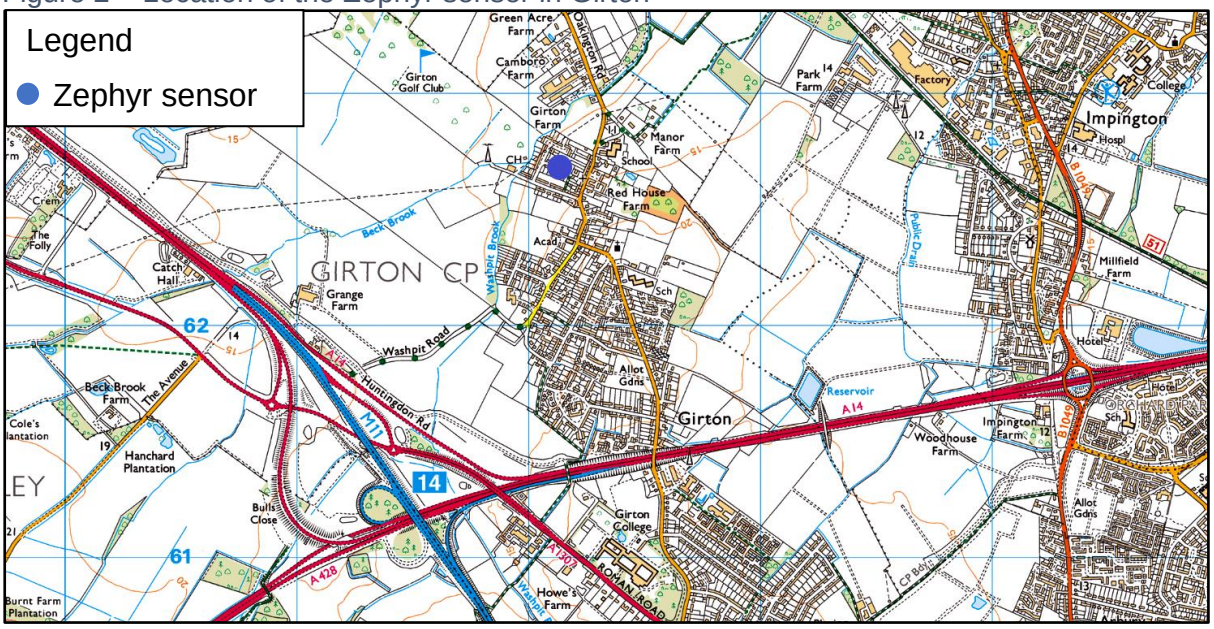
Girton was chosen due to residents' concerns about the potential impact of particulate matter near their homes. The major reason for this shift from studying pollution outside schools, as has been done in previous studies, to particulate matter is due to residents' concerns about the amount of PM in the district and the health considerations of this.

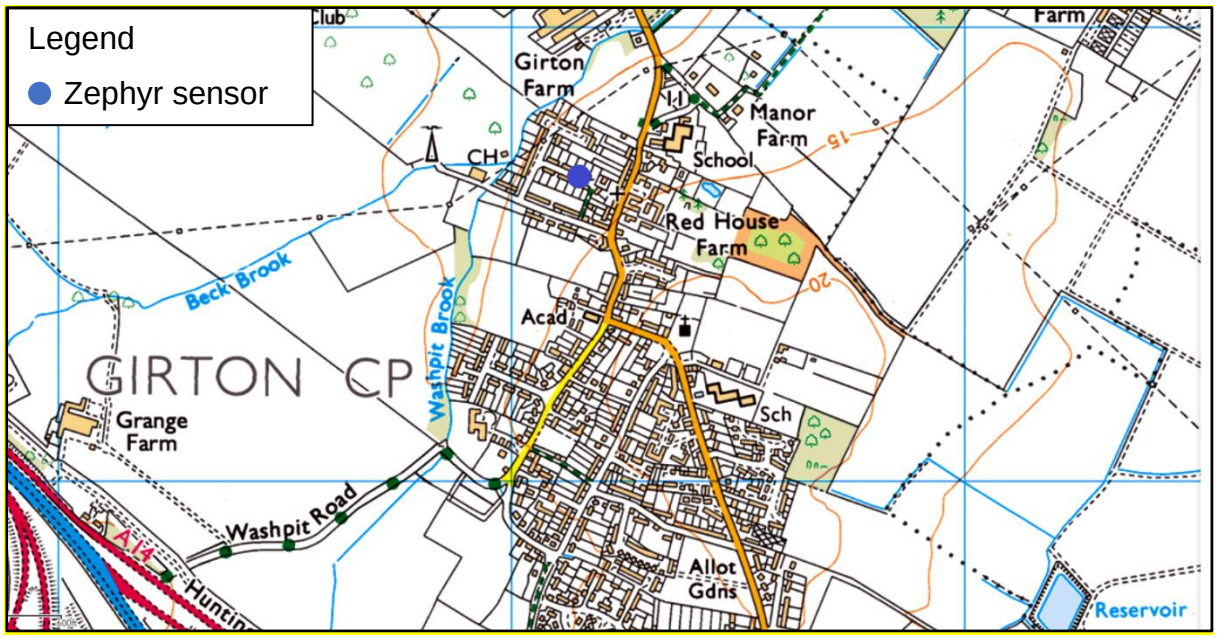
The monitor was located on a lamp post proximal to residential homes to ensure we could get accurate data regarding the amount of PM_{10} and $PM_{2.5}$ that was being experienced. The Zephyr measured the main pollutants of concern, nitrogen dioxide

