Annual Progress Report (APR)

2020 Air Quality Annual Progress Report (APR) for The Highland Council

In fulfilment of Part IV of the
Environment Act 1995

Local Air Quality Management

December 2020

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Executive Summary: Air Quality in Our Area

Air Quality in The Highland Council

Air Quality in The Highland Council area is generally good. The existing air quality issues relate to Nitrogen dioxide pollution in Inverness City Centre. The Council monitors air quality though existing automatic network stations and with passive sampling methods to identify areas where air quality might be poor. The planning process is also used to ensure appropriate siting of development with the potential to pollute, and new sensitive receptors.

Figure A Passive monitoring in Inverness

An Air Quality Management Area (AQMA) was declared in 2014 for Nitrogen dioxide covering a small area around the junction between Queensgate and Academy Street where there is relevant exposure in the form of flats in upper stories.

Figure B Automatic Monitoring in Inverness

During 2019 the Council secured funding and installed a second automatic monitor for Nitrogen dioxide at first floor level within the Inverness Air Quality Management Area, to better determine the impact of pollution upon the residences.

The Council has worked with partners, including SEPA, HITRANS, NHS Highland, Inverness BID to prepare an Action Plan to improve the Air Quality within the AQMA.

Actions to Improve Air Quality

Actions identified cover six broad areas:

- ***Action 1 – Promote smarter travel choices***
- ***Action 2 – Actively promote low emission vehicles and supporting infrastructure;***
- ***Action 3 – use the planning system to ensure that air quality is fully considered for new development;***
- ***Action 4 – Traffic management to reduce emissions within the AQMA;***
- ***Action 5 – Communication to inform the public about health impacts of air pollution and how they can change behaviour to reduce emissions and reduce exposure;***
- ***Action 6 – Continue to monitor and assess air quality in line with government guidance for LAQM.***

Local Priorities and Challenges

The Highland Council will be working with partners to progress measures included in the action plan and the Action Points identified above.

Current Council Initiatives

The Highland Council is working to develop a Low Carbon Travel and Transport Hub, including City Centre EV charging, and an active travel hub giving access to active travel information, cycle hire, a bike workshop and outreach programmes adjacent to the bus and train stations. The proposal will also develop EV and active travel satellite hubs at other locations in the city.

The Highland Council secured funding for a project to promote air quality issues in schools, along with portable air quality monitors that can be used alongside the educational work. This project will be progressed once COVID-19 restrictions allow.

How to Get Involved - Information on air quality within the Highlands can be obtained at **www.highland.gov.uk/pollution**

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1. Local Air Quality Management

This report provides an overview of air quality in **The Highland Council** during **2019**. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Progress Report (APR) is summarises the work being undertaken by **The Highland Council** to improve air quality and any progress that has been made.

Table 1.1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m^3	Annual mean	31.12.2010
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean	31.12.2020
Sulphur dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m^3	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m^3	Running 8-Hour mean	31.12.2003

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Lead	0.25 µg/m^3	Annual Mean	31.12.2008

2. Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12 months, setting out measures it intends to put in place in pursuit of the objectives.

A summary of AQMAs declared by **The Highland Council** can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at:

https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=374

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	Description	Action Plan
Inverness City Centre	• NO_2 annual mean	Inverness	An area encompassing a number of properties at the junction of Academy Street and Queensgate/Strothers Lane.	Currently in Final Draft

2.2 Cleaner Air for Scotland

Cleaner Air for Scotland – The Road to a Healthier Future (CAFS) is a national cross-government strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health and fulfil Scotland's legal responsibilities as soon as possible. A series of actions across a range of policy areas are outlined, a summary of which is available at https://www.gov.scot/Publications/2015/11/5671/17. Progress by **The Highland Council** against relevant actions within this strategy is demonstrated below.

2.2.1 Transport – Avoiding travel – T1

All local authorities should ensure that they have a corporate travel plan (perhaps within a carbon management plan) which is consistent with any local air quality action plan. **The Highland Council** has a local transport strategy and in partnership with

The Highlands and Islands Strategic Transport Partnership (HITRANS), The Highland Council is developing a series of Active travel audits and masterplans.

The purpose of these plans is to help establish a network for walking, cycling and access to public transport. The audits and masterplans will identify a core active travel network and prioritised action plans in each location which will serve as a framework for future investment and new development. These are accessible via the link:

https://www.highland.gov.uk/info/1523/transport_and_streets/121/local_transport_planning

2.2.2 Climate Change – Effective co-ordination of climate change and air quality policies to deliver co-benefits – CC2

Scottish Government expects any Scottish local authority which has or is currently developing a Sustainable Energy Action Plan to ensure that air quality considerations are covered.

Carbon CLEVER is a Highland Council-led initiative with a target of a carbon neutral Inverness in a low carbon Highlands by 2025. By 2025, the Highlands will be a region where its residents and visitors can move around easily by low carbon and sustainable forms of transport. Information on Carbon CLEVER is available via the link: https://www.highland.gov.uk/info/1210/environment/321/climate_change/2 .

2.3 National Low Emission Framework (NLEF) Stage 1 Screening Appraisal for The Highland Council

The NLEF[1], which is now part of the review and assessment process for LAQM reporting in Scotland, contributes to the Cleaner Air for Scotland strategy by aiming to improve local air quality in areas where air quality objectives are exceeded, or likely to be exceeded, primarily due to emissions from transport.

The NLEF is directly linked to Air Quality Action Planning (AQAP) for local authorities with Air Quality Management Areas (AQMAs), and will help to identify actions to improve local air quality within AQMAs. The NLEF appraisal takes the form of a two-stage process, as summarised in Table 2.2:

[1] https://www.gov.scot/publications/national-low-emission-framework/pages/2/

Table 2.2 – NLEF Appraisal Process

Stage		Outcome	Actions Required
1	Screening	• decision on whether to proceed to stage two assessment	• screening process to identify actions that will benefit air quality within the AQMA • screening evidence should form part of the Annual Progress Report, with the decision agreed by Scottish Government and SEPA
2	Assessment	• decision to proceed with introduction of LEZ or identification of alternative transport-related measures required to improve air quality • Stage two assessment report agreed by Scottish Government and SEPA	• NMF approach to support assessment of sources of pollution and options • quantitative impact assessment (based on predicted change in pollutant concentrations) • consideration of consequential impacts (e.g. congestion, export of pollution)

The NLEF Stage 1 Screening Appraisal for **The Highland Council** is detailed in Table 2.3. It is the opinion of The Highland Council that proposed measures are sufficient and there is therefore no need to proceed to a Stage 2 Assessment. The general trend of monitoring data suggests that the Nitrogen dioxide concentrations have reduced within the AQMA other than what is believed to be a temporary increase in 2019 due to specific short-term traffic conditions. Action plan measures and local developments such as the bus station remodelling are expected to offer up longer term improvements in air quality within the AQMA.

Table 2.3 – NLEF Stage 1 Screening Appraisal

No.	NLEF Stage 1 Screening Appraisal Question	Appraisal Response
1	What is the name of the declared AQMA(s)?	**Inverness City Centre**
2	What pollutants are the AQMA(s) declared for?	**Nitrogen dioxide**
3	What are the main sources of air pollution, or other factors, contributing to the declaration of the AQMA? *(If the main source is not transport–related no further screening is required).*	**Road Traffic**
4	Are the declared AQMA(s) (and therefore area(s) of exceedance) restricted in nature geographically to a small area for which a Low Emission Zone (LEZ) would not be appropriate or proportionate (e.g. single streets, road junctions, small town centre)?	**Yes**
5	Do the monitored concentrations within the AQMA(s) meet the air quality objective(s)? If yes, for how long has compliance been achieved? If not, what are the extent of the exceedances?	**Generally yes, at locations with relevant exposure. Exceedences recorded in 2019 relate to monitoring undertaken at kerbside or street level where relevant exposure is at first floor level.**

No.	NLEF Stage 1 Screening Appraisal Question	Appraisal Response
6	What is the current trend for pollutant concentrations within the AQMA(s) (state the trend for each pollutant declared)?	**Automatic monitoring within the AQMA only began in 2016, after the declaration of the AQMA. Some electric buses had already begun operating within the AQMA at that point. 2017 and 2018 annual mean NO2 concentration was 38ug/m3. 2019 concentration has increased to 43ug/m3 but it is believed that this is due to temporary traffic conditions caused by temporary road restrictions nearby.** **Diffusion tube site IV3A, which is the only long-term monitoring site in the AQMA has shown a steadily decreasing trend from the high of 48ug/m3 in 2012, before AQMA declaration. This site also, however, saw a significant increase in 2019 above what was recorded in the previous two years.**
7	Are there any major planned developments which could impact air quality within or surrounding the AQMA(s)?	**No known planned developments likely to impact on air quality**
8	What are the current trends for vehicle movements within the AQMA and surrounding areas?	**Traffic flow has varied significantly over the past few years due to temporary changes in traffic management. Closure of lanes to accommodate repairs to buildings involved re-routing of bus journeys. Most recently the Space for People initiative resulting from the response to the COVID19 pandemic has narrowed some traffic routes.**

No.	NLEF Stage 1 Screening Appraisal Question	Appraisal Response
9	Provide evidence showing how the AQAP (and associated plans, programmes and strategies) will deliver significant improvements towards achieving the air quality objective(s) in as short a timescale as possible?	**Many of the Action Plan points have overtaken the Action Plan in practice and have already been implemented. In addition, future developments include proposals to completely revise bus movements around the bus station. The proposals are to create a new exit route via Rose Street which will dramatically reduce the number of journeys via Academy Street and the AQMA.**

2.4 Progress and Impact of Measures to address Air Quality in The Highland Council

The Highland Council has taken forward a number of measures during the current reporting year of 2019 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in the air quality Action Plan relating to the AQMA. Key completed measures are:

- **Schools Engagement** – All Highland Council Schools have completed active travel plans
- **Investigate carparking differentiation** – No parking charge for ULEV in city centre car park
- **West Link Road Phase 1** completed with estimated 10K city journeys removed.

