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NHS Wales

NVCC ENABLING WORKS

Air Quality Monitoring Quarterly Report



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Air Quality Monitoring Quarterly Report

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EXECUTIVE SUMMARY

WSP has been commissioned by NHS Wales to undertake air quality monitoring to meet Cardiff Councils (CC) Pre-commencement planning condition 11 in relation to the Temporary Construction Access Route for the Construction of the Approved Velindre Cancer Centre, Cardiff, CF14 7XB.

During construction works there is the potential for air quality impacts from the generation of dust and particulate matter, which could lead to dust soiling and human health impacts at relevant sensitive receptors. There is also the potential for increases in pollutant emissions from construction vehicles using the local road network.

This report provides a summary of the monitoring data for the period between 15th July and 5th October 2022. Defra's Air Quality Index¹ has been used to provide a useful indication of the levels of air pollution (See Figure 2-1 in main report). The index is divided into four bands (low (green), moderate (yellow/orange), high (red), very high (purple)). Summary tables of the monitored concentrations is provided below, the background colour assigned to each of the cells corresponds to Defra's Air Quality Index. All concentrations were low and below the relevant Air Quality Objectives.

Summary of Average Monitored Diffusion Tube Nitrogen Dioxide (NO₂) Concentrations*

| Monitor Type | Location | NO ₂ Concentration (µg/m ³) |
|----------------|---|--|
| | | Annual Average (annualised and bias-adjusted) |
| Diffusion Tube | Vel 1: Lamppost 15, Park Road | 22.6 |
| | Vel 2: Lamppost 17, Corner of Park Road and Park | 23.1 |
| | Lamppost 25, Pendywyallt Road opposite Lon Y Celyn | 20.7 |
| | Vel 4: Lamppost 1, Hollybush Inn | 23.3 |
| | Vel 5: Lamppost 7, Pendywyallt Road opposite No. 32 | 32.2 |
| | Vel 6: Coryton Junior School | 11.7 |
| | Vel 8: Coryton Junior School – side entrance | 15.8 |

* Annual average based on monitoring data for period 18th January to 5th October 2022.

Summary of Monitored Zephyr Nitrogen Dioxide (NO₂) Concentrations (15th July to 5th October 2022)

| Monitor Type | Location | NO ₂ Concentration (µg/m ³) | |
|-----------------|---------------------------|--|---------|
| | | Average | Maximum |
| Zephyr Monitors | Lamppost 1, Hollybush Inn | 18.8 | 74.4 |
| | Lamppost 15, Park Road | 16.1 | 68.1 |

¹ <https://uk-air.defra.gov.uk/air-pollution/daq>

Summary of Monitored Zephyr Particulate Matter (PM₁₀ and PM_{2.5}) Concentrations (15th July to 5th October 2022)

| Monitor Type | Location | PM ₁₀ Concentration (µg/m ³) | | | PM _{2.5} Concentration (µg/m ³) | |
|-----------------|-----------------------|---|---------|----------------------|--|---------|
| | | Average | Maximum | Maximum 24-hour mean | Average | Maximum |
| Zephyr Monitors | Lamppost 1, Hollybush | 9.0 | 38.7 | 23.8 | 6.9 | 29.7 |
| | Lamppost 15, Park | 8.5 | 36.1 | 22.7 | 6.5 | 27.3 |

Summary of Monitored DM11 Pro Particulate Matter (PM₁₀ and PM_{2.5}) Concentrations (15th July to 5th October 2022)

| Monitor Type | Location | PM ₁₀ Concentrations (µg/m ³) | | | PM _{2.5} Concentrations (µg/m ³) | |
|--------------|--------------|--|---------|----------------------|---|---------|
| | | Average | Maximum | Maximum 24-hour mean | Average | Maximum |
| DM11 Pro | 19 Park Road | 9.9 | 63.3 | 13.4 | 9.2 | 16.9 |

1. INTRODUCTION

- 1.1.1. WSP has been commissioned by NHS Wales to undertake air quality monitoring to meet Cardiff Councils (CC) Pre-commencement planning condition 11 in relation to the Temporary Construction Access Route for the Construction of the Approved Velindre Cancer Centre, Whitchurch Hospital, Park Road, Whitchurch, Cardiff, CF14 7XB.
- 1.1.2. Condition 11 (CC Reference: 20/01110/MJR) states that:
- “Prior to commencement of the development hereby approved details of an air monitoring unit and its location shall be submitted to and approved in writing with the Local Planning Authority. The monitoring unit shall be implemented in accordance with the approved details and remain operational until cessation of the development. Data from the air monitoring unit shall be provided to the Local Planning Authority on request.*
- Reason: To monitor air quality in accordance with Policy EN13 of the adopted Cardiff Local Plan (2006-2026).’*
- 1.1.3. During construction works there is the potential for air quality impacts from the generation of dust and particulate matter, which could lead to dust soiling and human health impacts at relevant sensitive receptors. There is also the potential for increases in pollutant emissions from construction vehicles using the local road network.
- 1.1.4. In order to discharge the pre-commencement planning condition 11, on behalf of NHS Wales, WSP is carrying out monitoring in the study area using Nitrogen Dioxide (NO₂) diffusion tubes and using Zephyr and DM11 Pro continuous monitors. The air quality monitoring within the study area is being undertaken to ensure that dust and vehicle exhaust emissions from construction traffic are monitored and effectively managed. This report provides a summary of the monitoring data for the period between 15th July 2022 and 5th October 2022.