[2] https://www.earthsense.co.uk/zephyr

(NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The location of the Zephyr can be seen on Figure 2, below.

Figure 2 – Location of the Zephyr sensor in Girton





Monitoring Data and Comparison with Objectives

The average monthly concentrations measured in the period April 2023 to March 2024 are shown in Table 1 below, with the UK annual mean objective and WHO guidelines shown for comparison. The exact date range was from 1st April 2023 – 29th February 2024, which followed an initial 'settling in' period of the instrument in March. This data is also represented in

Figure 3.

Table 1 – Zephyr Air Quality data – monthly average concentrations

	Pollutant monthly average concentration / µg/m^3		
Month	NO_2	PM_{10}	$PM_{2.5}$
April 23	10.99	16.5	10.5
May 23	10.2	11.4	7.1
June 23	12.7	11.8	8.1
July 23	12.3	6.6	4.2
August 23	11.4	6.7	4.2
September 23	11.4	12.28	7.8
October 23	10.2	9.5	5.6
November 23	8.8	10.7	5.7
December 23	9.4	6.5	3.5
January 24	11.1	10.8	6.1
February 24	9.2	7.6	3.8
UK Objective (annual mean)	40	40	25†
WHO Guidelines (annual mean)	10	15	5

†not part of the Local Air Quality Management (LAQM) requirements

Figure 3 – Zephyr Air Quality data – monthly average concentrations and national annual mean objective

