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NVCC ENABLING WORKS

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Air Quality Monitoring Quarterly Report

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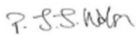
Signature				
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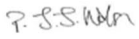
Signature				
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EXECUTIVE SUMMARY

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 5th October 2022 and 12th January 2023. Defra's Air Quality Index[1] 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 (NO_2) Concentrations, 5th October 2022 and 12th January 2023*

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, Pendwyallt 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

.

Summary of Monitored Zephyr Nitrogen Dioxide (NO_2) Concentrations, 5th October 2022 and 12th January 2023*

Monitor Type	Location	NO_2 Concentration (µg/m^3)	
		Average	Maximum
Zephyr Monitors	Lamppost 1, Hollybush Inn	21.2	72.5
	Lamppost 15, Park Road	20.8	74.8

[1] https://uk-air.defra.gov.uk/air-pollution/daqi

Summary of Monitored Zephyr Particulate Matter (PM_{10} and $PM_{2.5}$) Concentrations, 5th October 2022 and 12th January 2023*

Monitor Type	Location	PM_{10} Concentration (µg/m³)			$PM_{2.5}$ Concentration (µg/m³)	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
Zephyr Monitors	Lamppost 1, Hollybush	7.8	26.7	14.1	4.8	19.2
	Lamppost 15, Park	9.2	62.2	21.9	5.5	51.8

Summary of Monitored DM11 Pro Particulate Matter (PM_{10} and $PM_{2.5}$) Concentrations, 5th October 2022 and 12th January 2023*

Monitor Type	Location	PM_{10} Concentrations (µg/m³)			$PM_{2.5}$ Concentrations (µg/m³)	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
DM11 Pro Monitors	19 Park Road	12.1	32.5	22.3	11.6	32.0
	On-Site	14.6	32.7	25.6	13.7	32.2

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 (NO_2) 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 5th October 2022 and 12th January 2023.

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 NO_2. The tubes are designed to provide an indication of longer-term average NO_2 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 NO_2 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

CONTINUOUS MONITORS

2.1.3. Concentrations of Particulate Matter (PM_{10} and $PM_{2.5}$) and NO_2 are being continuously monitored at four locations within the study area (See Table 2-2 and Figure in Appendix A). There is a Zephyr monitor (NO_2, PM_{10} and $PM_{2.5}$) located close to the Hollybush Estate site and one located on Park Road, closer to the construction site entrance. There is a DM11 Pro monitor (PM_{10} and $PM_{2.5}$) located on Park Road close to the construction site entrance and also a DM11 Pro located on-site. The Zephyr monitors were installed on 28th February 2022, the Park Road DM11 Pro began monitoring concentrations on the 5th April 2022 and the DM11 Pro began monitoring on-site on the 25th November 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 is 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
	333	On-Site	314533	180939

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 legislation[3].

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 (µg/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 ($PM_{2.5}$) *	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 $PM_{2.5}$ at this time, only a framework.

2.3. DEFRA AIR QUALITY INDEX

2.3.1. A summary of available monitored concentrations for the period October 2022 to January 2023 are provided in Section 3. In addition, to the monitored concentrations, reference is also made to Defra's Air Quality Index[4] 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/daqi

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
µg/m³	0-67	68-134	135-200	201-267	268-334	335-400	401-467	468-534	535-600	601 or more

PM_{10} 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
µg/m³	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
µgm^{-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. NO_2 DIFFUSION TUBES

3.1.1. The results of the monitoring completed across the study area between 5th October 2022 and 12th January 2023 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. Monitored concentrations were below the annual mean objective of 40µg/m^3 for each of the monitoring periods, the annual average bias adjusted results are well below the annual mean objective. During the monitoring period 1st November to 8th December there were two diffusion tubes missing (at sampling locations Vel 2 and Vel 3).

3.1.3. 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 NO_2 Diffusion Tube Concentrations between 5th October 2022 and 12th January 2023*

Sampling Location	NO_2 Concentration (µg/m^3)			
	Monthly concentrations			Annual Average (annualised and bias-adjusted)*
	From: 05/10/2022 To: 01/11/2022	From: 01/11/2022 To: 08/12/2022	From: 08/12/2022 To: 12/01/2023	
Vel 1	25.0	30.1	28.4	22.6
Vel 2	22.6		28.7	23.1
Vel 3	21.6		25.3	20.7
Vel 4	24.8	28.3	31.8	23.3
Vel 5	36.3	18.4	36.2	32.2
Vel 6	16.4	14.9	18.5	11.7
Vel 8	14.6	27.3	20.1	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, August and November quarterly reports).