Progress on the following measures has been slower than expected .

- **Low Carbon Transport and Travel Hub** – revised proposal to reflect changes since original award
- **Statutory Quality Partnership (SQP)** – awaiting signature and will be picked up once the new transport bill goes live.

The Highland Council expects the following measures to be completed over the course of the next reporting year:

- **Low Carbon Transport and Travel Hub** – This development will provide additional EV charging and improved access to low carbon/active alternative transport for visitors to the city centre

Table 2.4 – Progress on Measures to Improve Air Quality

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	Train Station Cycle Parking	Transport Planning and Infrastructure	Enhancement to train station and cycle parking	Development and Infrastructure	complete	ongoing	Completion of Scheme		Ongoing	2019	
2	Low Carbon Transport and Travel (LCTT) Hub	Transport Planning and Infrastructure	Improvement of Public Transport Hub with integrated active travel	Development and Infrastructure	Ongoing		Completion of Scheme		In Planning phase	2021	A revised proposal is currently under consideration by the funder to reflect developments since the original grand award. Proposal includes EV charging hub at Rose Street Car Park plus various EV and AT satellite hubs throughout the city
3	Active Travel	Promoting Travel Alternatives	Further encouragement of active travel	Development and Infrastructure		Ongoing	Level of Awareness Revised travel and subsistence policy		Ongoing		Supported by HITRANS - Active Travel Officer Revised Travel and Subsistence Policy promotes active travel through new travel hierarchy – NHS Active Travel Policy in place

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
4	Pedestrian Friendly Academy Street	Traffic Management	Making Academy Street more pedestrian friendly (wider pavements, crossing points etc.	Development and Infrastructure	Ongoing		Delivery of Scheme		Ongoing		Tactile Paving in place and other associated improvement works completed – Currently investigating further improvements as part of Academy Street redevelopment
5	Cycling Strategy	Promoting Travel Alternatives	Cycling strategy to encourage greater levels of cycling and support the 'Cycling City' concept	Development and Infrastructure			Delivery of Cycling Strategy				See IMFLDP
6	School Engagement	Promoting Travel Alternatives	School Travel Plans	Community Services		Ongoing			Complete		Schools in Highland now have a School Travel Plan
7	Car and Lift Sharing	Alternatives to Private vehicle Use	Promotion and Encouragement of online tool for car sharing	Development and Infrastructure		Ongoing			Ongoing		The Highland Council Launched its own Liftshare platform in 2018: https://liftshare.com/uk/community/hitravel The Highland Council, in collaboration with Enterprise Car Club, now operate a fleet of around 80 shared asset car club vehicles across Highland

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
8	Low emission buses	Promoting low emission transport	Investigate the feasibility of increasing the number of low emission buses in Inverness	Community Services		Ongoing					6 EVs in place
9	Limits on Euro Standards of Buses	Promoting low emission transport	Limits on Euro Standards of buses could be implemented through the SQP	Community Services	complete		Improvement in EURO standard mix of bus fleet			2020	Draft SQP but not signed as yet. Will be picked up when new transport bill goes live.
10	Electric Vehicle Charge Points	Promoting low emission transport	Further electric charging points in Inverness City Centre and on the road network in the Highlands	Development and Infrastructure	ongoing	ongoing			Ongoing		Current 20/21 ~£1m programme ongoing to install an additional 50+ public charging points on the ChargePlace Scotland website. A member-led EV infrastructure vision has been established which forms part of a Strategic Control Plan and will strengthen funding bids by adding structure and focus to the work.

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
11	Lower Emission Council Fleet	Vehicle Fleet Efficiency	Investigating using lower emission vehicles within the Council fleet	Community Services			Number of low emission vehicles in Council Fleet		Ongoing		Pilot car club scheme incorporating 14 hybrid vehicles to 5 sites in 2018 and secured additional 5 EVs through Switched On Fleets Initiative. Car club scheme live now in 2019. £124k secured for expending EV fleet. Investigating provision of ERCV – Car club fleet now siginificantly expanded, with around 80 shared asset vehicles available for business travel across the region
12	Reduce Taxi Emissions	Promoting low emission transport	Investigate using taxi licensing system to reduce emissions from taxis	Community Services			Number of LEV and ULEV Taxis operating		Ongoing		EV points provided adjacent to AQMA to encourage ULEV Taxi uptake
13	Investigate parking Charge differentiat-ion for LEVs	Promoting low emission transport	Feasibility study investigating the use of parking charge differentiation for LEVs	Community Services			Implemented scheme		Complete		No parking Charge for EV whilst Charging
14	Ecostars	Promoting low emission transport	Consider ecostars for council fleet or promotion of ecostars to external parties	Community Services			Implemented scheme		No progress to date		

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
15	Identify relevant planning applications	Policy Guidance and Development Control	Ensuring that relevant planning applications are identified in consultation process	Development and Infrastructure	n/a	Ongoing	Relevant Planning Applications identified		Ongoing	n/a	Use of GIS system to ensure development influencing AQMA is identified
16	Air quality impact assessment of development	Policy Guidance and Development Control	Ensuring that planning application with potential air quality impacts are fully assessed for their impacts, at relevant locations using appropriate methodologies	Development and Infrastructure	n/a	Ongoing	AQIAs completed		Ongoing	n/a	
17	Air Quality Mitigation in the development Planning Process	Policy Guidance and Development Control	Ensuring that appropriate mitigation is not only proposed but also implemented where relevant impacts are identified	Development and Infrastructure	n/a	Ongoing	Mitigations identified and implemented		Ongoing	n/a	
18	Encouraging travel plans	Promoting Travel Alternatives	Encouraging travel plans for relevant new development	Development and Infrastructure	n/a	ongoing	Travel plans completed		Ongoing	n/a	Policy - Developer requirement for major projects
19	Encourage Electric vehicle infrastructure	Promoting low emission transport	Encouraging electric vehicle infrastructure through the planning system	Development and Infrastrusture	n/a	ongoing	EV Infrastructure installed		Ongoing		New EV Development Officer Post created and filled in 2019 New EV Development Officer Post secondment ended in October 2020

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
20	Providing Sustainable Transport Information	Policy Guidance and Development Control	Providing information re sustainable transport for residents of new development	Development and Infrastructure	n/a				Ongoing		
21	Traffic management on Academy Street	Traffic Management	Use SCOOT system more effectively to ensure traffic is not queueing on Academy Street	Development and Infrastructure	n/a	ongoing			Ongoing	2020	SCOOT system major repair work scheduled for 2019
22	Microsimulat-ion modelling	Traffic management	Study using microsimulation modelling to more accurately investigate impacts of traffic light phasing at the Academy Street – Queensgate junction	Development and Infrastructure							No progress on this however overtaken by Academy Street redevelopment (see measure 4)
23	Bus Movements Review	Transport Planning and Infrastructure	Review bus movements round Inverness, in terms of routes in and out of the bus station, bus stops and routes around the city centre	Community Services	n/a	ongoing	Review Undertaken		ongoing	n/a	Some services now stopping on Union Street so reduced traffic on Queensgate

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
24	Completion of Phase 1 West Link	Transport Planning and Infrastructure	Reduction of through city centre traffic by completion of A82 to A9 bypass	Development and Infrastructure	complete	complete	Traffic reduction +10,000 journeys removed from city		Complete 2018		Work completed and new link opened in 2018
25	Investigate Shortening Delivery Hours	Freight and Delivery Management	Investigate the feasibility of shortening delivery hours to reduce the impact of delivery vehicles on peak time congestion	Community Services	No progress to date						
26	Investigate Refuse Collection Vehicle Delivery times	Freight and Delivery Management	Investigate the feasibility of taking refuse collection vehicles out of the city centre at peak times	Community Services							
27	Commun-icate with residents	Public Information	Communicate with residents in the AQMA, and more widely, about the issues and this action plan	Community Services	ongoing	2016 and ongoing	Awareness Increased		ongoing		Already undertaken successful consultation exercise. Use publicity to increase awareness through campaigns like Clear Air Day
28	Improve Bus Information Provision	Public Information	Improve bus information provision	Community Services	n/a	Ongoing	Bus Information Provision Improved		ongoing		Live Bus information network widely implemented. Bus tracker app published. Smart Cities funding being considered for increasing real time information network

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
29	Active Travel Campaigns	Promoting travel alternatives	Support existing active travel campaigns (step count challenge/Big Bike Revival/Cycling Scotland Workplace Grant)	Development and Infrastructure	n/a	Ongoing	Uptake of Active travel alternatives		ongoing		In conjunction with HITRANS The Highland Council launched pilot pool bike scheme in September 2018. Info on number of Bikes provided? No of journeys undertaken?
31	Signposting to Car parks and other destinations	Transport Planning and Infrastructure	Review signposting around city centre to encourage traffic away from AQMA	Community Services	In progress	2019/20	Delivery of scheme			2020	Development of Network Mesh ongoing which will provide capacity for smart signposting
32	Improve commun-ication within the council	Policy Guidance and Development Control	Workshop for council officers	Chief Executive							

3. Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

The Highland Council undertook automatic (continuous) monitoring at two sites during 2019. There are also three automatic monitoring sites in the authority area operated by DEFRA as part of the AURN. **Error! Reference source not found.** in A ppendix A shows the details of the sites.