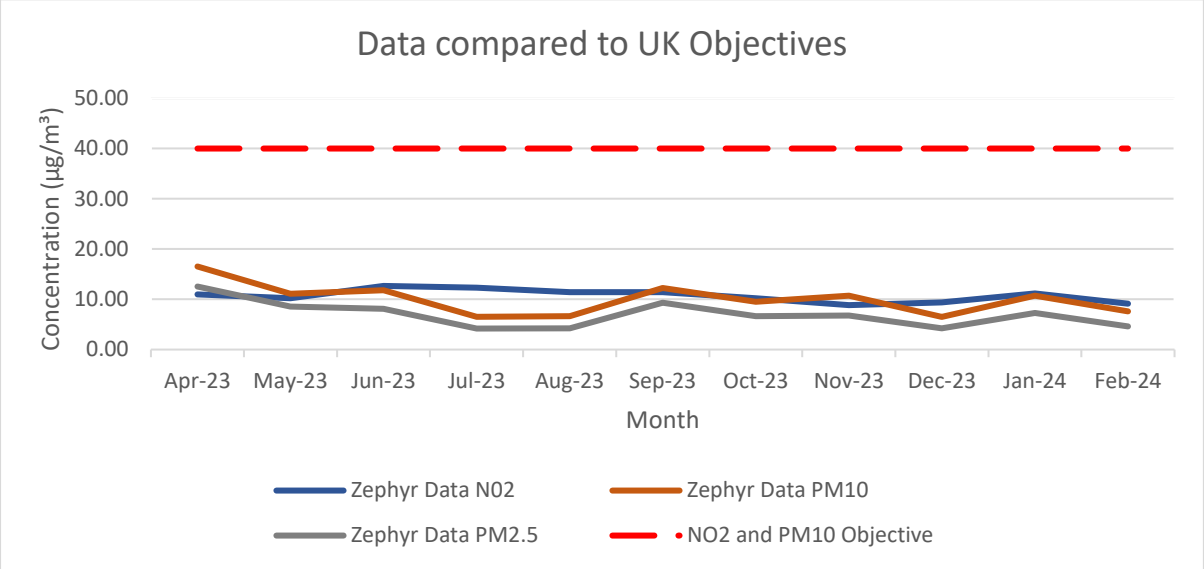
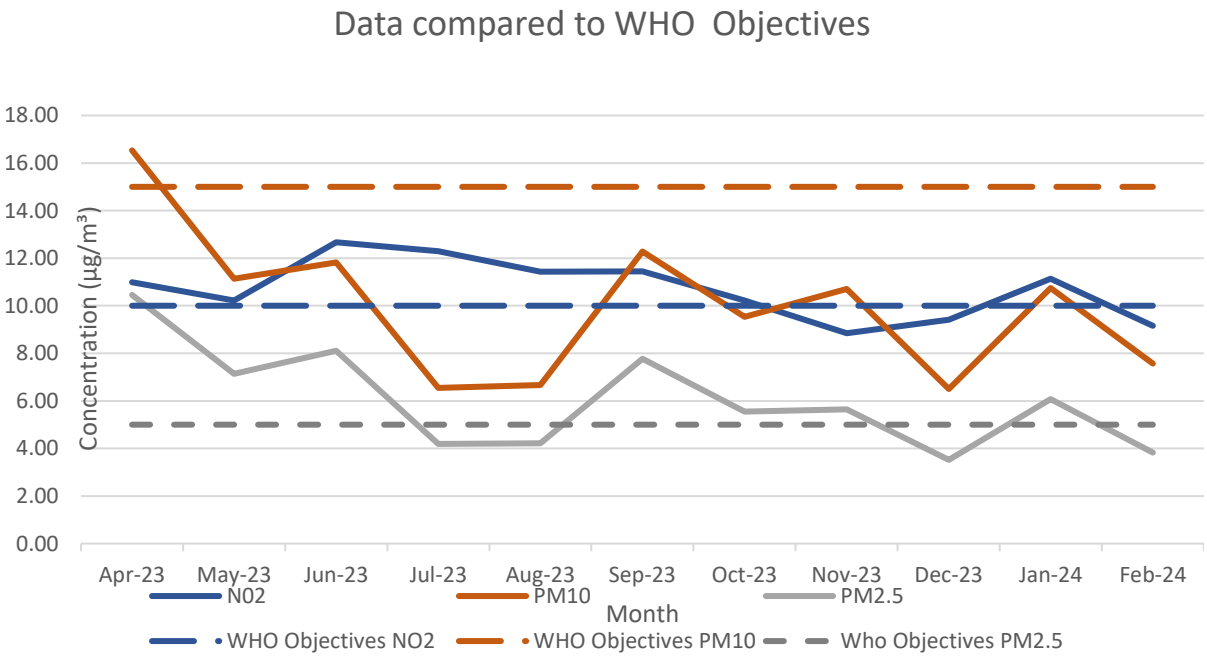


Figure 4 – Zephyr Air Quality data – monthly average concentrations and WHO national annual objectives



The data recorded in Girton was also compared to that recorded in the same monitoring period by other local monitoring stations for each pollutant. As shown in figure 5, below, the data and trends recorded by the Girton Zephyr are mostly consistent with those seen at other monitoring locations. In September and particularly October there is some drift in the data implying the pollution in Girton at this time was lower than other areas. What is causing this drift is unclear. However overall the data is fairly consistent with other local sites and there can be a reasonably degree of confidence in the data collected by the Zephyr .

Figure 5 – Comparison of Girton Zephyr data to automatic monitoring sites in South Cambridgeshire for nitrogen dioxide