[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 NO_2 data monitored at each of the Zephyr continuous monitors for the monitoring period and a summary of the monitored concentrations is provided in Table 3-2.

3.2.2. The monitor at Hollybush Inn developed a fault on the 23rd October 2022, this resulted in the monitor being sent back to the supplier to be serviced and re-calibrated. Once returned from the supplier and put back in place, it was apparent that the monitor was still not operating correctly and unfortunately, it had to be returned to the supplier for a second time for further investigation. Therefore, only data up until the 23rd October for the monitor at Hollybush Inn is presented in this report.

3.2.3. The monitor at Park Road developed a fault on the 4th December and the sensor was taken down on Friday 13th January in order to investigate the issue. It was not possible to access the site before this date due to both restrictions to access and then the Christmas break.

3.2.4. Average NO_2 concentrations across the monitoring period at both the monitoring sites were well below the air quality objective of 40µg/m^3. There were also no exceedances of the one-hour objective (200µg/m^3) 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 slightly higher than those reported within the previous quarterly reports, however, they remain well below the annual mean air quality objective.

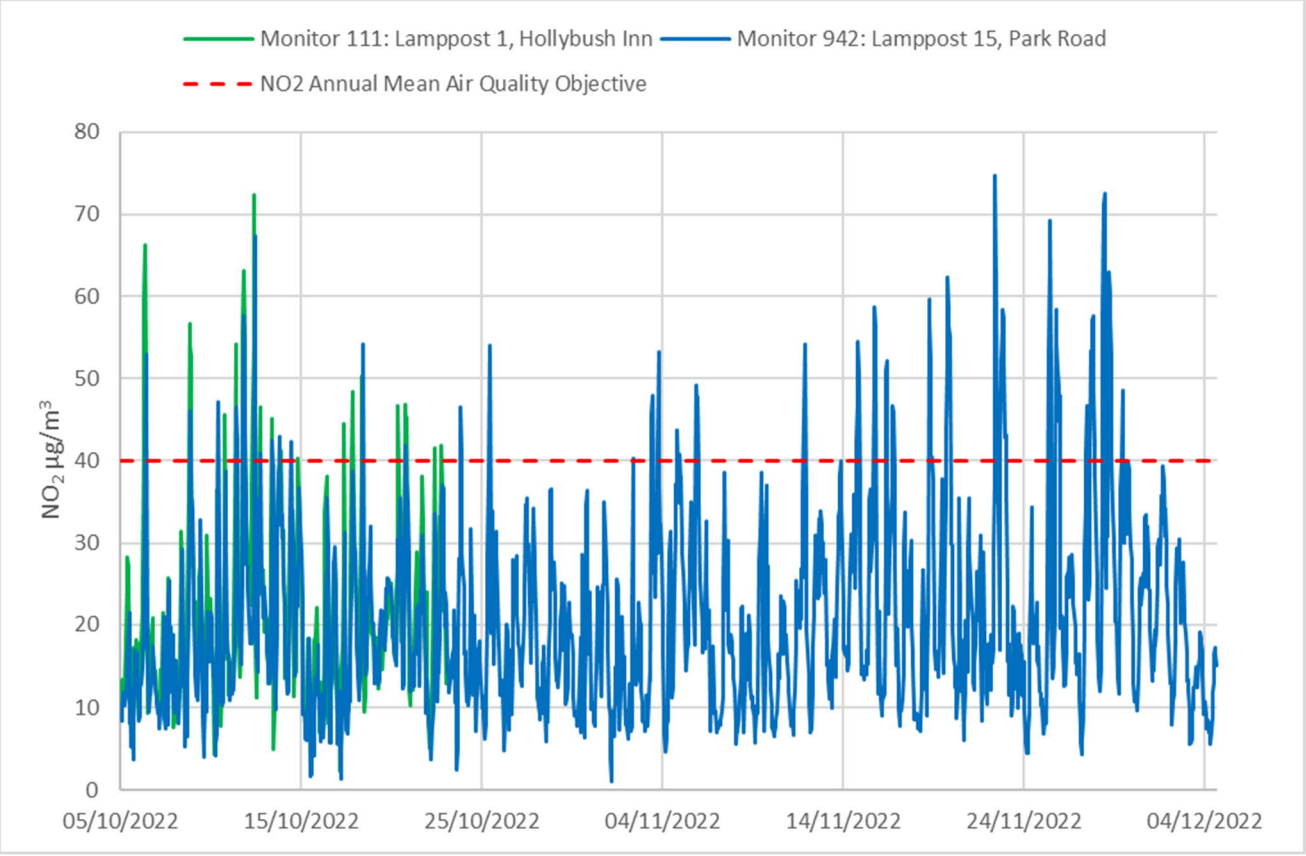


Figure 3-1 - Monitored Zephyr NO_2 Concentrations (µg/m^3)