2. MONITORING METHODOLOGY

2.1. MONITORING TECHNIQUES

DIFFUSION TUBE MONITORING

- 2.1.1. The diffusion tubes are passive samplers which are used to measure ambient concentrations of NO₂. The tubes are designed to provide an indication of longer-term average NO₂ concentrations and are useful in identifying areas of high concentrations in relation to road traffic emissions. They are not suitable for identifying short-term pollution events. In order to compare how well the diffusion tubes are performing against a reference method (i.e. a continuous analyser), three tubes have been co-located with the Castle Street continuous monitoring site.
- 2.1.2. The diffusion tubes have been located at 7 locations on accessible points along the main road network and where possible at relevant receptors (e.g. school) to assess any changes in NO₂ concentrations at those locations as a result of the construction traffic (see Table 2-1 and Figure in Appendix A). The tubes are changed over typically every 4 weeks and are then sent to Gradko Laboratories for analysis.

Table 2-1 - Diffusion Tube Monitoring Locations

| Tube ID | Location | X (m) | Y (m) |
|---------|---|--------|--------|
| Vel 1 | Lamppost 15, Park Road | 314782 | 180711 |
| Vel 2 | Lamppost 17, Corner of Park Road and Park Avenue | 314723 | 180758 |
| Vel 3 | Lamppost 25, Pendwyallt Road opposite Lon Y Celyn | 314537 | 180951 |
| Vel 4 | Lamppost 1, Hollybush Inn | 314520 | 180993 |
| Vel 5 | Lamppost 7, Pendywyallt Road opposite No. 32 | 314348 | 181128 |
| Vel 6 | Coryton Junior School* | 314321 | 181107 |
| Vel 8 | Coryton Junior School – side entrance | 314291 | 181157 |

* Due to access issues, during the school holidays this tube was re-located to the school boundary between 15th July and 6th September 2022.

CONTINUOUS MONITORS

- 2.1.3. Concentrations of Particulate Matter (PM₁₀ and PM_{2.5}) and NO₂ are being continuously monitored at two locations within the study area (See Table 2-2 and Figure in Appendix A). There is a Zephyr monitor (NO₂, PM₁₀ and PM_{2.5}) located close to the Hollybush Estate site and a Zephyr monitor (NO₂, PM₁₀ and PM_{2.5}) and DM11 Pro monitor (PM₁₀ and PM_{2.5}) located closer to the construction site entrance. The Zephyr monitors were installed on 28th February 2022 and the DM11 Pro began monitoring concentrations on the 5th April 2022.
- 2.1.4. The Zephyr and DM11 Pro are able to detect localised pollution events and fluctuations in the concentrations and can send alerts to the project team when concentrations go above a certain threshold. The Zephyr continuous monitoring devices are supplied by Earthsense and the DM11 Pro by Air Quality Monitors, data from each of the monitors is uploaded onto a cloud system/website where it can be viewed and downloaded by specific individuals.

Table 2-2 - Continuous Monitor Locations

| Monitor ID | | Location | X (m) | Y (m) |
|------------|-----|---------------------------|--------|--------|
| Zephyr | 111 | Lamppost 1, Hollybush Inn | 314520 | 180993 |
| | 942 | Lamppost 15, Park Road | 314782 | 180711 |
| DM11 Pro | 332 | 19 Park Road | 314887 | 180597 |

2.2. AIR QUALITY OBJECTIVES AND STANDARDS

- 2.2.1. The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)². The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation³.
- 2.2.2. The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.
- 2.2.3. The air quality objectives are policy-based targets set by the Government, which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.
- 2.2.4. The relevant standards and objectives for this monitoring programme are given in below.

Table 2-3 – Relevant Air Quality Objectives and Standards

| Pollutant | Concentration ($\mu\text{g}/\text{m}^3$) | Duration | Exceedances Allowed |
|--|--|--------------|---------------------|
| Nitrogen Dioxide | 200 | 1-hour mean | 18 |
| | 40 | Annual mean | - |
| Particulate matter (PM_{10}) | 40 | Annual mean | - |
| | 50 | 24-hour mean | 35 |
| Particulate matter ($\text{PM}_{2.5}$) * | 20 | Annual mean | - |

* Local Authorities are required to work towards reducing emissions/concentrations of particulate matter within their administrative area, however, there is no statutory objective given in the AQS for $\text{PM}_{2.5}$ at this time, only a framework.

2.3. DEFRA AIR QUALITY INDEX

- 2.3.1. A summary of available monitored concentrations for the period July to Oct 2022 are provided in Section 3. In addition, to the monitored concentrations, reference is also made to Defra's Air Quality Index⁴ which provides a useful indication of the levels of air pollution. The index is divided into four bands (low, moderate, high, very high), and the index is numbered from 1 to 10 within these bands (Figure 3). The bandings are based on hourly mean concentrations, however, can be used in relation to the diffusion tube monitoring results to provide an indication of the levels of air pollution.

² Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)

³ The UK formally left the EU on 31st January 2020 and new air quality legislation for the UK will be brought forward in due course. The Air Quality (Miscellaneous Amendment and Revocation of Retained Direct EU Legislation) (EU Exit) Regulations 2018 (SI 2018/1407) (see Regulation 5) makes changes to retained direct EU legislation relating to air quality, to ensure that it continues to operate effectively.