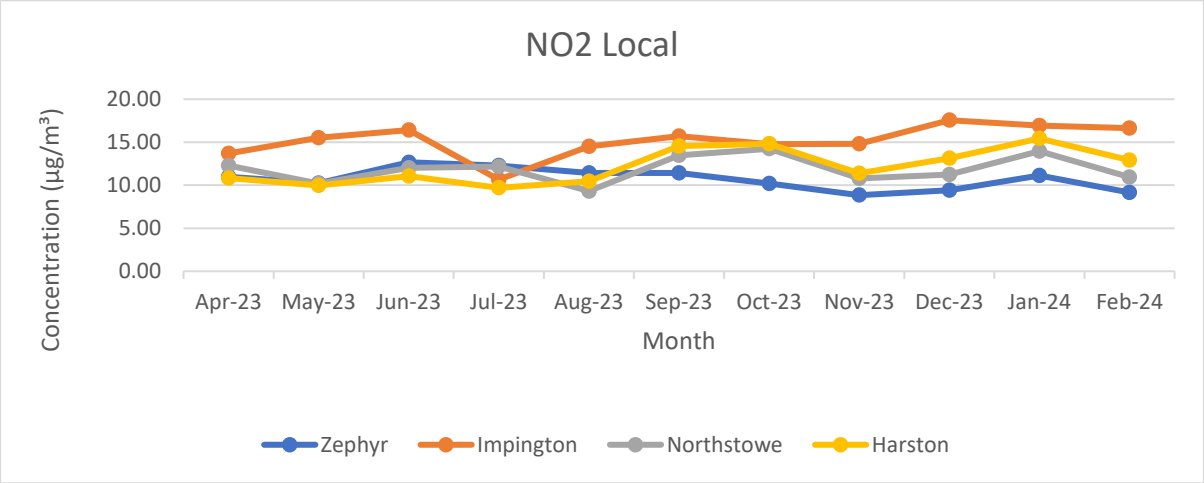
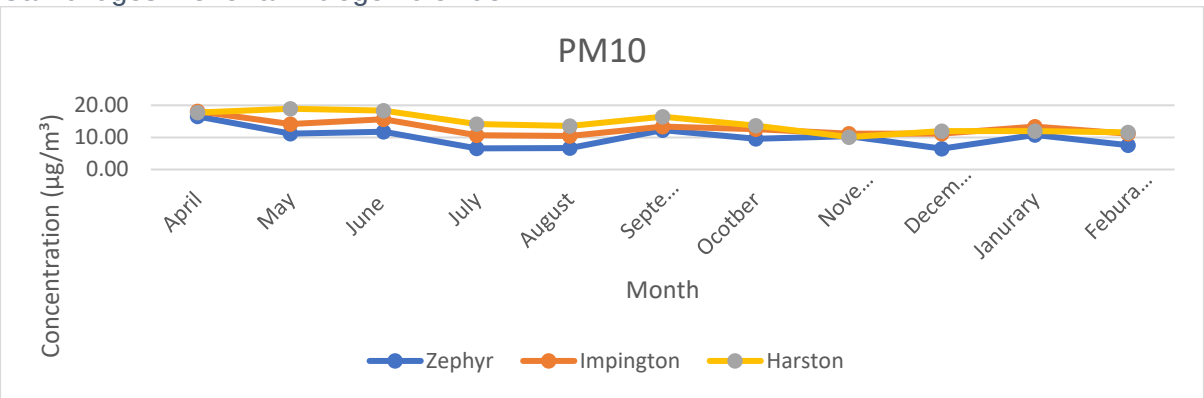


Figure 6 – Comparison of Girton Zephyr data to automatic monitoring sites in South Cambridgeshire for all nitrogen dioxide



In addition, the average concentrations of each pollutant for the whole period April 23 – February 24 were calculated and then ‘annualised’ to give estimated annual mean concentrations to allow for a better comparison to the annual mean objectives.

Annualisation is a calculation process used to estimate an average concentration for a full year from a shorter period, such as the approximately 11 months in this study. This is done to avoid the annual average being influenced by short-term events or seasonal changes, such as one day of high pollution like bonfire night, or pollution concentrations often being higher in the winter than the summer. The data was annualised using 2023 and 2024 data from a range of continuous monitoring background sites and is shown in Table 2, below. Full annualisation details are available in Appendix 3 – Annualisation of short-term data.

Table 2 – Zephyr Air Quality Data – annualised annual mean concentrations – 2021 annual mean

	Pollutant average concentration / µg/m^3		
	NO_2	PM_{10}	$PM_{2.5}$
Measured data average April 23- February 24	10.69	9.97	6.05
Annualisation factor	1.03	1.03	1.02
Annualised annual mean – Girton Zephyr	11.01	10.17	6.23
UK Objective (annual mean)	40	40	25*
WHO Guidelines (annual mean)	10	15	5

*not part of the Local Air Quality Management (LAQM) requirements

As shown in Table 1 and Table 2, the long-term annual mean concentrations of the main pollutants of concern at the Girton Zephyr are significantly below the national objectives for NO_2 and PM_{10}, indicating good air quality. The PM_{10} data would imply that we are already exceeding the ambitious WHO standards. Whereas the NO_2 and $PM_{2.5}$ concentration were just above the WHO guidelines, although it remains well below the current UK objectives.