National monitoring results are available at http://www.scottishairquality.scot/data/

A new automatic monitor was installed at the existing site on Queensgate within the Inverness AQMA during the summer of 2019. The new monitor runs alongside the existing equipment and will record concentrations of Nitrogen dioxide at first floor level within the AQMA where there is relevant exposure. The existing monitor on the site will continue to record concentrations of Nitrogen dioxide at street level. There is however no relevant exposure within the AQMA at street level.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

The Highland Council undertook non- automatic (passive) monitoring of NO_2 at 34 sites during 2019. **Error! Reference source not found.** in Appendix A shows the d etails of the sites.

New sites were added in March 2019 at Innes Street and George Street in Inverness. The two sites are on residential streets adjacent to the A82(T) one of the busiest intersecting roads in the city.

A short survey was undertaken between May and October 2019 on the High Street in Dingwall.

Diffusion tubes were deployed for one month in October 2019 at 4 sites on Tomnahurich Street and Kenneth Street within Inverness.

Four new sites were installed in Nairn along the A96(T) in September 2019. The A96, the trunk road between Inverness and Aberdeen passes through the centre of Nairn. In recent years there has been local adverse press around the pollution caused by traffic congestion especially at the east end of the town.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for annualisation and bias. Further details on adjustments are provided in Appendix C. Adjustment for distance from the carriageway, where appropriate, has also been discussed in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Error! Reference source not found. in Appendix A compares the ratified and a djusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B.

Error! Reference source not found. in Appendix A compares the ratified c ontinuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

Annual Mean Objective

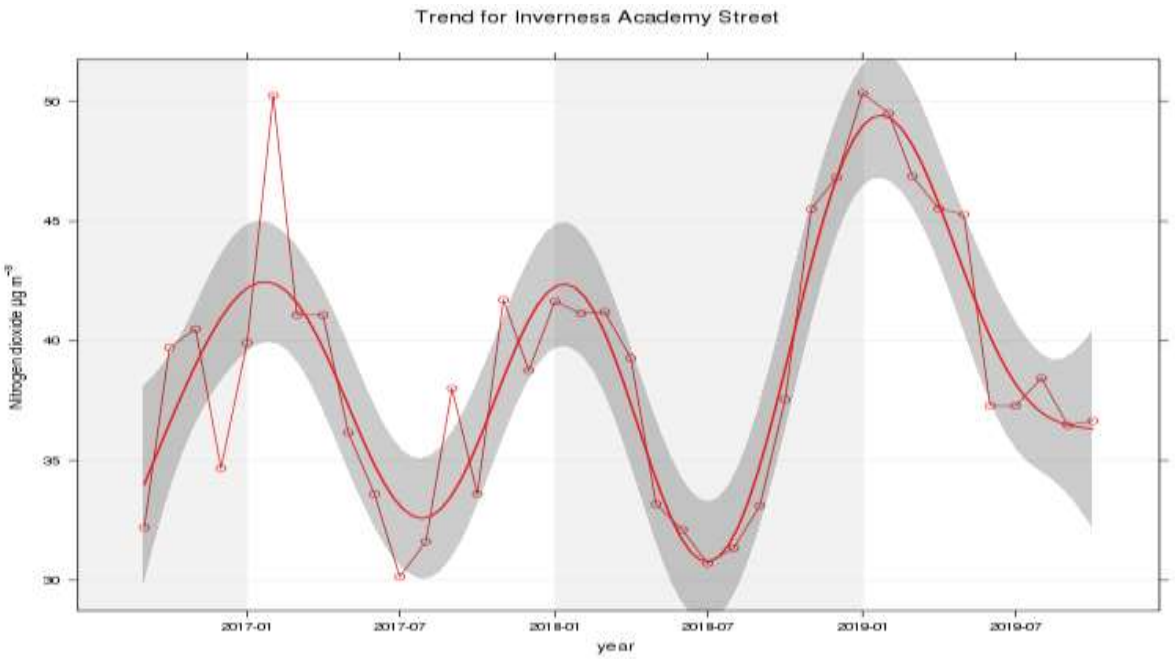
There was one automatic site that exceeded the annual mean objective in 2019. This was the SAQD site, INV03 on Queensgate within the AQMA and returned an annual mean of 43ug/m3. It is noted however that relevant exposure at this site is not at street level, being residential flats at first floor and above. Site INV04 began

monitoring during 2019 and is sited with the sampling intake at a height that will represent residential relevant exposure within the AQMA. The reported annual mean for INV04 was 31ug/m3, however only 5% data collection for 2019 occurred for the site so care is needed in interpretation of the result. A more reliable picture of the exposure at first floor level should be available for the 2020 measurement year.

In addition two diffusion tube locations exceeded the annual mean objective in 2019, both within the AQMA. One of these was the colocation study sited at INV03 (tube numbers IV3H, IV3K and IV3L). The other was IV9A, which is within the AQMA and is a kerbside monitoring point on the opposite side of the street from relevant exposure.

The automatic site INV03 has seen an increase in annual mean concentration from 2018 to 2019 of around 15%. It is believed that this may be due to the changes in traffic flow along Academy Street as a result of temporary construction works at a development site towards the west end of Academy Street. This construction work also resulted in the temporary relocation of a bus stop on Academy Street to Union Street. The number of bus movements through Queensgate will have increased because of this.

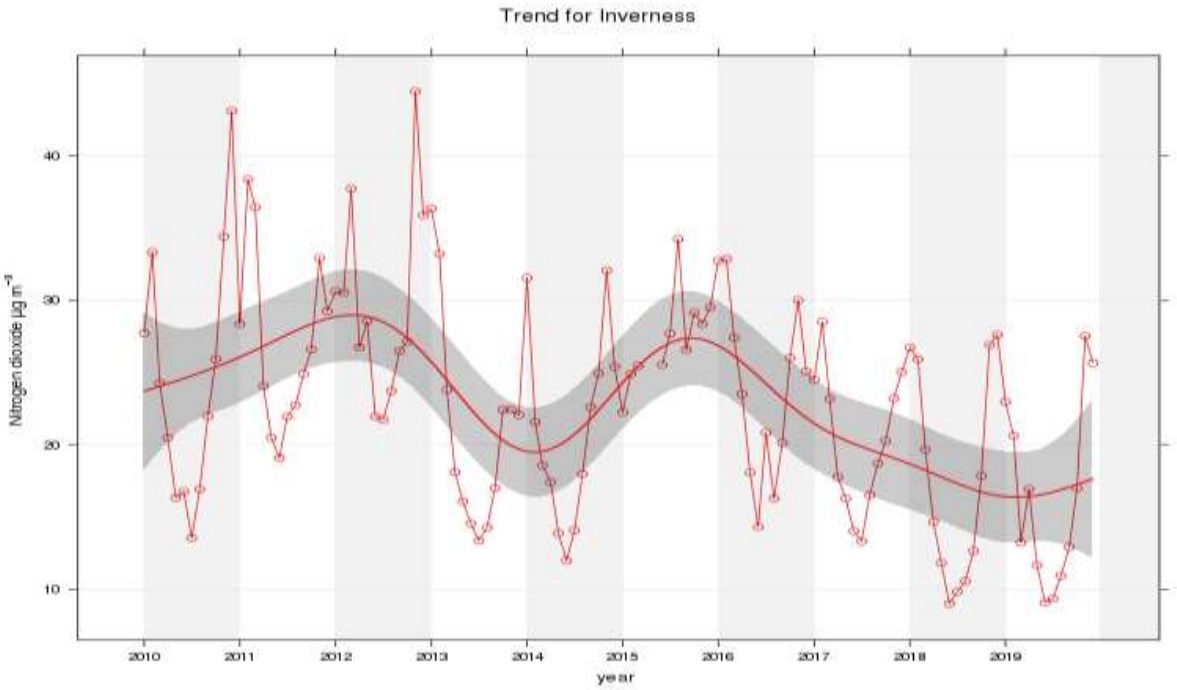
Figure C - Inverness Academy Street INV03 Trend 2016 - 2019



The combination of less efficient traffic flow along Academy Street and the increased bus movments through Queensgate have resulted in an increase in Nitrogen dioxide concentrations but it is expected that concentrations will reduce again once the normal flow of traffic is resumed.