⁴ <https://uk-air.defra.gov.uk/air-pollution/daq>

Nitrogen Dioxide

Based on the hourly mean concentration.

| Index | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------------------|------|--------|---------|----------|----------|----------|---------|---------|---------|-------------|
| Band | Low | Low | Low | Moderate | Moderate | Moderate | High | High | High | Very High |
| $\mu\text{g}/\text{m}^3$ | 0-67 | 68-134 | 135-200 | 201-267 | 268-334 | 335-400 | 401-467 | 468-534 | 535-600 | 601 or more |

PM₁₀ Particles

Based on the daily mean concentration for historical data, latest 24 hour running mean for the current day.

| Index | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------------------|------|-------|-------|----------|----------|----------|-------|-------|--------|-------------|
| Band | Low | Low | Low | Moderate | Moderate | Moderate | High | High | High | Very High |
| $\mu\text{g}/\text{m}^3$ | 0-16 | 17-33 | 34-50 | 51-58 | 59-66 | 67-75 | 76-83 | 84-91 | 92-100 | 101 or more |

PM_{2.5} Particles

Based on the daily mean concentration for historical data, latest 24 hour running mean for the current day.

| Index | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------------------|------|-------|-------|----------|----------|----------|-------|-------|-------|------------|
| Band | Low | Low | Low | Moderate | Moderate | Moderate | High | High | High | Very High |
| $\mu\text{g}/\text{m}^3$ | 0-11 | 12-23 | 24-35 | 36-41 | 42-47 | 48-53 | 54-58 | 59-64 | 65-70 | 71 or more |

Figure 2-1 – Defra Air Quality Index

3. MONITORING RESULTS

3.1. NO₂ DIFFUSION TUBES

- 3.1.1. The results of the monitoring completed across the study area between 15th July and 5th October 2022 are provided in Table 1 below. The background colour assigned to each of the results corresponds to Defra's Air Quality Index.
- 3.1.2. All tubes were present during this monitoring period, and monitored concentrations were below the annual mean objective of 40µg/m³. As with the previous monitoring reports, monitored concentrations were highest overall at the Vel 5 diffusion tube site which is located at Lamppost 7, Pendywyallt Road opposite No. 32. This location is closer to the roadside than residential premises, or nearby footpaths, and will be impacted from emissions from vehicle exhausts. Concentrations will be lower at the nearby residential properties which are set further back from the roadside. Monitored concentrations were lowest at the Vel 6 diffusion tube site which is located at Coryton Junior School and considered representative of background concentrations.

Table 3-1 - Summary of NO₂ Diffusion Tube Concentrations

| Sampling Location | NO ₂ Concentration (µg/m ³) | | | |
|-------------------|--|------------------------------------|------------------------------------|--|
| | Monthly concentrations | | | Annual Average (annualised and bias-adjusted)* |
| | From: 15/07/2022 To: 09/08/2022 | From: 09/08/2022 To: 06/09/2022 | From: 06/09/2022 To: 05/10/2022 | |
| Vel 1 | 24.1 | 21.5 | 23.1 | 22.6 |
| Vel 2 | 28.5 | 19.8 | 23.5 | 23.1 |
| Vel 3 | 16.3 | 22.1 | 20.9 | 20.7 |
| Vel 4 | 27.7 | 20.9 | 24.8 | 23.3 |
| Vel 5 | 36.6 | 32.6 | 32.2 | 32.2 |
| Vel 6** | 13.8 | 10.9 | 13.5 | 11.7 |
| Vel 8 | 16.1 | 13.2 | 14.8 | 15.8 |

* Following methodology in LAQM.TG(22)⁵, a local bias adjustment factor was used. The annual average data is calculated using all diffusion tube monitoring data to date (i.e. includes data presented in the May and August quarterly reports).

** Due to access issues, during the school holidays this tube was re-located to the school boundary between 15th July and 6th September 2022. The results for these two monitoring periods are presented here for info but have not been included within the annual average calculations.

⁵ Defra (2022) Local Air Quality Management Technical Guidance (TG22) Sept 2022.

3.2. ZEPHYR CONTINUOUS MONITOR

Nitrogen Dioxide

- 3.2.1. Figure 3-1 shows the NO₂ data monitored at each of the Zephyr continuous monitors for the period 15th July to 5th October 2022. A summary of the monitored concentrations is provided in Table 3-2. The continuous monitor at Park Road had 100% data capture during the monitoring period. The monitor located at Hollybush Inn experienced a technical fault for part of July, however, the overall data capture at this monitor between 15th July to 5th October was 97%, which is considered reliable.
- 3.2.2. Average NO₂ concentrations across the monitoring period at both the monitoring sites were well below the air quality objective of 40µg/m³. There were also no exceedances of the one-hour objective (200µg/m³) at either of the sites. Concentrations remained relatively stable during the monitoring period and concentrations at both monitors followed a similar trend. Average concentrations were similar in magnitude to those reported in the August and May quarterly reports.