Table 3-2 - Summary of NO_2 Concentrations

Monitor	Location	NO_2 Concentration Summary*	
		Average	Maximum
111	Lamppost 1, Hollybush Inn	21.2	72.5
942	Lamppost 15, Park Road	20.8	74.8

* data for monitor 111 is for the period 5th October to 23rd October and from the 5th October to 4th December for monitor 942.

Particulate Matter (PM_{10} and $PM_{2.5}$)

3.2.5. Figure 3-2 and Figure 3-3 respectively, show the PM_{10} and $PM_{2.5}$ data monitored at each of the Zephyr continuous monitors for the monitoring period. As above, data for the monitor located at Hollybush Inn represents the period 5th October to 23rd October and data for the Park Road monitor is for the period 5th October to 4th December.

3.2.6. Average concentrations of PM_{10} and $PM_{2.5}$ at both the continuous monitors are below the respective annual mean objectives of 40µg/m^3 and 20µg/m^3 during the monitoring period. In addition, there were no 24-hour mean concentrations above 50µg/m^3. Average concentrations were similar in magnitude to those reported in the November quarterly report and lower than those reported in the May and August quarterly reports. Monitored concentrations follow a similar trend at both locations. A peak in data occurred on the 5th November which is bonfire night, and therefore the peak in data is unlikely to be related to road transport.

