Appendix 4

Monitoring and Evaluation Plan

1. Introduction

This document sets out how Derby City Council will observe and record changes in air quality and traffic variables as part of our scheme monitoring. It also proposes how we will understand the effectiveness of our different interventions through our evaluation. It seeks to address the key requirements of the monitoring and evaluation process, as set out in the Monitoring and Evaluation Note provided by JAQU on 23 October 2018.

Derby City Council's preferred option contains a primary abatement measure (to be funded by the Implementation Fund) and mitigation measures (to be funded by the Clean Air Fund) as follows:

1. A traffic management and network management solution, including required physical changes at key junctions (*abatement*) and alternative routes

2. Strategic EV charging infrastructure provision and supporting measures, for example traffic management measures to support EV usage

3. Clean Air Incentive scheme using mobility credits

2. Key outcomes

The local authority identifies that the key outcomes of the policy are:

2.1. Overall programme
a. Improved air quality (both NO_2 and PM concentrations)
b. Contribution to improved public health
c. Improved asset management to halt structural deterioration to ensure network availability

2.2 Traffic management and wider network management (Junction alterations, signals upgrades & UTMC)
a. Changes in journey patterns due to traffic redistribution without creating new sites of exceedance
b. Fewer journeys being taken through the area of exceedance by motor vehicle
c. Reduced vehicle emissions in the site of exceedance

2.3. Clean Air Incentive Scheme (CAIS) – Mobility Credits
a. Greater proportion of low emission, active travel, sustainable transport trips
b. Fewer trips made by car (petrol / diesel)

2.4. Electric Vehicle (EV) charging infrastructure and supporting measures
a. Delivery of a network of electric vehicle charging infrastructure across Derby (to improve the viability of increased EV uptake)

b. Increased use of electric vehicle infrastructure

3. Derby's Monitoring and Evaluation overview

The data collected will be used to assess the ongoing success of the preferred option. Traffic flow data capture will be continuous, as part of the preferred option delivery, to support network wide dynamic traffic management. This will allow the scheme to be closely monitored on an ongoing basis and adapted where necessary if potential issues or improvements are identified. The wider network management improvements have been specifically designed to be a dynamic system which can be used to react to any issues.

Feedback and analysis of Clean Air Fund (CAF) measures will also help to identify key areas of success and modify scheme elements where appropriate to ensure that delivery targets continue to be met.

3.1 Quarterly Data to be supplied to JAQU

Data collected will include traffic flows and NO_2 concentration on a quarterly basis. Quarterly data, as required by JAQU, will also be assessed by Derby City Council. As data is collated over time it will become possible to compare monthly traffic flow averages year on year, detailing annual patterns and it will be easier to understand overall progress on a rolling basis.

3.2 Vehicle Emissions monitoring

Derby City Council intends to provide quarterly vehicle emissions monitoring data, including NO_2 and particulates, which also have known health implications. The emissions data will also allow the contribution of the traffic flow to the measured diffusion tube data to be better understood. The emissions monitoring will use ANPR data using one week of data per quarter from six sites (the core monitoring area of Stafford St, Uttoxeter Old, Uttoxeter New Road and Friar Gate area).

3.3 Annual Air Quality Modelling

It is proposed that annual evaluation of the impact of the scheme will include air quality modelling. This will use local data to underpin modelling assumptions wherever possible. Traffic flow data for the target core area will be derived from ANPR, provided as AADT by vehicle class for each road link to go into model. ANPR data will be linked to vehicle details to derive updated local fleet composition on an annual basis. The modelling will also make use of the increased network of diffusion tubes data in key locations, including bias corrected NO_2 data for links for model verification and adjustment.

Speed data will be taken annually from Traffic Master data, if possible, for links of interest, or potentially derived from ANPR if the Traffic Master data is not available.

The central core area in the vicinity of Stafford Street will be modelled and updated annually, but the rest of the model will remain as in 2020 to ensure the background is representative without having to renew the whole modelled area each year. PCM receptors will be inserted along all updated links. Results will only be reported for the updated core area.

This methodology is intended to build on the principles and agreed methodologies for modelling in the feasibility study and provide the most accurate possible modelled representation of air quality in Derby, focussed on the area of exceedance

Both the specialised quarterly emissions monitoring and annual modelling will be provided through external consultant support via appropriate procurement processes.

3.4 Data reporting and availability

Derby City Council will share recorded traffic flow and NO_2 concentration data with JAQU every three months as required. The specifications for this data provision have not yet been determined as we are awaiting confirmation from JAQU. Associated estimates of the time and costs of producing these outputs must therefore remain with a high level of uncertainty and are therefore subject to change.