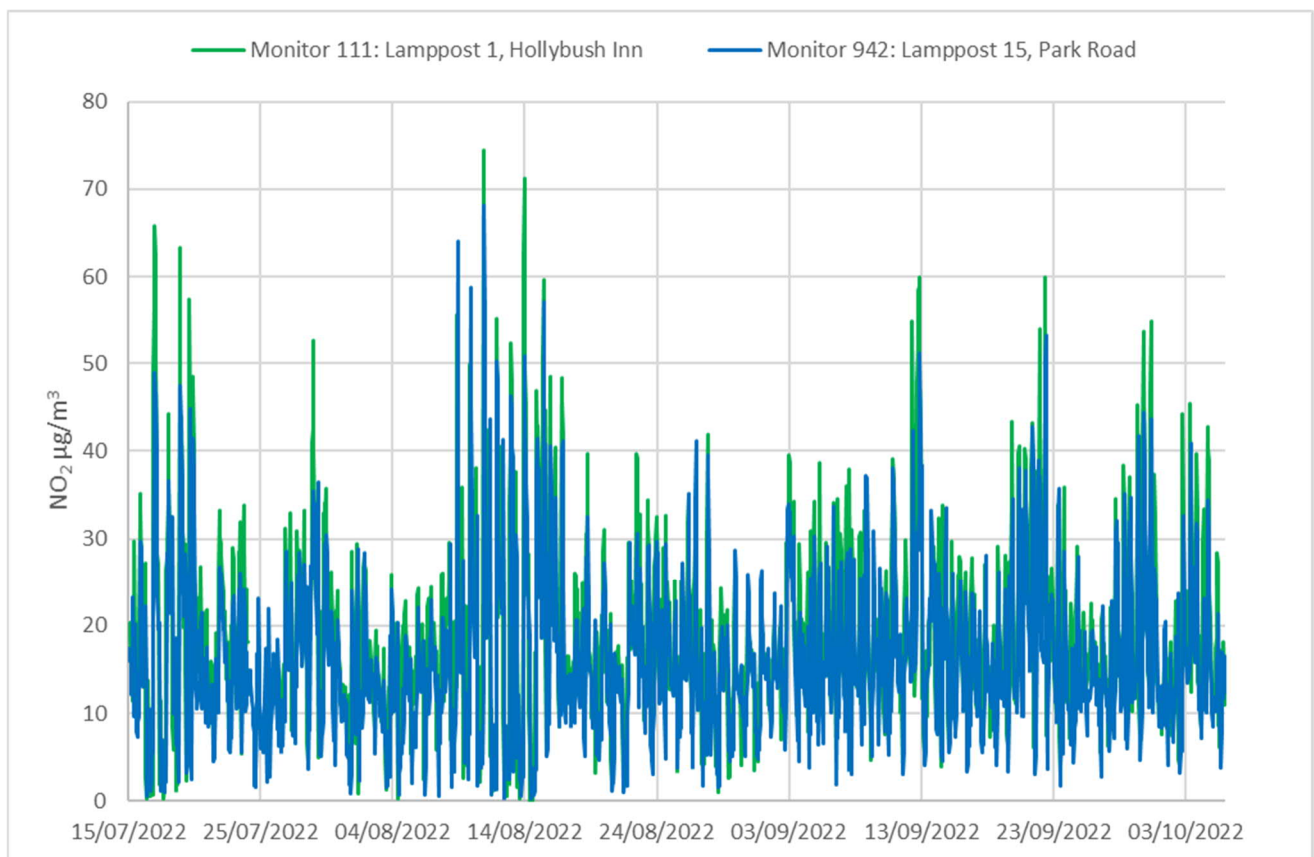


Figure 3-1 - Monitored Zephyr NO₂ Concentrations (µg/m³)

Table 3-2 - Summary of NO₂ Concentrations

| Monitor | Location | NO ₂ Concentration Summary (15 th July to 5 th October 2022) | |
|---------|---------------------------|---|---------|
| | | Average | Maximum |
| 111 | Lamppost 1, Hollybush Inn | 18.8 | 74.4 |
| 942 | Lamppost 15, Park Road | 16.1 | 68.1 |

Particulate Matter (PM₁₀ and PM_{2.5})

- 3.2.3. Figure 3-2 and Figure 3-3 respectively, show the PM₁₀ and PM_{2.5} data monitored at each of the Zephyr continuous monitors for the period 15th July to 5th October 2022. A summary of the monitored concentrations is provided in Table 3-3. The continuous monitor at Park Road had 100% data capture during the monitoring period. The monitor located at Hollybush Inn experienced a technical fault for part of July and had 97% data capture.
- 3.2.4. Average concentrations of PM₁₀ and PM_{2.5} at both the continuous monitors are below the respective annual mean objectives of 40µg/m³ and 20µg/m³ during the monitoring period. In addition, there were no 24-hour mean concentrations above 50µg/m³. Average concentrations were lower than those reported in the August quarterly report. Monitored concentrations follow a similar trend at both locations. A peak in data occurred at midday on the 9th August at the Hollybush Inn monitor, the same spike was not picked up at the Park Road monitor suggesting that it was a local pollution event, and not necessarily related to road transport.