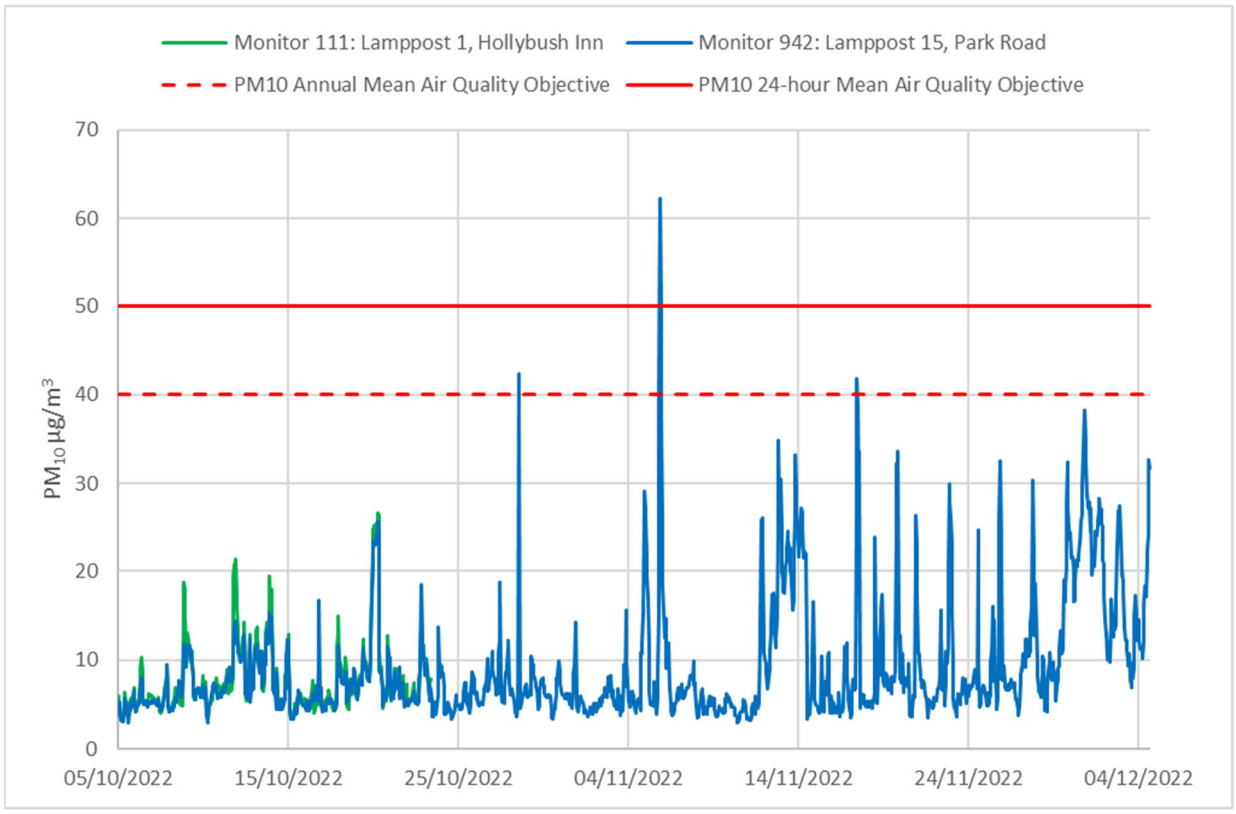


Figure 3-2 - Monitored Zephyr PM_{10} Concentrations (µg/m^3)

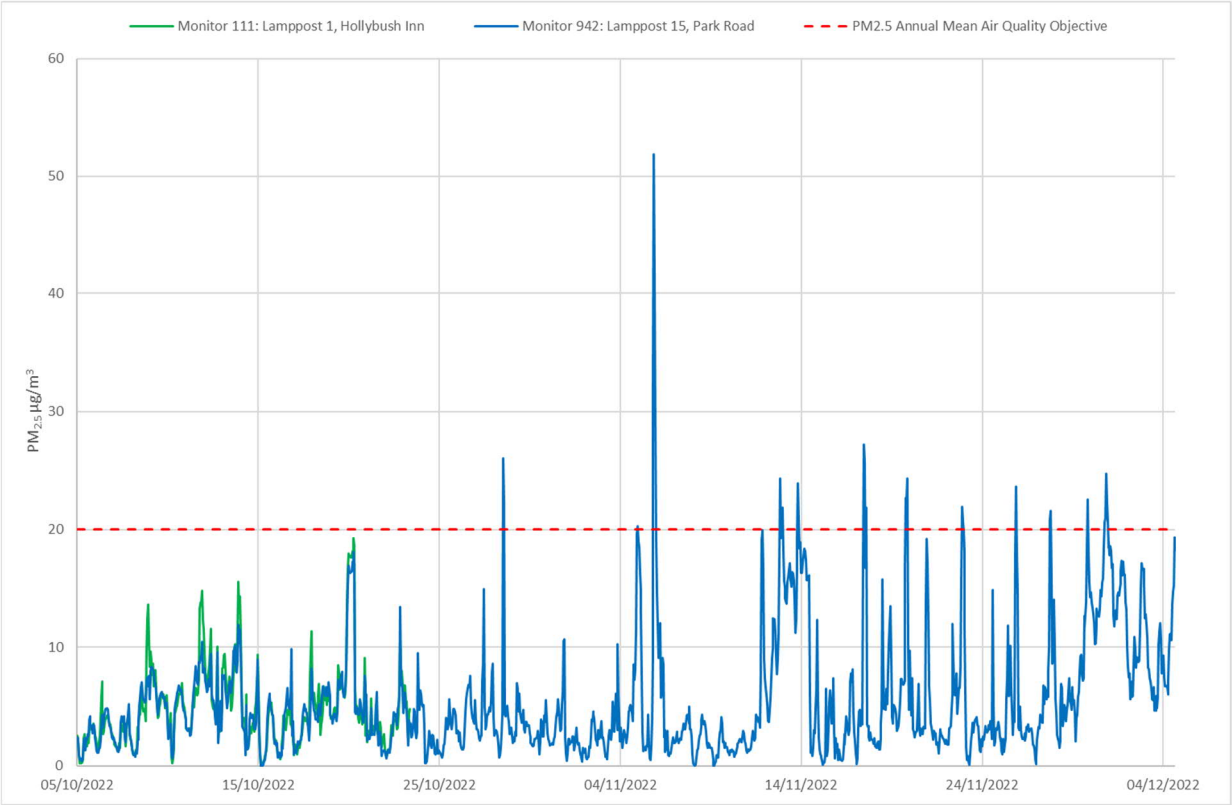


Figure 3-3 - Monitored Zephyr $PM_{2.5}$ Concentrations (µg/m^3)