At INV02 Telford Street a trend of reduction in Nitrogen dioxide annual mean concentrations over the previous 10 years has been noted.

Figure D - Inverness INV02 trend 2010 - 2019



1-hour Mean Objective

There were no exceedances of the 1-hour mean objective in 2019.

3.2.2 Particulate Matter (PM_{10})

Error! Reference source not found. in Appendix A compares the ratified and a djusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 18µg/m^3.

Error! Reference source not found. in Appendix A compares the ratified c ontinuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 7 times per year.

There were no exceedences of the PM10 objectives in 2019

3.2.3 Particulate Matter ($PM_{2.5}$)

Error! Reference source not found. in Appendix A compares the ratified and a djusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years with the air quality objective of 10µg/m^3.

There were no exceedances of the PM2.5 objectives in 2019

3.2.4 Sulphur Dioxide (SO_2)

The Highland Council does not undertake any monitoring for Sulphur dioxide.

3.2.5 Carbon Monoxide, Lead and 1,3-Butadiene

The Highland Council has not undertaken any monitoring for these pollutants.

4. New Local Developments

4.1 Road Traffic Sources

There are no new narrow congested streets with residential properties close to the kerb; busy streets where people may spend one hour or more close to traffic; roads with a high flow of buses and/or HGVs; junctions; new roads constructed or proposed; roads with significantly changed traffic flows; and bus or coach stations.

Spaces for People initiative which emerged from the COVID19 response has led to changes to traffic layout at a number of locations throughout the city. No specific areas have been identified as affecting relevant receptors, however the changes are fluid and subject to revision so this area will be observed to ascertain if further air monitoring is required.

4.2 Other Transport Sources

There are no new airports; locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m; locations with a large number of movements of diesel locomotives, and potential long-term exposure within 30m; or ports for shipping.

4.3 Industrial Sources

There are no new industrial installations; or existing installations where emissions have substantially increased; or new or significantly changed installations with no previous air quality assessment.

There are no new major fuel storage depots storing petrol, petrol stations, or poultry farms.

4.4 Commercial and Domestic Sources

The following new biomass combustion plant installations were identified in 2019.

Ashley Ann, Wick

Keeper's Cottage, Lairg

Aldourlie Castle, Inverness

Farness, Poyntzfield

Udale, Poyntzfield

Home Farm, Ardourlie, Inverness

All sites were screened out of further consideration in terms of LAQM at the development planning stage.

4.5 New Developments with Fugitive or Uncontrolled Sources

There were no new potential sources of fugitive or uncontrolled particulate matter identified.

5. Conclusions and Proposed Actions

5.1 Conclusions from New Monitoring Data

No new potential exceedance has been identified, out with the existing AQMA.
A significant localised increase in Nitrogen dioxide concentration in the 2019 monitoring year was identified. It is believed that this increase is a short-term variance caused by unusual traffic conditions in the area for part of the year

5.2 Conclusions relating to New Local Developments

No new local developments were considered beyond initial screening.

5.3 Proposed Actions

New monitoring data has not identified any new exceedances of the objectives. An increase in Nitrogen dioxide concentrations in and around the AQMA was noted in 2019. The Highland Council will continue to monitor Nitrogen dioxide levels in and around the AQMA. Data will become available in the 2020 monitoring year from the collocated street level and first floor level automatic monitoring within the AQMA.

There is no evidence to suggest that the boundary of the AQMA should be modified or that at present it should be revoked.

The Highland Council will submit the next Air quality Annual Progress Report and will continue to work towards the implementation of action plan measures

Appendix A: Monitoring Results

Table A. 1 – Detail of automatic monitoring sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
INV02	Inverness	Roadside	265709	845670	NO2; PM10; PM2.5	N	Chemiluminescent (2018 onwards) Daily Gravimetric (until 2017)	2.5	4	3
FW	Fort William	Suburban	210857	774431	NO2; Ozone	N	Chemiluminescent	77	47	2.5
SV	Strath Vaich	Rural	234831	875029	Ozone	N	Chemiluminescent	717	n/a	3
INV03	Inverness Academy Street	Roadside	266650	845446	NO2	Y	Chemiluminescent	0	4	1.3
INV04	Inverness Academy Street First Floor	Roadside	266650	845446	NO2	Y	Chemiluminescent	0	4	5

(1) 0 if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A. 2 - Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
IV1	Union Street	Roadside	266681	845361	NO2	N	0	4	N
IV2E	Academy Street E	Kerbside	266610	845487	NO2	N	1.5	1.5	N
IV2F	Academy Street F	Roadside	266629	845473	NO2	N	N/A	2	N
IV2G	Academy Street G	Roadside	266704	845413	NO2	N	N/A	2	N
IV3A	Queensgate A	Roadside	266650	845428	NO2	Y	0	4	N
IV3C	Queensgate C	Roadside	266609	845404	NO2	N	0	4	N
IV3H	Queensgate H	Roadside	266650	845446	NO2	Y	0	4	Y
IV3K	Queensgate K	Roadside	266650	845446	NO2	Y	0	4	Y
IV3L	Queensgate L	Roadside	266650	845446	NO2	Y	0	4	Y
IV4A	Telford Street A	Roadside	265710	845672	NO2	N	2.5	4	Y
IV4B	Telford Street B	Roadside	265710	845672	NO2	N	2.5	4	Y
IV4C	Telford Street C	Roadside	265710	845672	NO2	N	2.5	4	Y
IV6A	Church Street A	Roadside	266586	845337	NO2	N	0	2	N
IV6B	Church Street B	Roadside	266513	845476	NO2	N	2.5	2.5	N
IV8	Margaret Street	Roadside	266654	845532	NO2	N	0	3	N
IV9A	Academy St /Queensgate A	Kerbside	266666	845441	NO2	Y	N/A	3	N
IV9B	Academy St /Queensgate B	Kerbside	266657	845447	NO2	Y	3.5	0.5	N
IV9C	Academy St /Queensgate C	Roadside	266677	845451	NO2	Y	N/A	2	N
IV9D	Academy St /Queensgate	Kerbside	266659	845467	NO2	Y	2.5	0.5	N

RC1	Wyvis Terrace, Dingwall	Roadside	254430	858968	NO2	N	7.5	1	N
RC2	Station Road, Dingwall	Roadside	255200	858185	NO2	N	0	1	N
RC3	Kintail Place, Dingwall	Urban Background	255112	859866	NO2	N	4	1	N
RC4	Burns Crescent, Dingwall	Urban Background	254420	859288	NO2	N	4	1	N
FW1A	McAndie Court, Fort William	Roadside	211342	774369	NO2	N	3	2.5	N
FW1B	McAndie Court, Fort William	Roadside	211355	774386	NO2	N	0	5	N
FW1C	Belford Road, Fort William	Roadside	211148	774294	NO2	N	6.8	2	N
FW1D	Belford Road, Fort William	Roadside	210818	774188	NO2	N	10	2	N
IV11	George Street, Inverness	Roadside	266567	845743	NO2	N	10	1	N
IV12	Innes Street, Inverness	Roadside	266639	845759	NO2	N	2	1	N
IV13A	Tomnahurich Street A, Inverness	Roadside	266353	845060	NO2	N	2	0	N
IV13B	Tomnahurich Street B, Inverness	Roadside	266311	845049	NO2	N	2	0	N
IV13C	Tomnahurich Street C, Inverness	Roadside	266274	845020	NO2	N	2	0	N
IV13D	Central Primary School, Inverness	Roadside	266285	845116	NO2	N	N/A	13	N

N1A	**Bridge Street, Nairn**	**Roadside**	**288660**	**85663**	**NO2**	**N**	**N/A**	**2**	**N**
N1B	**Boath Terrace, Nairn**	**Roadside**	**288698**	**856538**	**NO2**	**N**	**3**	**2**	**N**
N2A	**Asher's Court, Nairn**	**Roadside**	**288561**	**856628**	**NO2**	**N**	**0**	**2**	**N**
N2B	**St Ninian Road, Nairn**	**Roadside**	**288510**	**856654**	**NO2**	**N**	**2**	**2**	**N**
RC5	**Dingwall 15N, Dingwall**	**Roadside**	**254719**	**858767**	**NO2**	**N**	**0**	**5**	**N**

(1) 0 if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property).

(2) N/A if not applicable.