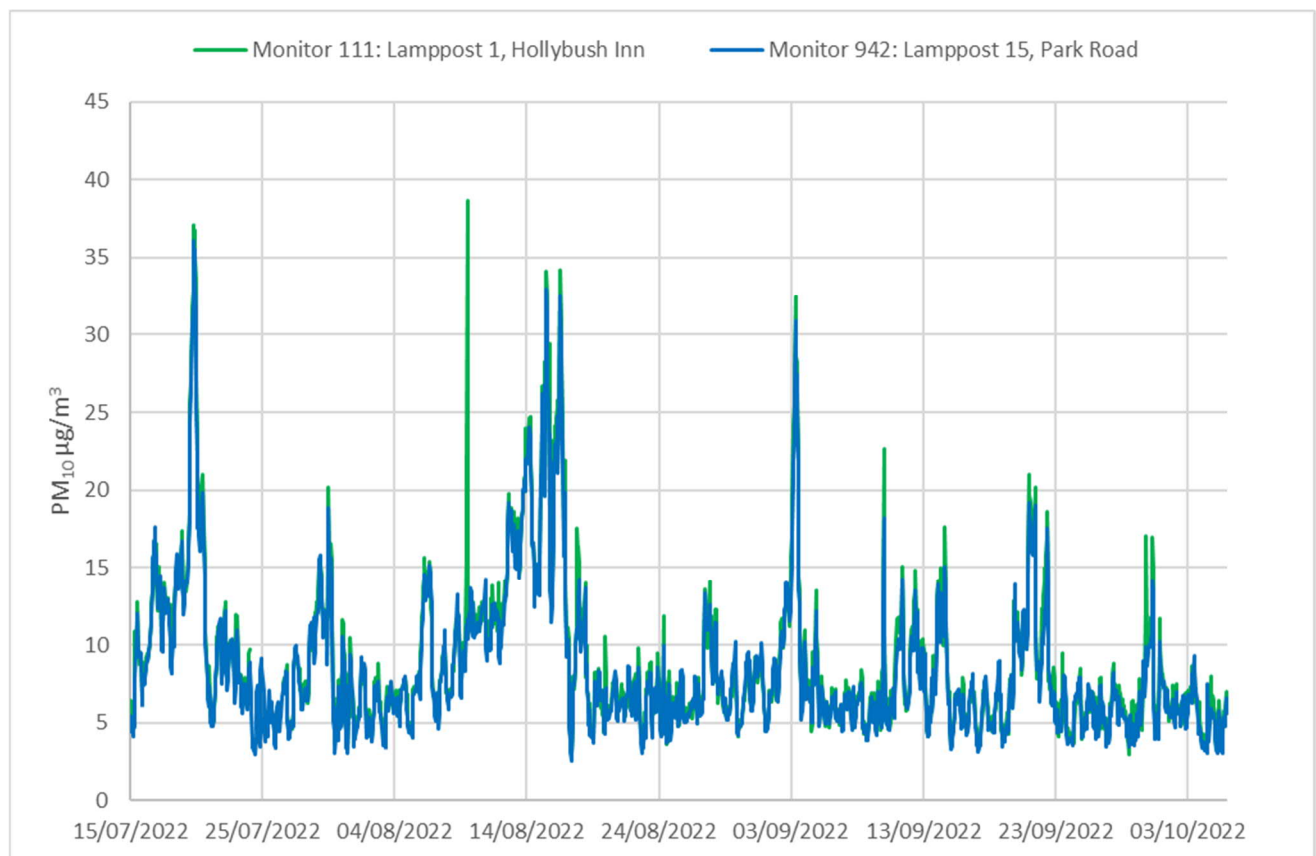


Figure 3-2 - Monitored Zephyr PM₁₀ Concentrations (µg/m³)