JAQU has specified that the preferred scheme should be in place for a year after compliance is predicted to be achieved without intervention. It is assumed that monitoring data will also need to be provided to JAQU throughout this period and Derby City Council will also continue to monitor and evaluate over this timeframe. In the single exceedance location on Stafford Street, natural compliance is predicted in 2024. The scheme and associated monitoring will therefore continue until the end of the 2025 calendar year.

3.5 Existing Data Availability

Table 1 sets out the availability of existing monitoring and additional opportunities for data capture that are anticipated to be provided as part of the implementation of Derby's preferred option. Figure 1 and 2 provide plans of the current and proposed approximate locations of ATCs ANPR cameras and diffusion tubes.

Table 1 - identifies the availability of existing and expected monitoring

Metric	Type	Data Frequency	Quantity	Control
NO_2 concentrations	Diffusion tube	Monthly	Network across the AQMAs	Local

Metric	Type	Data Frequency	Quantity	Control
Traffic volume & composition of type / euro standard (to be funded as part of scheme implementation)	ANPR (from summer 2019)	Real –time as required and AADT calculations as appropriate. Fleet composition data to be extracted over a neutral period of one to two weeks and processed annually.	(*Subject to agreement with JAQU as part of the preferred scheme bidding process*) This will include six sites in the key core area to facilitate the traffic management scheme and 10 sites to ensure wider network coverage plus a number of additional mobile sites. Wider area cameras to have the flexibility for relocation to allow more detailed analysis in areas of interest. See figure 1 & 2.	Local
Traffic volume	Automatic traffic count	Real-time	45 sites across the highway network	Local
Cycle flows	Automatic counters with optional additional manual counts	Real-time	2 in vicinity of Stafford Street area and key area of re-routing	Local
*Bus patronage	Bus operator ticket sales	Annual	Published once per year	Tertiary (industry)
*Ebike usage figures	Operator data	Available monthly. Annual reporting proposed.	Currently 200 Ebikes over 30 docking stations.	Tertiary (industry)) and Derby City Council in partnership
*Car Club data	Existing and future suppliers			
*EV charging infrastructure delivery and usage	Data from infrastructure provider and Derby City Council	Annual	City wide data were DCC have ownership / managed	Tertiary (industry)) and Derby City Council in partnership
*uptake of supporting traffic management schemes for EVs	Derby City Council		(*Subject to agreement with JAQU as part of the preferred scheme bidding process*)	

Metric	Type	Data Frequency	Quantity	Control
*Council House EV fleet uptake	Operator data	Annual	Single site, 5 EVs	Tertiary (industry) and Derby City Council in partnership
*Mobility credit uptake	Operator data	Annual	Regular (at least annual) report from the assured partner running them mobility credit scheme to detail numbers of vehicles permanently removed from fleet, number of grants allocated and how the grants have been used. (S*ubject to agreement with JAQU as part of the preferred scheme bidding process*)	Tertiary (industry)) and Derby City Council in partnership

*Metrics associated primarily with CAF measures. The extent and purpose of CAF funding awarded will determine which of the metrics remain relevant for reporting.

3.6 Additional Monitoring and Evaluation Requirements

Table 2 sets out the options for fulfilling additional monitoring and evaluation requirements, including preferred options and a cost overview. Further financial breakdown of costs is provided in the financial case.

Table 2 - Proposals / options to address the gaps in the currently available monitoring data

Option	Cost	Coverage	Data Quality	Decision	Funding Source
Install a new continuous analyser	£16k initial then £1300 annually	One site on Stafford Street	Good – continuous readings with uncertainty of +/- 10%	Discounted – JAQU has suggested that diffusion tube data will be adequate at a much lower cost.	Shortfall – discuss with JAQU as set out in guidance
Other continuous monitors e.g. EDAR or NDIR	Variable depending on chosen technology.	One site on Stafford Street	Average continuous readings of emissions	Discounted – does not monitor concentrations, new technology insufficiently	Shortfall – discuss with JAQU as set out in guidance

				tested/accepted	
Install and service 10 new sites for diffusion tube data collection.	£4,650 in total project lifetime	Stafford Street key areas of predicted re-routing	Poor if used in isolation but could complement ANPR data. Monthly readings with uncertainty of +/-25%	Preferred following discussion with JAQU. Cost effective option with adequate information if placed at appropriate intervals.	Shortfall – discuss with JAQU as set out in guidance
Emissions monitoring	£170,735	6 sites for seven days per quarter	Good	Preferred to understand emissions	Shortfall – discuss with JAQU as set out in guidance
Traffic volume ATCs	£97,026 in total project lifetime				
Traffic volume ATC co-location	Six sites at £10k per site £60k	Stafford Street and Uttoxeter Old Road as the key areas of predicted re-routing	Good, continuous	Preferred to enable greater accuracy of flow data on the most important area and validate ANPR data.	Shortfall – discuss with JAQU as set out in guidance
DVLA data processing and reporting					
Analysis and reporting of data by a third party					
Transport modelling	£129k over the period of the project				
Air Quality modelling	£90k over the period of the project				
Surveys and focus groups for qualitative analysis	£5K		Scalable and affected in grant awarded for CAF		

A detailed breakdown of associated staff fees to provide sufficient resource for monitoring and evaluation and provision of required quarterly data to JAQU is provided in the financial case.