Typically, $PM_{2.5}$ is a pollutant that is more regional than local as it can travel long distances suspended in the air. Therefore, its concentration is often more impacted

by national and regional sources and less by local factors than other pollutants (such as nitrogen dioxide).

The Zephyr also allows measurements of the short-term concentrations of pollutants, which can be compared to short-term objectives. These are presented and compared to the national objectives in Table 3, below. The short-term objectives are presented as hourly/daily concentrations that should not be exceeded more than a certain number of times in a year. There is currently no short-term objective for $PM_{2.5}$.

Table 3 – Zephyr Air Quality data – short-term average concentrations

Month	Number of exceedances of short-term UK objectives	
	NO_2 1-hour mean	PM_{10} 24-hour mean
April	0	0
May	0	0
June	0	0
July	0	0
August	0	0
September	0	0
October	0	0
November	0	0

December	0	0
January	0	0
February	0	0
Objective	200 µg/m^3*	50 µg/m^3**

*Not to be exceeded more than 18 times a year

**Not to be exceeded more than 35 times per year

As shown in Table 3, there were no exceedances of the short-term objectives for NO_2 or PM_{10}. The relevant maximum short-term concentrations of the pollutants were also recorded. For NO_2 the maximum 1-hour concentration measured during the ten-month period was 61.81 µg/m^3, which occurred during the evening of the 24th of February 2024. It is unclear as to why this dataset is highest, from investigating this period specifically, the pollution levels of the 24th of February showed that there was an unusual spike in NO_2 concentrations also picked up by our other monitors. This would imply that the zephyr was working correctly. This unusually high level of NO_2 in the evening that day lasted for around 3 hours before dropping back to normal levels. This is well under the 200 µg/m^3 threshold and was the only 1-hour concentration above 60 µg/m^3 recorded. For PM_{10}, the maximum 24-hour concentration recorded was 32.56 µg/m^3, on the 7th September, which is below the 50 µg/m^3 objective. This was at the end of a spell of warm weather and high pressure in England at the beginning of September and is likely a reflection that high pressure leads to still air, which allows pollutant levels to build up without being dispersed by wind or rain, leading to higher concentrations.

Short term trends can be reviewed to see if high levels of pollution being recorded at a monitor are localised or regional. Hourly averages from the Zephyrs can be compared to the hourly readings from ratified continuous monitors and other Zephyrs to identify localised or regional trends.

$PM_{2.5}$ data from five sites was analysed between the 1st and 5th of March 2024. Although outside of the initial time period for our study, the Zephyr had still been in place waiting for relocation when the following data was recorded. The $PM_{2.5}$ data was selected for this analysis as it is the primary pollutant associated with domestic burning which was the reason for the assessment. This analysis included three