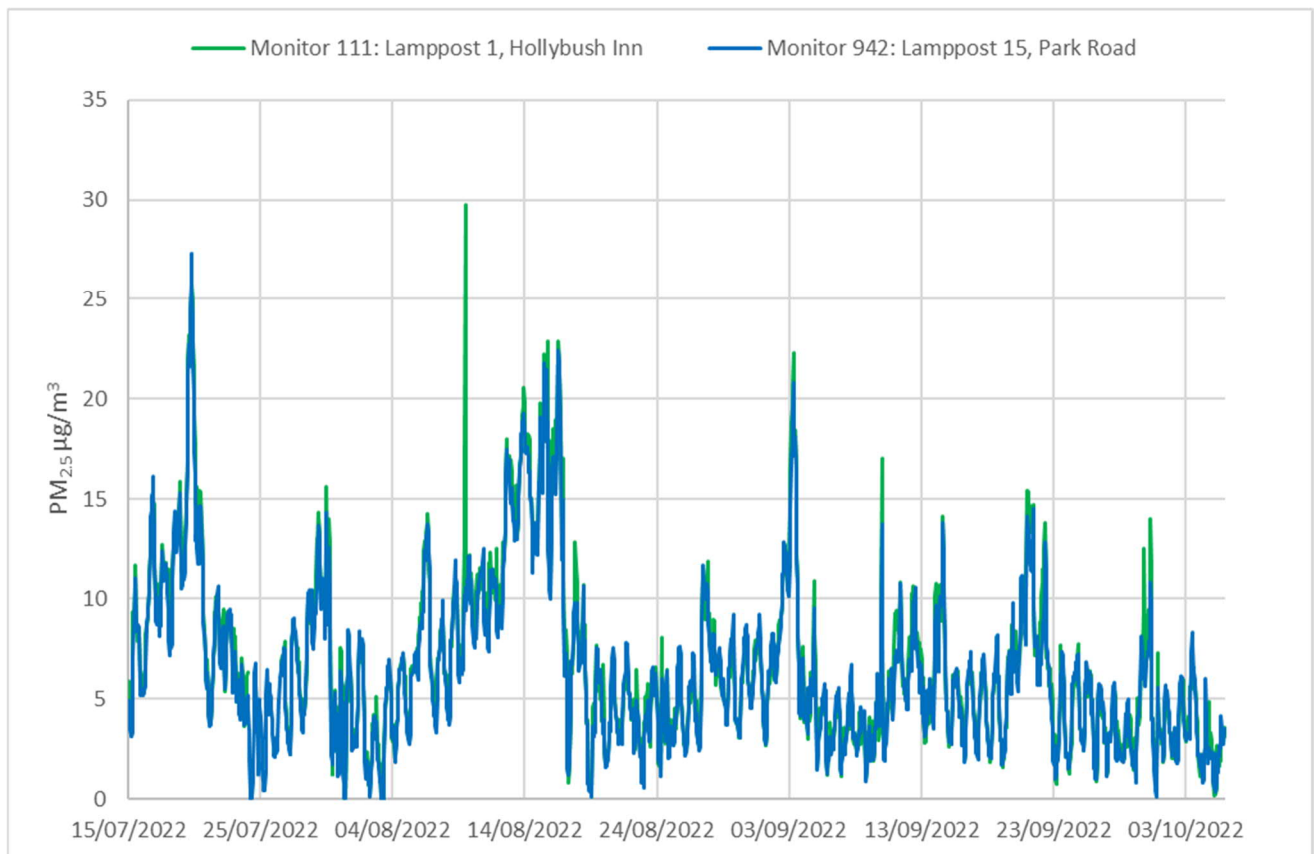


Figure 3-3 - Monitored Zephyr PM_{2.5} Concentrations (µg/m³)

Table 3-3 - Summary of PM₁₀ and PM_{2.5} Concentrations (15th July to 5th October 2022)

| Monitor | Location | PM ₁₀ Concentrations (µg/m ³) | | | PM _{2.5} Concentrations (µg/m ³) | |
|---------|---------------------------|--|---------|----------------------|---|---------|
| | | Average | Maximum | Maximum 24-hour mean | Average | Maximum |
| 111 | Lamppost 1, Hollybush Inn | 9.0 | 38.7 | 23.8 | 6.9 | 29.7 |
| 942 | Lamppost 15, Park Road | 8.5 | 36.1 | 22.7 | 6.5 | 27.3 |

3.3. DM11

Particulate Matter (PM₁₀ and PM_{2.5})

- 3.3.1. Figure 3-2 shows the PM₁₀ and PM_{2.5} data monitored at the DM11 Pro monitor for the period 15th July to 5th October 2022. A summary of the monitored concentrations is provided in Table 3-3. The DM11 Pro was off-line for part of the 21st July, however, over the whole of the monitoring period the data capture was 99.4%.
- 3.3.2. Average concentrations of PM₁₀ and PM_{2.5} at the continuous monitor are below the respective annual mean objectives of 40µg/m³ and 20µg/m³ during the monitoring period. In addition, there were no 24-hour mean concentrations above 50µg/m³.

- 3.3.3. A peak in the PM₁₀ was monitored on the 3rd October at 4am, however, a similar peak was not recorded in the PM_{2.5} data. This implies that the peak relates to an invalid reading by the DM11 monitor, especially as monitored concentrations fell again immediately after