Table 3-3 - Summary of PM_{10} and $PM_{2.5}$ Concentrations

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	7.8	26.7	14.1	4.8	19.2
942	Lamppost 15, Park Road	9.2	62.2	21.9	5.5	51.8

3.3. DM11

Particulate Matter (PM_{10} and $PM_{2.5}$)

3.3.1. Figure 3-2 shows the PM_{10} and $PM_{2.5}$ data monitored at the DM11 Pro monitors for the period 5th October to 12th January 2022. A summary of the monitored concentrations is provided in Table 3-3. A DM11 Pro monitor was installed on site on the 24th November 2022. Both of the DM11 Pros had 100% data capture for the relevant monitoring periods.

3.3.2. Average concentrations of PM_{10} and $PM_{2.5}$ at the continuous monitor are below the respective annual mean objectives of 40µg/m^3 and 20µg/m^3 during the monitoring period. In addition, there were no 24-hour mean PM_{10} concentrations above 50µg/m^3. PM_{10} and $PM_{2.5}$ data at both monitoring sites follow a similar trend during the monitoring period.

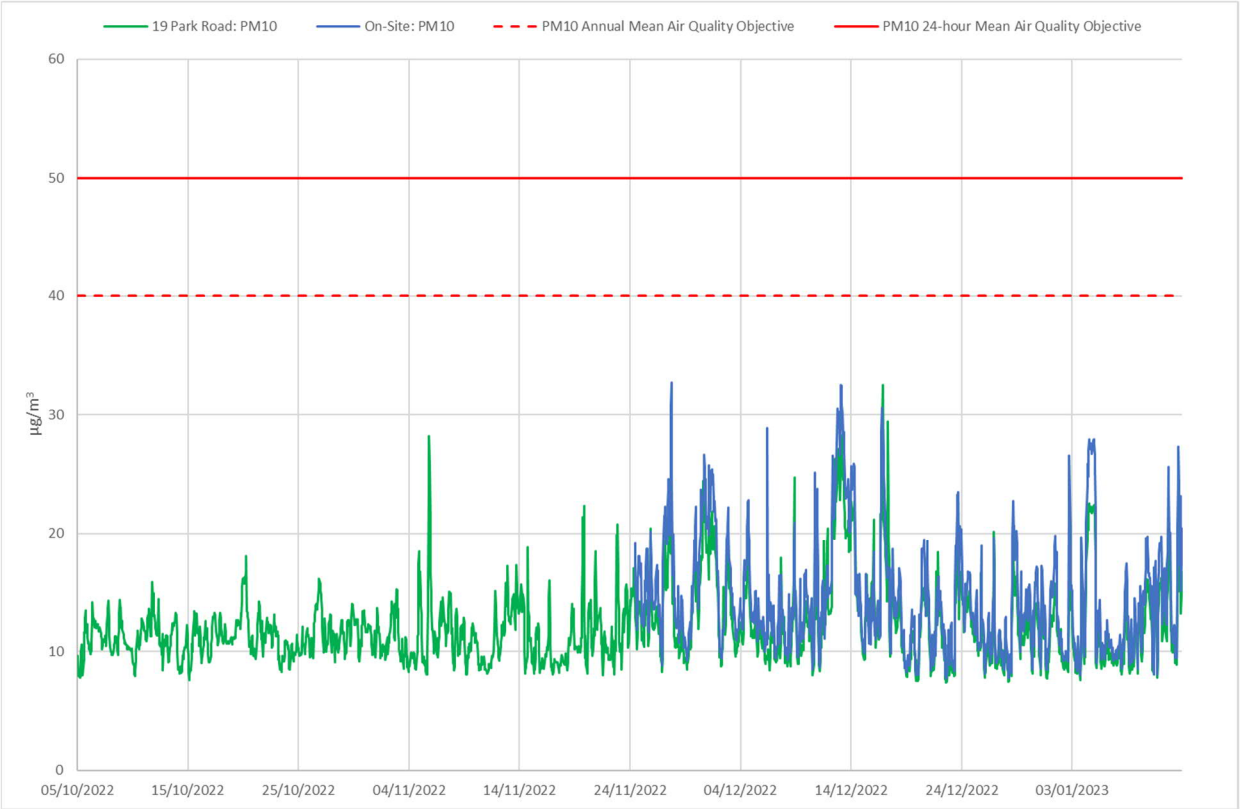


Figure 3-4 - Monitored DM11 Particulate Matter Concentrations (PM_{10}) (µg/m³)