Table A. 3 - Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2015	2016	2017	2018	2019
INV02	Roadside	Automatic	99	99	25	24	20	18	16
INV03	Roadside	Automatic	75	75			38	38	**43**
INV04	Roadside	Automatic	23	5					31
FW	Suburban	Automatic	99	99	13	10	10	9	8.1
IV1	Roadside	Diffusion Tube	100	100	20	27	20	19	25
IV2E	Roadside	Diffusion Tube	91.7	91.7	37	37	35	35	34
IV2F	Roadside	Diffusion Tube	75	75	38	**42**	**40**	36	38
IV2G	Roadside	Diffusion Tube	100	100	39	**46**	**42**	35	37
IV3A	Roadside	Diffusion Tube	100	100	32	38	36	35	38
IV3C	Roadside	Diffusion Tube	100	100	35	37	31	30	33
IV3H	Roadside	Diffusion Tube	100	100		33	38	38	**41**
IV3K	Roadside	Diffusion Tube	100	100		33	38	38	**41**
IV3L	Roadside	Diffusion Tube	100	100		33	39	38	**41**
IV4A	Roadside	Diffusion Tube	100	100	21	25	20	17	16
IV4B	Roadside	Diffusion Tube	83.3	83.3	21	25	21	17	17
IV4C	Roadside	Diffusion Tube	100	100	21	25	21	17	17
IV6A	Roadside	Diffusion Tube	100	100	25	32	25	23	27
IV6B	Roadside	Diffusion Tube	100	100	17	18	19	21	18
IV8	Roadside	Diffusion Tube	100	100	22	24	23	21	22
IV9A	Kerbside	Diffusion Tube	100	100	**45**	**50**	**47**	**42**	**45**
IV9B	Kerbside	Diffusion Tube	100	100	36	29	30	34	38
IV9C	Roadside	Diffusion Tube	100	100	33	38	**43**	39	**40**
IV9D	Kerbside	Diffusion Tube	100	100	32	27	28	33	34
RC1	Roadside	Diffusion Tube	91.7	91.7	18	14	14	21	20

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2015	2016	2017	2018	2019
RC2	Roadside	Diffusion Tube	100	100	28	32	34	30	30
RC3	Urban Background	Diffusion Tube	100	100	7	8	7	8	8
RC4	Urban Background	Diffusion Tube	100	100	8	8	8	11	9
FW1A	Roadside	Diffusion Tube	100	100			17	21	21
FW1B	Roadside	Diffusion Tube	100	100			16	19	18
FW1C	Roadside	Diffusion Tube	100	100			13	21	19
FW1D	Roadside	Diffusion Tube	100	100			12	24	22
IV11	Roadside	Diffusion Tube	100	75					18
IV12	Roadside	Diffusion Tube	100	75					19
IV13A	Roadside	Diffusion Tube	100	8.3					22
IV13B	Roadside	Diffusion Tube	100	8.3					29
IV13C	Roadside	Diffusion Tube	100	8.3					25
IV13D	Roadside	Diffusion Tube	100	8.3					19
N1A	Roadside	Diffusion Tube	100	33.3					18
N1B	Roadside	Diffusion Tube	100	33.3					19
N2A	Roadside	Diffusion Tube	100	33.3					25
N2B	Roadside	Diffusion Tube	100	33.3					33
RC5	Roadside	Diffusion Tube	100	50					18

Notes: Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A. 4 - 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2015	2016	2017	2018	2019
INV02	Roadside	Automatic	99	99	0(106)	0	0	0	0
INV03	Roadside	Automatic	75	75		0(115)	0	0	0(143.7)
INV04	Roadside	Automatic	23	5					0(95.1)
FW	Suburban	Automatic	99	99	0(70)	0	0	0	0

Notes: Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A. 5 - Annual Mean PM10 Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2015	2016	2017	2018	2019
INV02	Roadside	89	89	9	9	10	9	9

Notes: Exceedances of the PM_{10} annual mean objective of 18µg/m^3 are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A. 6 - 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2015	2016	2017	2018	2019
INV02	Roadside	89	89	0	0	0	0	0

Notes: Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 7 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 98.1st percentile of 24-hour means is provided in brackets.

Table A. 7 Annual Mean $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
				2015	2016	2017	2018	2019
INV02	Roadside	88	88	5	5	4	6	5

Notes: Exceedances of the PM_{10} annual mean objective of $10\mu g/m^3$ are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B. 1 - NO_2 Monthly Diffusion Tube Results for 2019

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted (1)
IV1	30.38	25.25	25.73	35.10	31.43	30.24	34.48	21.33	28.55	26.24	34.50	25.60	29.07	25.00
IV2E	43.24	47.07	33.91	48.76		35.09	43.36	30.18	36.70	38.02	41.36	43.49	40.11	34.49
IV2F	49.98	51.83	41.52	52.39		36.77		34.96	41.90		42.94	44.96	44.14	37.96
IV2G	50.86	49.71	43.62	57.11	40.55	40.89	44.68	33.26	38.14	38.97	41.62	38.37	43.15	37.11
IV3a	51.00	52.49	43.21	58.83	43.80	37.71	46.53	35.60	39.10	39.35	45.54	41.51	44.56	38.32
IV3c	38.57	42.16	40.17	49.66	39.95	39.31	47.27	27.29	34.63	33.77	37.87	35.32	38.83	33.39
IV3h	52.09	48.43	43.30	46.47	39.52	39.16	47.06	34.41	39.18	35.35	43.43	34.16	41.88	40.62
IV3k	51.45	49.11	46.15	43.85	46.17	40.97	48.44	32.88	41.82	33.15	39.51	39.99	42.79	41.51
IV3l	50.94	52.05	50.04	46.88	45.78	39.58	46.10	31.59	38.36	33.90	36.81	41.15	42.77	41.48
IV4a	29.71	37.20	18.07	22.13	12.28	14.57	16.33	15.50	20.69	21.74	25.02	27.46	21.73	16.51
IV4b	30.51	34.89	19.81	22.29		13.78	16.94	15.86		20.75	27.24	24.33	22.64	17.21
IV4c	30.90	35.23	19.08	22.48	15.76	12.53	17.23	15.18	19.60	20.11	26.82	27.25	21.85	16.60
IV6a	32.26	32.09	25.81	39.68	29.95	28.24	32.47	22.36	30.24	29.49	38.53	31.12	31.02	26.88

Site ID	NO_2 Mean Concentrations (µg/m^3)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted (1)
IV6b	22.01	23.74	19.46	27.63	19.58	19.38	21.35	14.21	19.26	19.99	27.43	20.38	21.2	18.23
IV8	30.08	28.12	20.69	32.15	25.37	22.47	29.86	17.49	24.90	24.65	30.40	26.59	26.06	22.42
IV9a	60.26	63.72	52.45	57.71	39.86	50.14	66.36	42.66	48.82	44.12	50.72	55.10	52.66	45.29
IV9b	46.19	51.98	42.61	50.32	48.86	40.62	43.67	37.60	44.25	38.22	44.92	42.62	44.32	38.12
IV9c	49.34	50.20	45.43	56.62	52.29	45.11	50.82	37.65	46.29	35.76	47.93	45.97	46.95	40.38
IV9d	43.24	38.35	34.92	53.24	44.36	43.18	43.30	26.21	39.72	34.86	45.22	35.16	40.15	34.53
IV11				29.85	18.95	15.23	18.97	13.78	21.14	20.61	22.36	24.13	20.56	17.68
IV12				32.79	20.47	14.74	21.25	10.02	21.69	22.55	27.53	24.82	21.76	18.72
IV13A										24.90			24.90	21.41
IV13B										32.79			32.79	28.20
IV13C										28.24			28.24	24.29
IV13D										20.97			20.97	18.03
RC1	34.19	28.89	18.45	19.07	15.89	14.02	17.13	13.74	20.26	20.93	30.14		21.16	19.67
RC2	45.25	38.81	27.85	33.41	29.95	27.23	27.50	21.56	29.73	32.86	41.21	35.54	32.58	30.29
RC3	14.13	12.66	7.13	7.81	5.21	4.92	5.86	3.90	6.93	7.42	12.32	10.19	8.21	7.63
RC4	18.02	13.85	8.09	9.01	6.42	5.51	5.15	5.50	7.57	9.82	12.50	15.97	9.78	9.10
FW1A	32.85	22.58	17.48	22.71	22.80	18.76	17.10	16.96	20.14	26.86	26.74	21.52	22.21	20.65

Site ID	NO_2 Mean Concentrations (µg/m^3)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted (1)
FW1B	27.85	17.52	17.20	16.98	24.46	19.22	17.02	15.36	19.85	20.36	25.35	18.01	19.93	18.54
FW1C	30.14	21.11	18.02	23.55	25.33	19.65	19.89	18.52	19.62	23.77	6.32	19.40	20.44	19.01
FW1D	26.57	23.46	22.79	25.09	28.99	22.10	21.22	22.11	22.00	23.44	24.39	20.12	23.52	21.88
RC5					15.95	12.37	16.41	10.02	15.94	17.78			14.75	13.71
N1A									18.94	17.43	28.71	17.41	20.62	19.18
N1B									19.21	24.27	23.62	22.95	22.51	20.94
N2A									27.99	27.70	26.51	34.85	29.26	27.21
N2B									39.36	39.55	27.49	46.42	38.21	35.53

(1) See Appendix C for details on bias adjustment

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

Adjustment of data to account for short term monitoring

Adjustments were made to the diffusion tube results of the sites identified in the table below to take account of short monitoring periods. The method described in the LAQM.TG(16) has been followed in making this adjustment. The Nitrogen dioxide concentrations reported in the main document have been corrected for the sites identified in the table with the Mean Ra value.