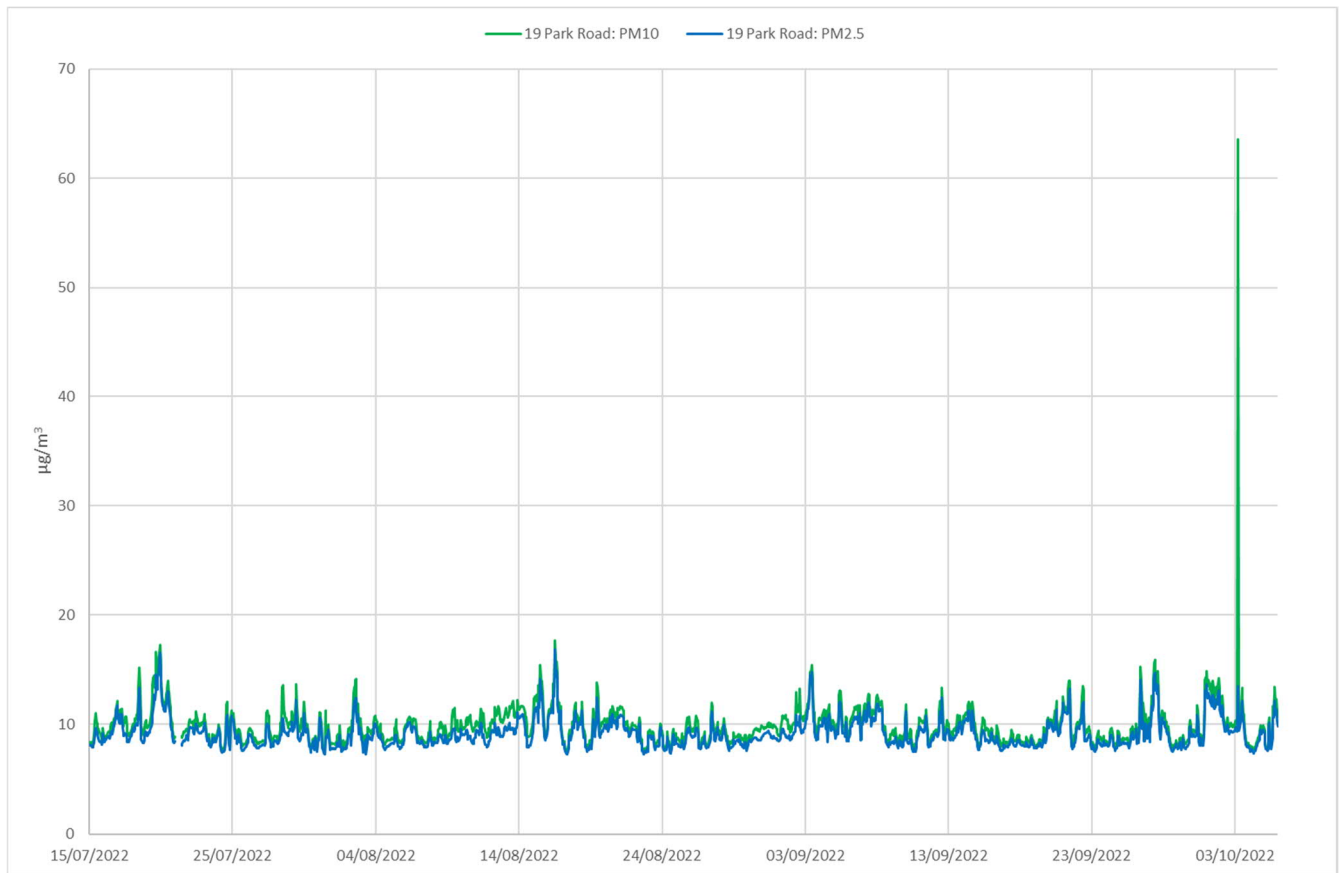


Figure 3-4 - Monitored DM11 Particulate Matter Concentrations (µg/m³)

Table 3-4 - Summary of PM₁₀ and PM_{2.5} Concentrations (15th July to 5th October 2022)

| Monitor | Location | PM ₁₀ Concentrations (µg/m ³) | | | PM _{2.5} Concentrations (µg/m ³) | |
|---------|--------------|--|---------|----------------------|---|---------|
| | | Average | Maximum | Maximum 24-hour mean | Average | Maximum |
| 332 | 19 Park Road | 9.9 | 63.6 | 13.4 | 9.2 | 16.9 |