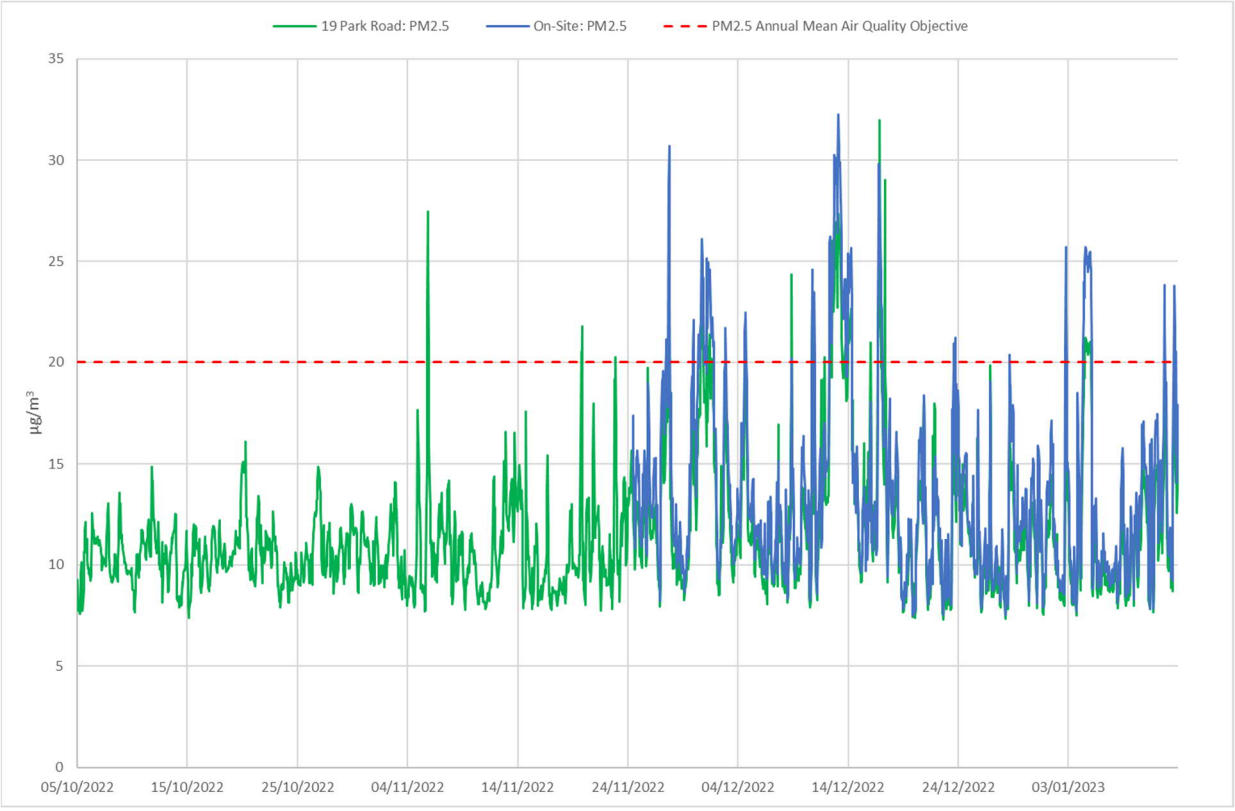


Figure 3-5 - Monitored DM11 Particulate Matter Concentrations ($PM_{2.5}$) (µg/m³)

Table 3-4 - Summary of PM_{10} and $PM_{2.5}$ Concentrations (5th October 2022 to 12th January 2023)

Monitor	Location	PM_{10} Concentrations (µg/m³)			$PM_{2.5}$ Concentrations (µg/m³)	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
332	19 Park Road	12.1	32.5	22.3	11.6	32.0
333	On-Site	14.6	32.7	25.6	13.7	32.2