The calculation was undertaken for: the four new sites in Nairn, operating from September onwards; the site RC5 in Dingwall operating for 6 months from May to October; and the four sites identified as IV13 in Inverness which operated for one month (October) only.

Automatic background site data from Aberdeen and Edinburgh were used in all these calculations.

Table C. 1 - Period Mean Adjustment Calculation Outputs (Nitrogen dioxide)

Site(s)	Am	Pm	Ra
RC5 (Nitrogen dioxide)			
Aberdeen Errol Place	16.75	13	1.29
Edinburgh St Leonards	20.5	15.7	1.31
		Mean Ra	**1.298**
N1A, N1B, N2A, N2B (Nitrogen dioxide)			
Aberdeen	16.75	18.25	0.92
Edinburgh	20.5	22	0.93
		Mean Ra	**0.925**
IV13A, IV13B, IV13C, IV13D (Nitrogen dioxide)			
Aberdeen	16.75	18	0.93
Edinburgh	20.5	18	1.14
		Mean Ra	**1.035**

Adjustment of Data to Account for Distance from Carriageway

Nitrogen dioxide concentrations fall away sharply with distance from the carriageway. Where the monitoring location is nearer, or further away, from the carriageway than the location of relevant exposure a correction can be applied to the concentrations reported.

The NO2 Fall off with Distance from Roads Calculator version 4.2, produced by Bureau Veritas has been used to make this correction.

Table C. 2 - Distance from Roads Calculator Outputs.

Site ID	Distance (m)		Nitrogen dioxide Annual Mean (ug/m3)		
	Monitoring site to Kerb	Receptor to Kerb	Background Concentration	Measured Concentration (bias adjusted)	Predicted Concentration at receptor
INV02 IV4	4.0	6.5	8.3	16	15
IV2E	1.5	3.0	9.2	34	30.2
IV6B	2.5	5.0	9.2	18	16.5
IV9B	0.5	4.0	9.2	38	27.4

IV9D	0.5	3.0	9.2	34	26.1
RC1	1.0	8.5	3.0	19.7	12.5
FW1A	2.5	5.5	4.9	19	16.2
FW1C	2.0	8.8	4.9	18	13.4
FW1D	2.0	10	3.1	20	13.6
IV11	1.0	11.0	9.2	18	13.7
IV12	1.0	3.0	9.2	19	16.8
N1B	2.0	5.0	4.7	19	16.2
N2B	2.0	4.0	4.7	32.9	28.3

Choice of Bias Adjustment Factor for diffusion tube monitoring

A bias adjustment factor is applied to diffusion tube monitoring results to account for bias between diffusion tube results and a reference method automatic monitor.

Bias adjustment factors are derived by undertaking a colocation study, where diffusion tubes are exposed alongside an automatic monitor.

There are two local colocation studies being undertaken in Highland. Both are in Inverness at the automatic monitoring stations on Telford Street (IV4) and Queensgate (IV3).

The 2019 bias adjustment factor obtained by the Telford Street study was 0.76. This study included 12 periods of data with good precision.

The Queensgate study returned a bias adjustment factor of 0.97. This study included 9 periods of data with good precision.

The two factors have been used to generate a combined local bias factor of 0.86.

DEFRA compiles a database of colocation studies from which can be obtained a national combined bias adjustment factor. The combined bias adjustment factor for Gradko 20% TEA in Water for 2019 is 0.93 and is based upon 27 studies.

LAQM.TG(16) provides advice as to which bias factor (local or national combined) should be used but ultimately states that it is up to a local authority to decide which factor is most appropriate to use in their particular circumstance.

The following decisions have been made in relation to the application of bias factors to diffusion tube monitoring data obtained by The Highland Council in 2017.

- Sites IV4(A,B&C) and IV3(H,K&L) – these are the two co location study sites so the local bias adjustment factor for each site (Bias 1 and Bias 2 respectively) has been applied to the reported data.
- All sites starting FW, RC and N – the National database combined bias adjustment factor (Bias 4) has been applied to these sites as they are geographically distant from both local co location studies.
- All other sites have been adjusted with the combined local bias factor (Bias 3).

As an example of how choice of bias can influence reported pollutant concentrations the table below shows the resultant concentration with each bias applied for some of the diffusion tube sites with the highest concentration in this study.

Table C. 3 - Bias Adjustment Examples

Site ID	Raw Data	Bias 1 (0.76)	Bias 2 (0.97)	Bias 3 (0.93)	Bias 4 (0.86)
IV9A	**52.66**	40.02	51.08	48.97	**45.28**
IV9C	**46.95**	35.68	45.54	43.66	**40.38**
IV3A	**44.56**	33.87	43.22	41.44	38.32
IV9B	**44.32**	33.68	42.99	41.21	38.11
IV2F	**44.14**	33.54	42.81	41.05	37.96
IV2G	**43.15**	32.79	41.85	40.13	37.11
IV2E	**40.11**	30.48	38.91	37.30	34.49

QA/QC of Automatic Monitoring

The AURN sites in Highland are operated for DEFRA by Bureau Veritas with QA/QC provided by Ricardo E and E.

Site IV3 is operated by The Highland Council as part of the Scottish Air Quality Database (SAQD). QA/QC for the SAQD is provided by Ricardo E and E.

QA/QC of diffusion tube monitoring

Gradko, who supply and analyse the tubes reported here, have supplied the following QA/QC statement:

Supply and Analysis of Nitrogen Dioxide (NO2) Diffusion Tubes

Analysis of the NO2 diffusion tubes is carried out using ion chromatography techniques in accordance with Gradko International Ltd U.K.A.S. accredited (ISO/IEC 17025) internal laboratory procedure GLM 7, which is a recommended UV spectrophotometric method. Reporting of the NO2 analysis results is sent to electronically to each authority in PDF format or if requested EXCEL format. The report is issued within 10 working days from receipt of the exposed diffusion tubes to the Gradko Laboratory.

Quality Assurance: The laboratory has a fully documented Quality Management System, which has been assessed and accredited by U.K.A. S. (Accreditation No. 2187). A copy of the Quality Manual Contents Index is available on request.

Quality Control Procedures: All tube components are maintained in a high state of cleanliness. New absorbent is prepared by the Laboratory and checked for levels of nitrogen dioxide.
The diffusion tubes are prepared in a dedicated clean laboratory and stored under refrigerated conditions to maintain stability. A sample of each batch of tubes prepared is checked by the analyst for blank levels. If the tubes are stored for more than one week, a further sample is taken and checked for any increases in blank levels. If the levels reach a pre-determined value, the batch of tubes is discarded

Analytical Quality Control Procedures are implemented by the use of internal standards checks using certified standards from two different sources, and the use of external proficiency schemes such as AIR/PT Scheme.

AIR is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combined two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.
https://laqm.defra.gov.uk/assets/laqmno2performancedatauptonovember2019v1.pdf
100% of submissions by Gradko to the proficiency scheme were satisfactory over the monitoring period, apart from the round AR030 during which 75% of submissions were satisfactory.

Tube Exposure Procedure

The Highland Council exposes diffusion tubes according to the method described in “Passive Diffusion Air Monitors – Instruction Manual for Exposure and Location” by Gradko International Ltd. Guidance is also found in “Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance” by AEA for DEFRA.

Appendix D – Maps of Monitoring Locations

Figure E – Automatic Sites – Highland (see below for detail of Inverness sites)