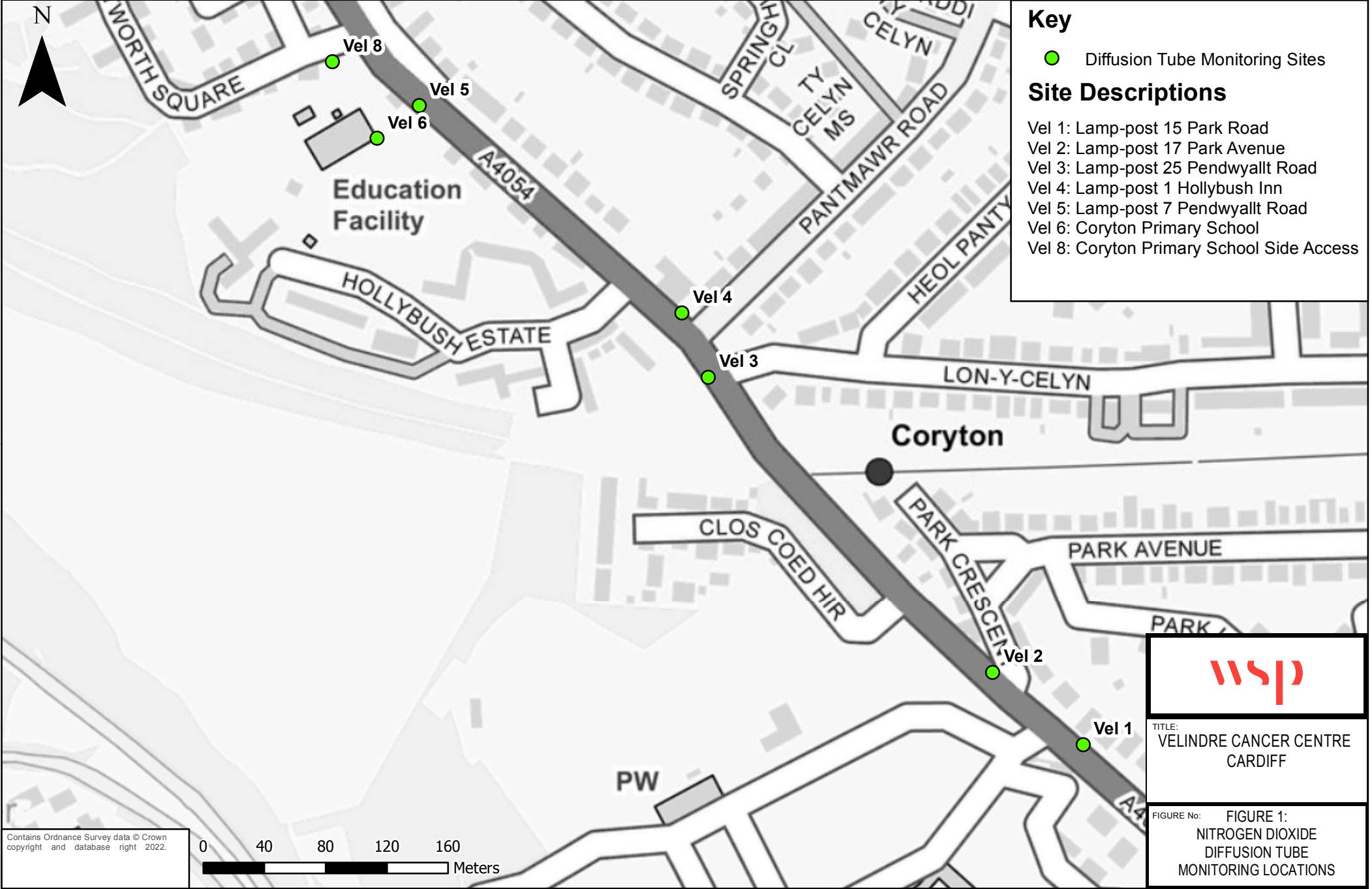
4. SUMMARY

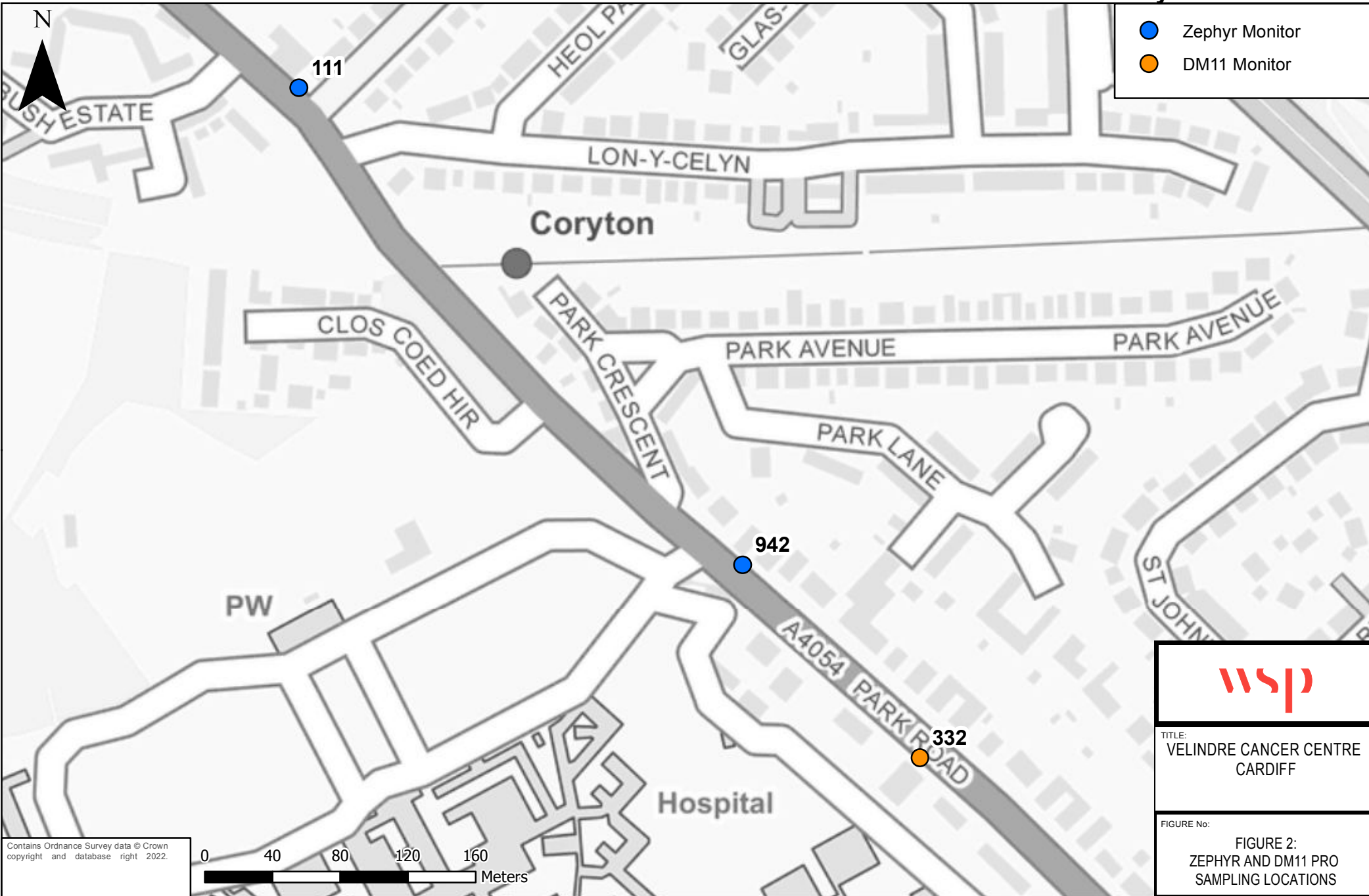
- 4.1.1. NO₂ diffusion tube monitoring was carried out at seven locations during the period 15th July to 5th October 2022. Concentrations were continuously monitored at two locations using Zephyr monitors (NO₂, PM₁₀ and PM_{2.5}) and at one location using a DM11 Pro (PM₁₀ and PM_{2.5}) during the period.
- 4.1.2. Monitored concentrations of NO₂, PM₁₀ and PM_{2.5} across the study area have been below the relevant objectives within this monitoring period. NO₂ concentrations were highest overall at the Vel 5 diffusion tube site which is located at Lamppost 7, Pendywyallt Road opposite No. 32. This sample location is closer to the roadside than residential premises, or nearby footpaths, and will be impacted from emissions from vehicle exhausts.
- 4.1.3. Monitored concentrations of NO₂, PM₁₀ and PM_{2.5} using the Zephyr monitors followed similar trends at both locations. Average concentrations of PM₁₀ and PM_{2.5} at the DM11 Pro were similar in magnitude to those monitored at the Zephyrs. The maximum 24-hour mean concentrations are lower at the DM11 Pro than at the Zephyrs most likely as the DM11 Pro is located slightly further from the road than the Zephyrs.

Appendix A

MONITORING LOCATIONS









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