4. SUMMARY

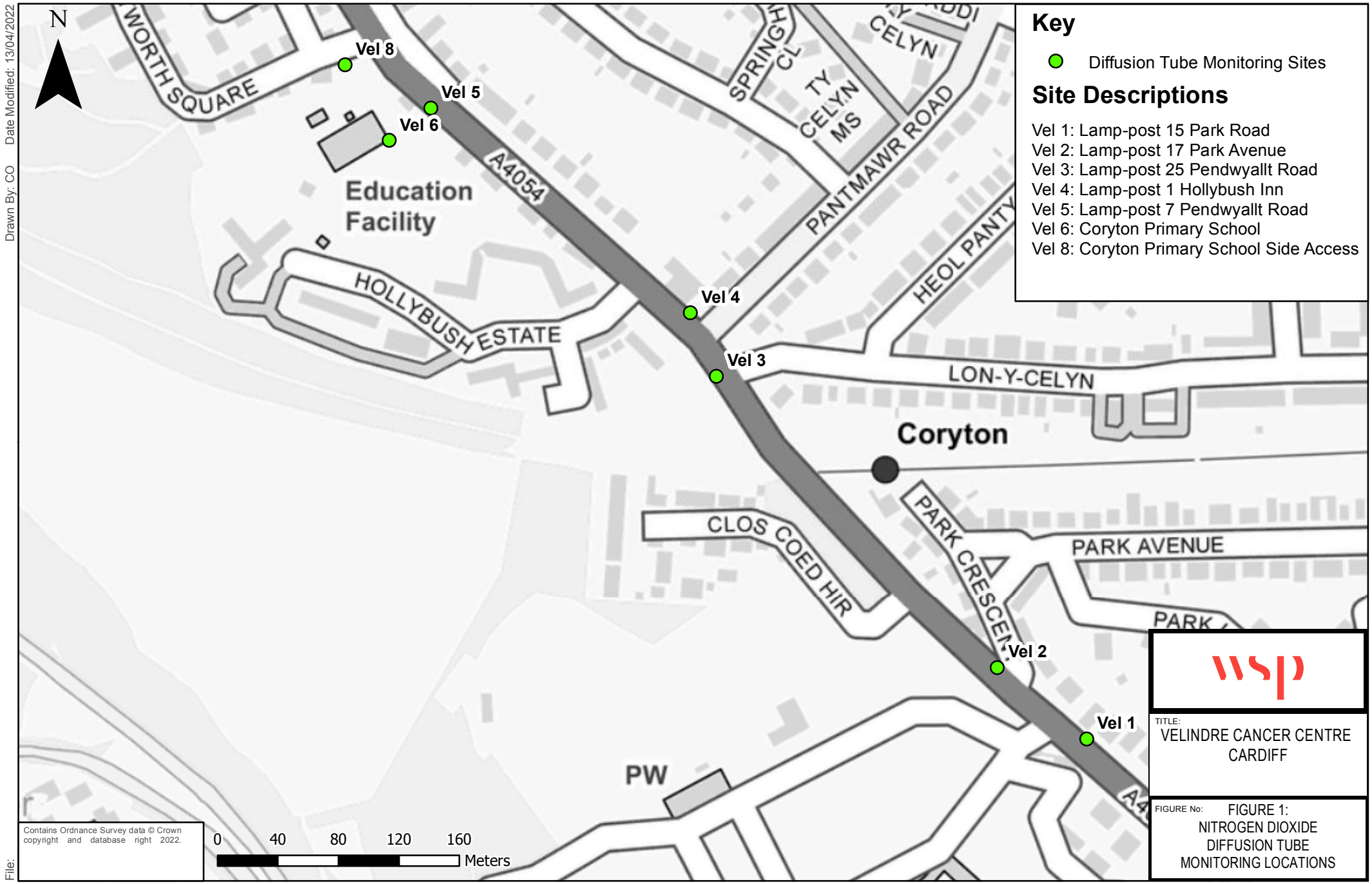
4.1.1. NO_2 diffusion tube monitoring was carried out at seven locations during the period 5th October 2022 to 12th January 2023. Concentrations were continuously monitored at two locations using Zephyr monitors (NO_2, PM_{10} and $PM_{2.5}$) and at two locations using a DM11 Pro (PM_{10} and $PM_{2.5}$) during the period (On-site DM11 Pro was installed in November 2022).

4.1.2. Monitored concentrations of NO_2, PM_{10} and $PM_{2.5}$ across the study area have been below the relevant objectives within this monitoring period. NO_2 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 NO_2, PM_{10} and $PM_{2.5}$ using the Zephyr monitors followed similar trends at both locations. In addition, monitored concentrations of PM_{10} and $PM_{2.5}$ using the DM11 Pros followed a similar trend at both monitoring locations. Average concentrations of PM_{10} and $PM_{2.5}$ at the DM11 Pro were slightly higher than those monitored at the Zephyrs, however it should be noted that the data capture for the Zephyr monitor located near the Hollybush Inn was low within this monitoring period.