4. Qualitative assessment

4.1 Public Health in Derby

Road transport is estimated to be responsible for up to 70% of the harm associated with air pollution. There is a growing evidence base that demonstrates long term exposure to air pollution is harmful at levels well below current air quality limits / targets and is causing a significant morbidity and mortality burden in Derby. By far the largest disease burden attributable to environmental exposure and management of chemicals is related to exposure to air pollution. The local mortality burden attributed to particulate matter (PM2.5) air pollution in Derby City is calculated as being equivalent to 131 deaths and an associated loss to the population of 1,425 life-years. The impact of air pollution affects the whole population, however it disproportionately affects those living in environments close to main transport routes, the most deprived communities, children, older people and those with pre-existing medical conditions such as heart disease and respiratory conditions.

4.2 Public Health Data

Derby City Council will utilise available public health data to supplement the monitoring and evaluation data collected in order to help assess the Local Air Quality Plan's impact on health. This will include the indicators measured through the Public Health Outcomes Framework (PHOF) and the resulting information available in the data tool. PHOF analyses many key indicators of public health including 3.01 which measures "Fraction of mortality attributable to particulate air pollution". PHOF data will also enable Derby to benchmark and compare outcomes with other local authorities. We will also utilise other data sources such as DEFRA background maps to provide estimates of background concentrations for specific pollutants. These can then be used in air quality assessments to better understand the contribution of local sources to total pollutant concentrations.

4.3 Public Perception

The monitoring and evaluation of public perception on air quality will be key in determining people's response, acceptance and engagement with Derby's Local Air Quality Plan. Understanding public perception is critical to inform the design process in determining appropriate measures and an important component of behavior change which plays a major role in the public response to air quality.

In addition to the quantitative measures set out within the monitoring and evaluation plan Derby City Council proposes to supplement this with qualitative data collection. The methodology for measuring public perception will primarily focus on surveys to assess perceived local air pollution, perceived health risks and views on the Local Air Quality Plan and supporting mitigation measures. Focus groups will also be conducted amongst key representative groups to gather further qualitative monitoring and evaluation for the scheme. The survey data will be collected before, post implementation and post mitigation in order to measure the impact of implementation and the success of the mitigation measures. Public perception of local air quality in Derby will be monitored and reported at these key project

stages as an indicator of scheme success and can be used to shape and develop interventions to promote awareness and behavior change.

Three monitoring surveys and three focus groups have been included in the marketing and communications cost as part of the Clean Air Fund (CAF) Bid. If the CAF bid for this activity is not successful this will be an additional cost to the scheme Monitoring and Evaluation, as identified in Table 2.

5. Limitations of the data

5.1 ANPR data

While every effort will be made to ensure the best use of the most appropriate equipment, it is acknowledged that ANPR cameras do not usually achieve 100% data capture. For this reason, co-location studies are planned with new ATC equipment in key locations in the core area, including on Stafford Street and Uttoxeter Old Road. This will allow calibration of the ANPR outputs. Existing ATCs on the wider network will be used to support data collection and ANPR calibration as required, dependant on the allocation of sufficient funding to maintain these ATCs.

5.2 Use of diffusion tubes

Derby City Council does not have any real time air quality monitors. A bid to JAQU for a new roadside continuous analyser through the feasibility study was unsuccessful in 2016. There is one existing real time monitor in Derby located on Bass's Recreation Ground adjacent to Holmes Bridge. This does not belong to the Council and is too far removed from the exceedance location to be of use in monitoring the primary objective of the project i.e. achieving compliance in the shortest time possible.

JAQU have advised that the use of diffusion tubes is suitable for monitoring and evaluation purposes for this project in preference to more costly real time monitors.

However, it should be noted that diffusion tube monitoring is not considered appropriate in terms of compliance monitoring against the EU Directive (2008/50/EC) and the transposed UK Regulations (The Air Quality Standards Regulations 2010). Part A of Annex I of Directive 2008/50/EC clarifies the *data quality objectives for ambient air quality assessment* against the Limit Values, confirming that for "*fixed measurements*", a maximum uncertainty of 15% is permitted for measurements of NO_2. NOx/NO_2 diffusion tubes are stated under DEFRA Guidance Document TG(16) as having an uncertainty of +/-25%. Such a level of uncertainty is only permitted under Part A of Annex I for *"indicative measurements"*, suggesting that diffusion tubes are not appropriate for compliance monitoring against the Directive.