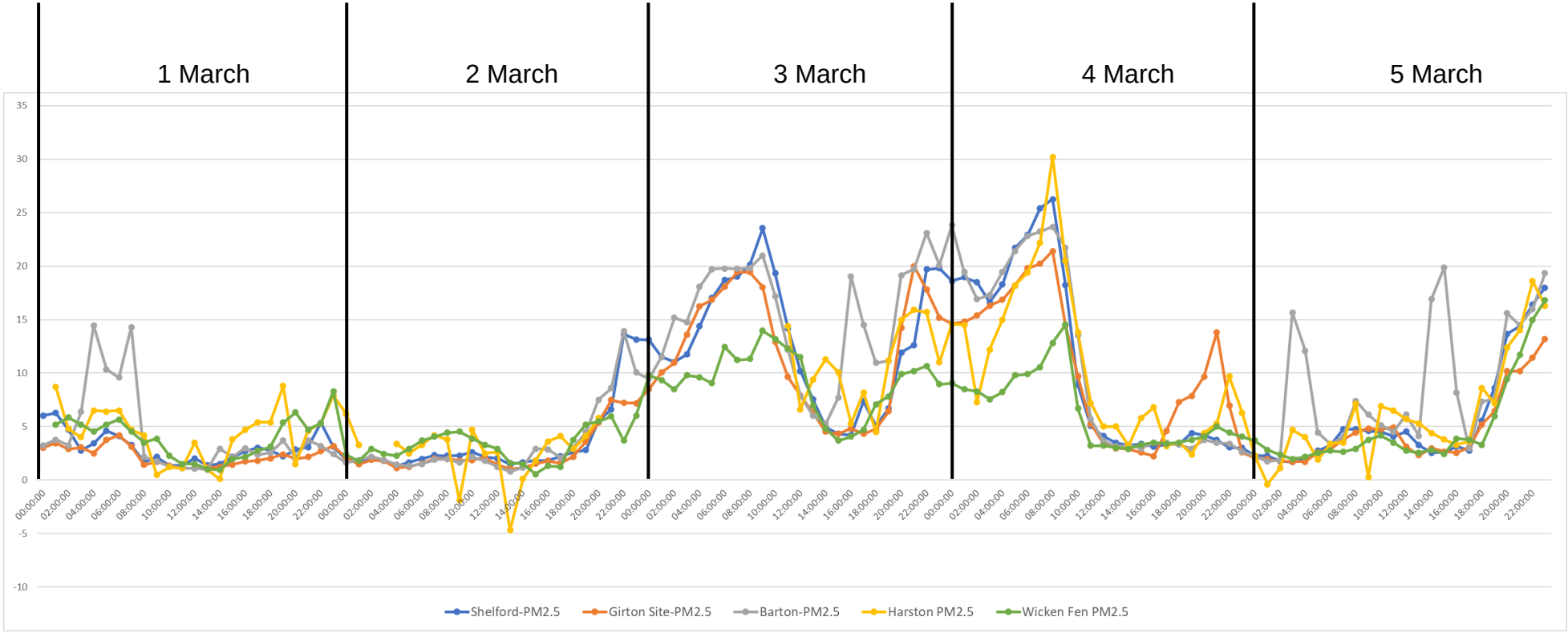
Zephyr monitors including Girton, and sites within Shelford (approximately 12km to the south of Girton) Barton (approximately 7km to the south), as well as two continuous monitors, one located adjacent to the busy A10 road in Harston (approximately 12km to the south) and a Defra background monitor remote from any houses or roads in Wicken Fen (approximately 15km to the northeast).

The results, shown on Figure 7 below, show that all sites followed a very similar trend throughout the study period, with lower and higher pollution levels being seen at all sites at the same times regardless of whether they were in a village, adjacent to a busy road (Harston) or away from all infrastructure (Wicken Fen). This provides confidence that the PM results from the Zephyr are accurate.

However, it is possible to pick out some localised events where a short-term pollution ‘spike’ is seen at one location but not the others. It is possible that these localised events are caused by domestic burning, however, other localised factors may be the cause of these short-term pollution spikes. During this period a single localised event is seen at the Girton monitoring site, during the evening of Monday 4th March.

As trends generally follow a pattern across reasonably large distances it can be concluded that PM pollution is dominated by regional factors, however, localised events, such as domestic burning, can cause short-term spikes as well as contributing to regional background values.

Figure 7: $PM_{2.5}$ Concentrations at selected sites between 1st and 5th March 2024



Summary

The data measured by the Zephyr real-time monitor in the period April 2023 – February 2024 shows that the air quality in Girton remains good, with estimated annual mean concentrations (as well as the measured monthly averages) of the main pollutants of concern well below the national objectives. There were no exceedances of the short-term national objectives.

There were occasional rises in particulates which were most likely due to the burning of solid fuels in the local area. However, these rises were short term and were unlikely to have any significant impacts on human health.

Given the data collected there is little evidence to suggest that any smoke produced is having a significant impact on particulates in the air. The PM2.5 data mirrors other local monitors suggesting that any localised burning that has occurred has a minimal impact on local air quality.

Results were under the WHO objectives with regard to PM_{10}, although they were slightly above these for NO_2 and $PM_{2.5}$. It is worth noting that 99% of the world's population breathe air that exceeds the WHO $PM_{2.5}$ guideline values.

The data from the Zephyr was generally consistent with that from the rest of the monitoring sites in the district during the monitoring period, which provides confidence in the instrument. This also matches the general patterns seen across the South Cambridgeshire district of good air quality. Assessment of the hourly data shows that $PM_{2.5}$ pollution is dominated by regional events with localised factors causing spikes in pollution and contributing to background levels.