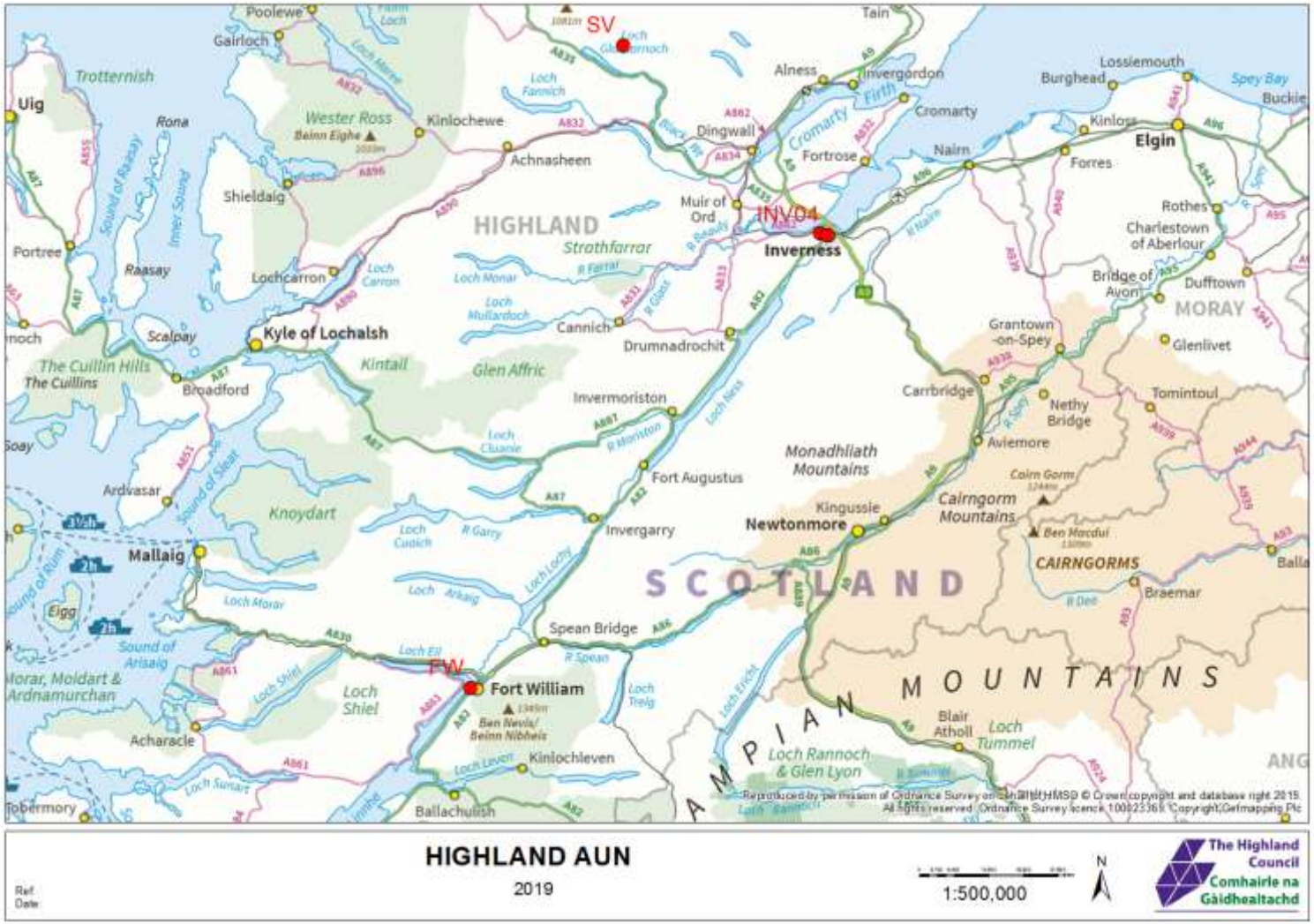


Figure F - Automatic Site - Inverness

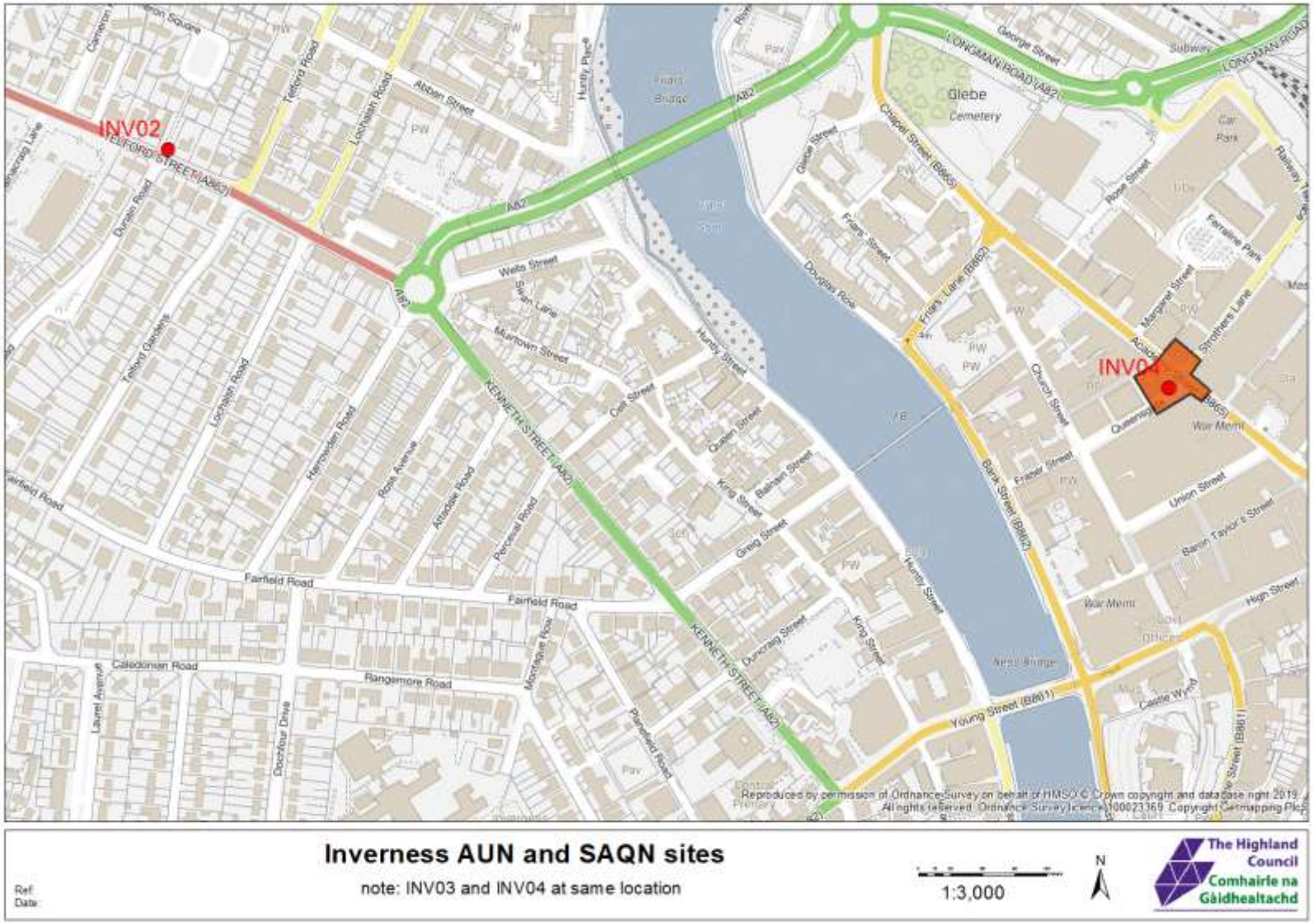


Figure G - Inverness diffusion tube sites (see below for detail of city centre sites)