Furthermore, Annex III outlines the requirements for the assessment of ambient air quality and the location of sampling points for the measurement of a number of pollutants, including NO_2. Part C of Annex III confirms the requirements for *microscale siting of sampling points.* Within this section, reference is made to *"the flow around the inlet sampling probe"* and *"the sampler's exhaust outlet"* among other things. It is clear that these are specific references to 'active' sampling techniques (where air is pumped or drawn through the

sampler at a known volume). Clearly such requirements would not apply to diffusion tube monitoring which is a 'passive' sampling technique and which have no 'inlet probe' or 'exhaust outlet'. Consequently, Annex III also seems to clarify that diffusion tubes should not be used for the assessment of ambient NO_2.

The above-mentioned Annex III, Part C requirements are transposed directly into Part 3 of Schedule I of the Air Quality Standards Regulations 2010 and therefore presumably apply equally to the UK Regulations as they do to the EU Directive.

Relying solely upon diffusion tube monitoring is therefore not considered to be compliant with EU Directive 2008/50/EC or the Air Quality Standards Regulations 2010, which require a greater level of data confidence in conjunction with automatic monitoring techniques.

Figure 1

The current and proposed approximate locations of ATCs ANPR cameras and diffusion tubes
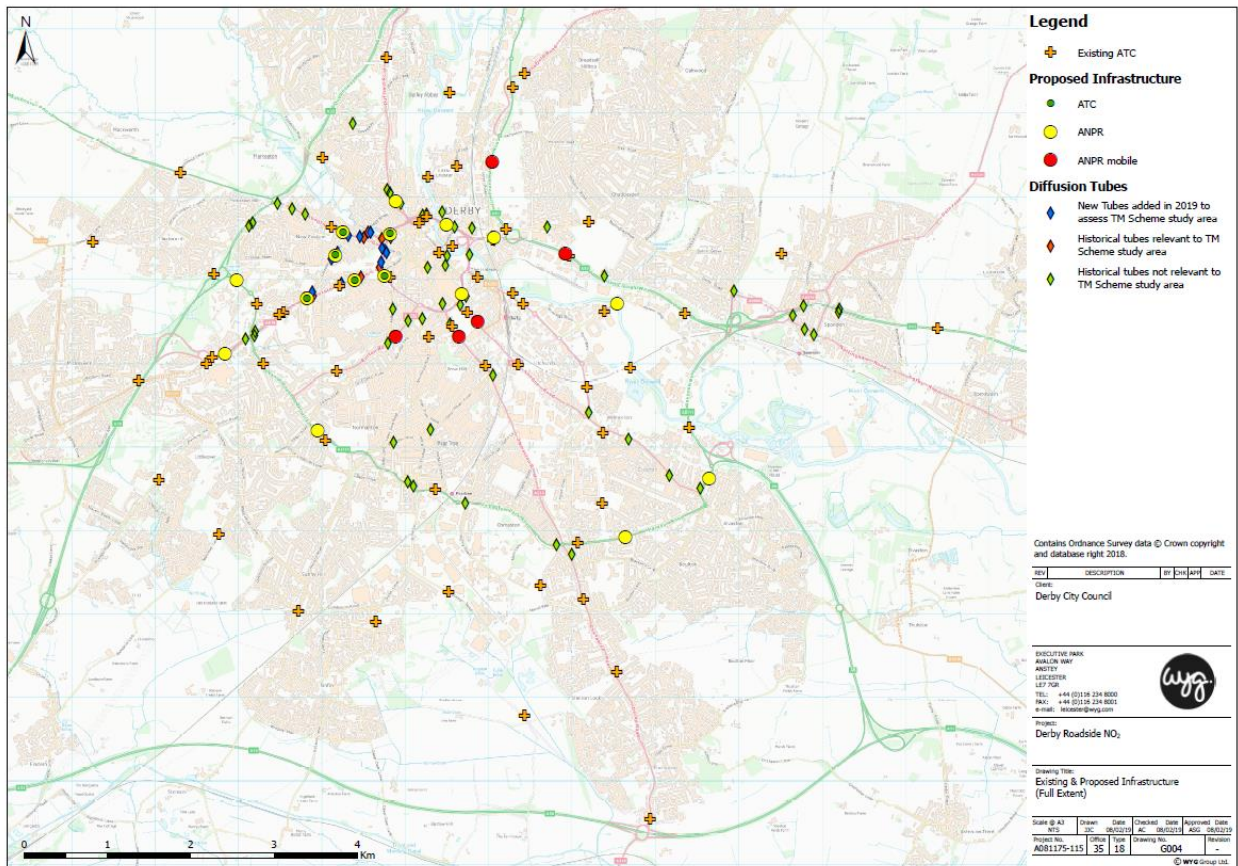
Figure 2

Core Area - current and proposed approximate locations of ATCs ANPR cameras and diffusion tubes