However, due to the importance of air quality and its links to health, it remains important to both monitor air quality across the district and take actions to improve air quality in our area. Ideas on how to play a role in improving local air quality can be found in Appendix 2 – How to get Involved with Local Air Quality.

Appendix 1 – Air Quality Frequently Asked Questions

Why is air quality important?

There are a number of reasons air quality is important. In particular, polluted air is the biggest environmental threat to health in the UK. It is linked to up to 36,000 deaths per year from long-term exposure[3]. The main impacts of poor air quality are contributing to heart and lung conditions, but air quality has also been linked to a wide range of issues[4]. Air pollution also particularly effects the most vulnerable, including children and older people and those with existing lung and heart conditions. Air quality also strongly links to climate change, as many of the causes of the issues are the same, such as the burning of fossil fuels. This means that actions taken to improve air quality also helps prevent climate change.

How does the Council monitor air quality?

South Cambridgeshire District Council operates a monitoring network of over 30 locations across the district, made up of diffusion tubes and three continuous monitoring sites, which measure air quality accurately in real-time. This existing monitoring network allows the long-term monitoring of trends and changes in air quality across the district. Live data from the three continuous monitoring stations are available at https://scambs-airquality.ricardo-aea.com/. In addition, the Council has purchased three Zephyr air quality sensors which provide real-time measurements for the main pollutants of concern from a single monitor. These can be used for shorter-term monitoring to identify hotspots of pollution or be used in a range of targeted studies to complement our existing monitoring network. The first of these instruments was installed in Harston, with subsequent monitors installed in Cambourne, Northstowe, Histon and most recently Swavesey.

[3] Defra. Air quality appraisal: damage cost guidance, July 2020
[4] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

What else does the Council do around air quality?

As well as monitoring air quality, the Council acts to improve air quality through its Green to the Core focus, including an air quality strategy designed to go beyond simply meeting the national objectives, Zero Carbon Community Grants to fund community initiatives to improve sustainability, such as encouraging and enabling cycling which in turn helps air quality, and by considering air quality during the planning process[5,6]. Ideas on how anyone can play a role in improving local air quality can be found in Appendix 2 – How to get Involved with Local Air Quality.

What are the main pollutants of concern?

The main pollutants of concern are:

- Nitrogen Dioxide (NO_2) – a gas predominantly formed following the burning of fossil fuels, which can cause irritation of the airways and exacerbate symptoms of other conditions
- Particulate Matter (PM_{10} and $PM_{2.5}$), where the number refers to the size of the particulates in micrometres – a mix of solid particles and liquid droplets of various sizes and composition, the smallest of which can get into the blood and be transported around the body[7]

What are the air quality objectives?

For NO_2 and PM_{10} national objective levels have been set which must be achieved by local authorities, otherwise an Air Quality Management Area (AQMA) must be declared for the objective which is being exceeded. Objectives have been set for both long-term concentrations (measured as annual means) and short-term concentrations (hourly means for NO_2 and daily means for PM_{10}). South Cambridgeshire District Council currently has one AQMA, along the A14 between Bar Hill and Milton, which was declared in 2008 for NO_2 annual mean and PM_{10} 24-

[5] Being green to our core https://www.scambs.gov.uk/your-council-and-democracy/performance-and-plans/our-business-plan/
[6] Zero Carbon Communities Grant https://www.scambs.gov.uk/community-development/grants/zero-carbon-communities-grant/.
[7] Defra, Clean Air Strategy, 2019

hour mean. This AQMA was revoked in early 2022 due to sustained compliance with the relevant objectives in line with Defra guidance and the Council's constitution. The Air Quality Objectives applicable to local authorities through the Local Air Quality Management (LAQM) requirements in England are set out in Table 4. In addition, local authorities are expected to work towards reducing emissions and concentrations of $PM_{2.5}$ (particulate matter with a diameter of 2.5 µm or less), although there is currently no legal objective for local authorities.