Figure H - Diffusion tube sites - Inverness City Centre

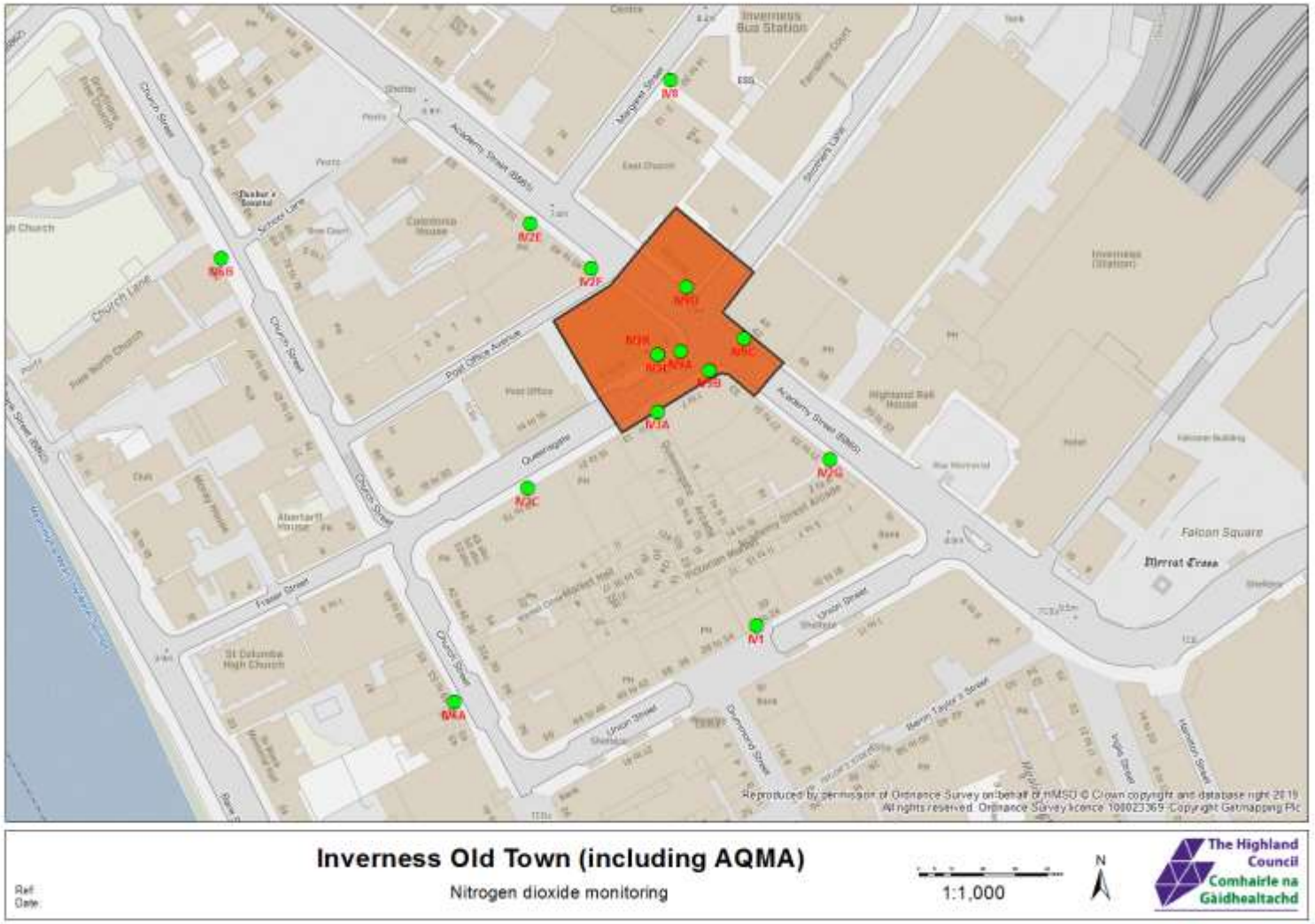


Figure I - Diffusion tube sites - Dingwall

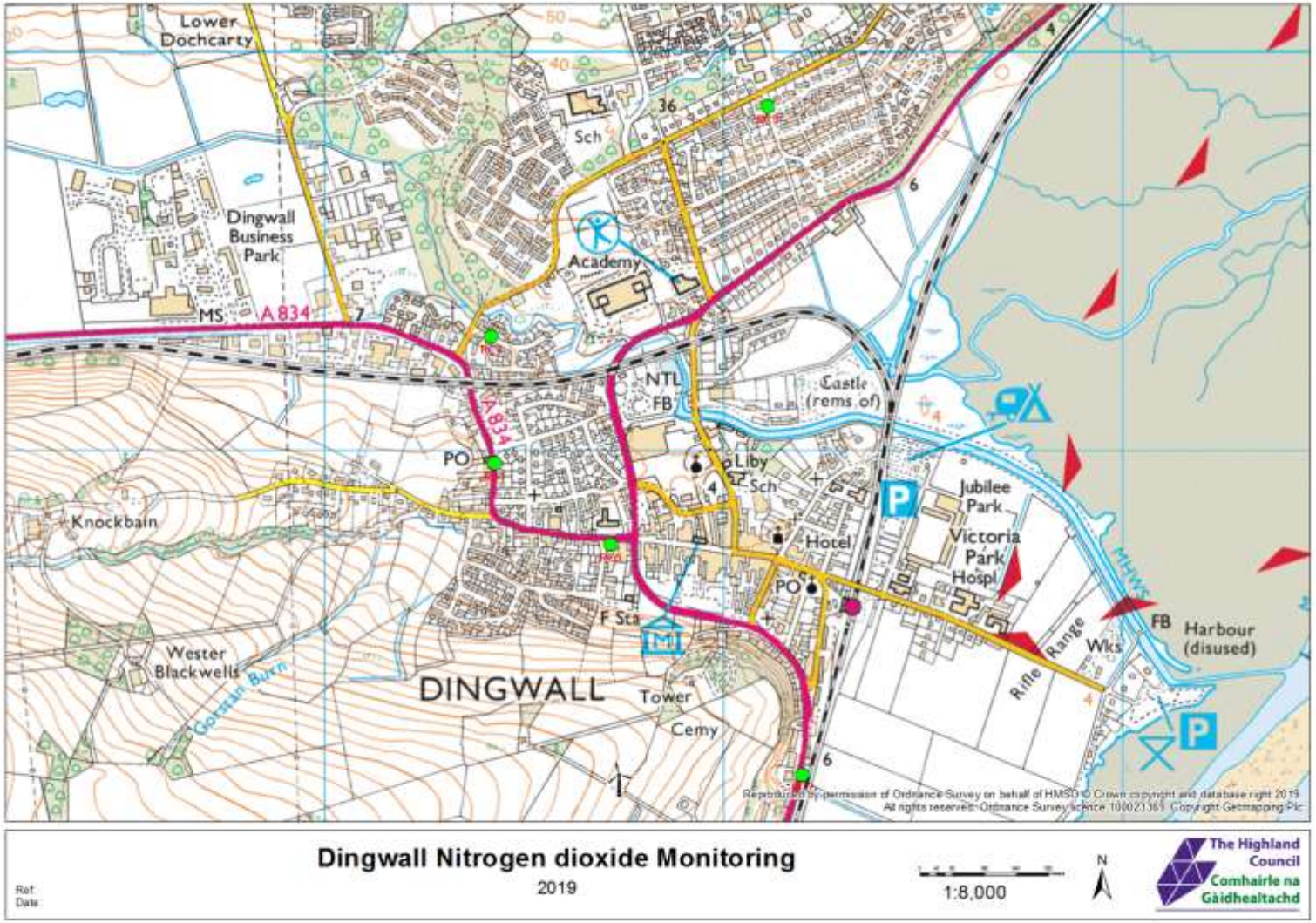
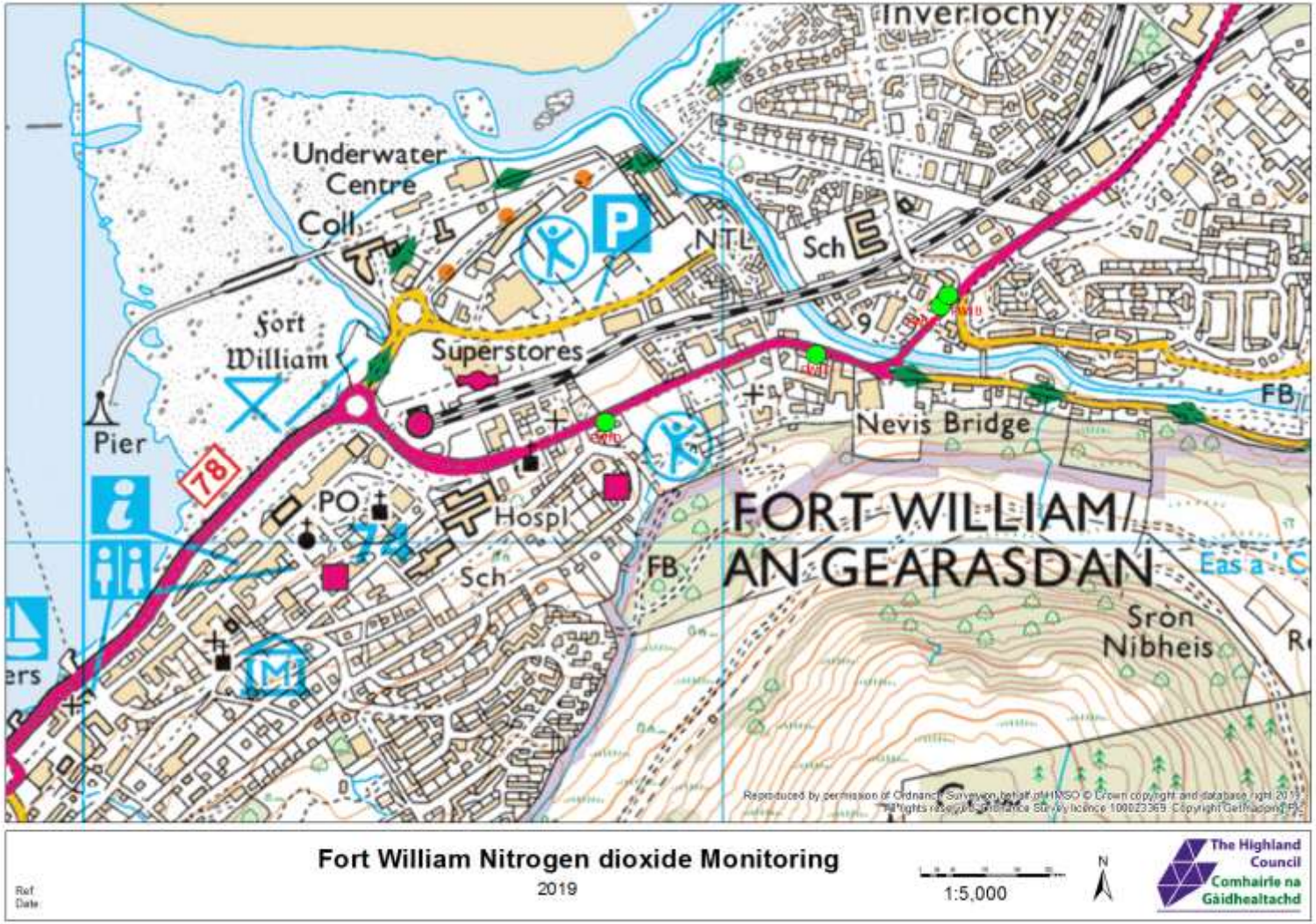


Figure J - Diffusion tube sites - Nairn

Figure K - Diffusion tube sites - Fort William



Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
APR	Air quality Annual Progress Report
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SAQN	Scottish Air Quality Network
SO_2	Sulphur dioxide

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