Appendix A

MONITORING LOCATIONS



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TITLE:
VELINDRE CANCER CENTRE
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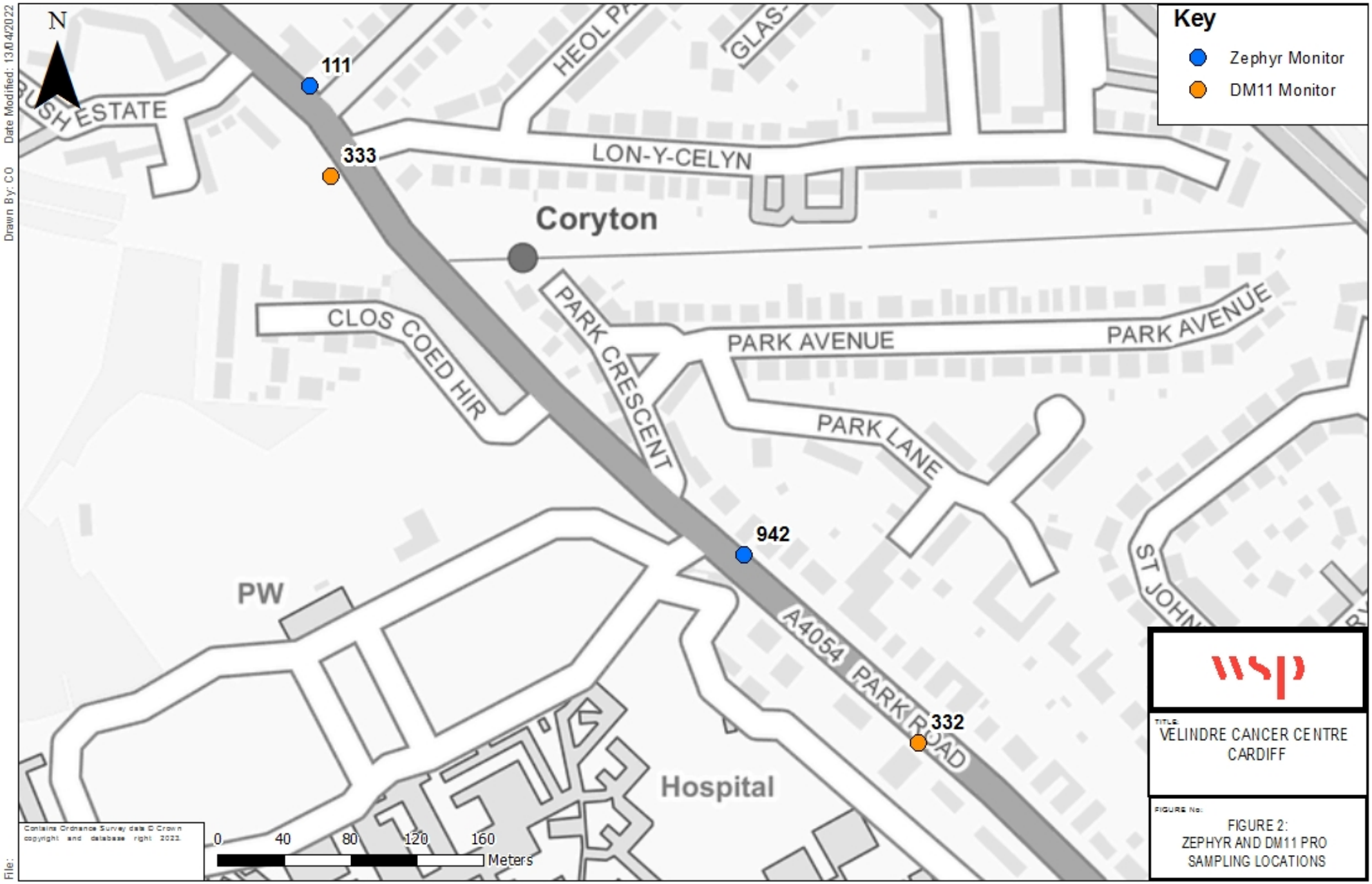
FIGURE No: FIGURE 1:
NITROGEN DIOXIDE
DIFFUSION TUBE
MONITORING LOCATIONS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Zephyr Monitor
DM11 Monitor
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