Table 4 – Air Quality Objectives in England

Pollutant	Air Quality Objective – Concentration	Air Quality Objective – Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
Nitrogen Dioxide (NO_2)	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
Particulate Matter (PM_{10})	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO_2)	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO_2)	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

Air Quality Objectives WHO

Pollutant	Air Quality Objective – Concentration	Air Quality Objective – Measured as
Nitrogen Dioxide (NO_2)	25 µg/m^3 not to be exceeded more than 4 days per year	24hour mean
Nitrogen Dioxide (NO_2)	10 µg/m^3	Annual mean
Particulate Matter (PM_{10})	45 µg/m^3 not to be exceeded more than 4 days per year	24-hour mean
Particulate Matter (PM_{10})	15 µg/m^3	Annual mean
Particulate Matter ($PM_{2.5}$)	5 µg/m^3	Annual Mean
Particulate Matter ($PM_{2.5}$)	15 µg/m^3, not to be exceeded more than 4 days per year	24-hour mean
Sulphur Dioxide (SO_2)	25 µg/m^3, not to be exceeded more than 4 days per year	24-hour mean

If air pollution is a result of vehicles utilising the A14, how can local residents change this?

There are a number of way local residents can have an impact on air quality through everyday actions, such as those mentioned in **Error! Not a valid bookmark self-reference.**. Many of these are very small changes that can add up to a big impact.

Appendix 2 – How to get Involved with Local Air Quality

Annual reports and details on air quality monitoring are available on our website, https://www.scambs.gov.uk/environment/pollution/air-pollution/local-air-quality-management/, and you can share your views via our email address, air.quality@scambs.gov.uk.

Although air quality in the South Cambridgeshire District is generally good, with concentrations below the objectives, there are actions we can all take to improve it further. Ways you can help to improve air quality in South Cambs include:

- Minimise car use wherever possible:
    - Avoid using your car for short trips (under 2 miles) - short trips are very polluting as modern engines needs to reach a very high temperature to work efficiently; on short trips it won't reach that temperature.
    - For short journeys try cycling or walking more often – this helps you stay healthy and saves you money in fuels costs.
    - For longer journeys consider public transport options.
    - Use journey-planning apps such as MyBusTrip or MotionMap for travel by bus, train, walking and cycling.
- Switch it off – don't leave your car engine idling if you are stationary e.g. waiting to pick someone up, in a traffic jam or waiting at level crossings.
- When driving, use techniques that help you use less fuel, like driving more slowly and smoothly.
    - You could use 10% less fuel by following the tips on the AA website http://www.theaa.com/motoring_advice/fuels-and-environment/drive-smart.html.
    - Like switching your engine off when stationary, this will not only reduce your emissions of air pollution but will save fuel and therefore money too!
- Consider making your next vehicle an electric vehicle.
- Join a car club or car-share regularly.
- Consider working at home where possible – the first Covid-19 lockdown showed widespread improvements in the air quality as the amount people travelled reduced.

- Use less energy at home – consider a smart meter to monitor usage and be aware of boiler standards.
- Opt for ‘green energy’ tariffs where available or switch to renewable sources of heating or power.
- Reduce the use of solid fuel stoves and open fires – domestic burning is now the single biggest source of particulate matter pollution in the UK (greater than traffic and industry).
    - If you are burning wood or coal ensure any fuel used meets the new standards of moisture content and emissions – more information is available at https://woodsure.co.uk/are-you-ready-to-burn/
- Make your children aware of the impact that day to day activities have on air quality.

Appendix 3 – Annualisation of short-term data

Annualisation is a calculation process used to estimate an average concentration for a full year from a shorter period, such as the 6 months in this study. Annualisation ratios are worked out as a ratio of the average concentration in a full year (annual mean (Am)) to the average in the actual monitoring period measured (period mean (Pm)), using data from background continuous sites. The average concentration from the Zephyr data during the monitoring period is then multiplied by that ratio to give an estimate of the average concentration at the Zephyr for a full year.

The data from the period April 2023 to February 2024 was annualised according to the process set out in box 7.9 of Defra's Local Air Quality Management Technical Guidance (TG16). Continuous monitoring background sites were used for the annualisation calculations. Full year data for 2023 was used for the annual mean concentrations.

NO_2:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	5.5	5	1.09
Northampton Spring Park	9.4	9.4	1
Norwich	8.4	8.5	1
Average ratio	-	-	1.03

PM_{10}:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Wicken Fen	10.7	10.3	1.04
Norwich	11.8	11.5	1.02
Average ratio	-	-	1.03

$PM_{2.5}$:

Background Site	Annual mean (Am)	Period mean (Pm)	Ratio (Am/Pm)
Northampton Spring Park	7.0	7.1	0.98
Norwich Lakenfields	7.6	7.1	1.06
Average ratio	-	-	1.02