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Bristol City Council Clean Air Plan:
Outline Business Case

Option Assessment Report

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Bristol City Council



Option Assessment Report

Bristol City Council Clean Air Plan

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Acronyms and Abbreviations

AQ	Air Quality
AQC	Air Quality Consultancy
AQMA	Air Quality Management Area
AQAP	Air Quality Action Plan
BCC	Bristol City Council
CAP	Clean Air Plan
CAZ	Clean Air Zone
CSF	Critical Success factors
Defra	Department for Environment, Food & Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EU	European Union
GHG	Green House Gas
HGV	Heavy Goods Vehicle
JAQU	Joint Air Quality Unit
LGV	Light Goods Vehicle
MCA	Multi-criteria assessment
NAEI	National Atmospheric Emissions Inventory
NO _x	Nitrogen oxides
NO ₂	Nitrogen dioxide
NPV	Net Present Value
OBC	Outline Business Case
PCM	Pollution Climate Mapping
PHV	Private Hire Vehicle
PM ₁₀	Particulate Matter with particles less than 10 µm micrometers in diameter
P&R	Park and Ride
SOC	Strategic Outline Case

Executive Summary

This document sets out the option development work for the Bristol Clean Air Zone project. It has been undertaken in four steps comprising of:

- Step 1: Assessment of options proposed in the Strategic Outline Case
- Step 2: Development of Medium area Class D charging option and diesel car exclusion over a small area
- Step 3: Development of Variant 1
- Step 4: Development and assessment of New Option 1, New Option 2, Medium CAZ D+ New Option 1, and Hybrid of New Option 1 and New Option 2

Following the assessments outlined in this document the Hybrid Option has been selected as the preferred option to meet NO₂ compliance in Bristol in line with legal obligations. This option has been modelled as providing compliance across Bristol by 2027, with the exceedance at Church Road responsible for holding back the compliance date until 2027. The Hybrid Option consists of the following measures:

- A charging scheme for non-compliant buses, taxis, HGVs and LGVs, within a medium sized zone.
- A 24hr a day seven days a week HGV weight restriction (3.5 tons) on some of the most polluted routes: Rupert St, Baldwin Street, Park Row/Upper Maudlin Street, Marlborough Street and Lewins Mead
- Bus and local traffic interventions in the most polluting areas; this includes a Park and Ride on the M32, an inbound bus lane on the M32 from Junction 2 to Cabot Circus car park, an inbound bus lane on Cumberland Road, and using existing traffic signals to control the amount of traffic entering congested areas with poor air quality.
- A scrappage scheme (up to £2,000) for private diesel cars. This would provide a grant towards a new vehicle or an alternative mode of transport. Vehicles belonging to residents in Bristol, Bath & North East Somerset, North Somerset and South Gloucestershire would be eligible – as long as their drive into work passes through the charging zone area or they live within charging zone.
- All diesel cars are banned from entering a specific central area from 7am to 3pm 7 days a week (does not apply to taxis or private hire).

The Medium CAZ D+ with New Option 1 Components was also modelled as achieving compliance by 2027. This option involved charging non-compliant cars, buses, taxis, HGVs and LGVs within a medium sized zone, as well as a number of other measures. This option had other locations which held back the compliance date until 2027 and due to this reason, and disproportional disbenefits to low income households and hence this option was not selected as the preferred option.

All the options presented in this report have risks associated with them. The risks for the hybrid are set out in the quantified risk assessment appended to the OBC, OBC -35.

1 Introduction

Poor air quality is the largest known environmental risk to public health in the UK¹. Investing in cleaner air and doing more to tackle air pollution are priorities for the EU and UK governments, as well as for Bristol City Council (BCC). BCC has monitored and endeavoured to address air quality in Bristol. Despite this, Bristol has ongoing exceedances of the legal limits for Nitrogen dioxide (NO₂) and these are predicted to continue until around 2029 without intervention.

In 2017 the government published a UK Air Quality Plan for Nitrogen dioxide² setting out how compliance with the EU Limit Value for annual mean NO₂ will be reached across the UK in the shortest possible time. Due to forecast air quality exceedances, BCC, along with 27 other Local Authorities, was directed by Minister Therese Coffey (Defra) and Minister Jesse Norman (DfT) in 2017 to produce a Clean Air Plan (CAP). The Plan must set out how BCC will achieve sufficient air quality improvements to comply with legal requirements. In line with Government guidance BCC is considering implementation of a Clean Air Zone (CAZ), including both charging and non-charging measures, in order to achieve sufficient improvement in air quality and public health.

BCC are producing an Outline Business Case (OBC) for the delivery of the CAP; a package of measures which will be most likely to bring about compliance with the Limit Value for annual mean NO₂ in the shortest time possible in central Bristol and reduce exposure of people to pollutants as quickly as possible. The OBC assesses the shortlist of options set out in the Strategic Outline Case, and proposes a preferred option including details of delivery. The OBC forms a bid to central government for funding to implement the CAP.

This document is written to support the OBC and provides an overview of the option selection process, both for charging and non-charging measures. This document supersedes the draft Option Assessment Report prepared in January 2019 in support of the draft economic case that was also prepared in January 2019.

1.1 Funding Sources

There are five main funding sources for the implementation of CAZ. These are:

- **A £255 million Implementation Fund** - this is designed to support local authorities in the planning and delivery of targeted action to improve air quality
- **An Early Measures Fund** - this was to support small, ambitious and good value early measures to improve air quality and start to reduce concentrations in Clean Air Zone. A maximum of £3m per local authority was allocated for this funding which is part of the Clean Air Fund. BCC was successful in obtaining funding for a scheme to incentivise the uptake of electric taxis through various discounts.
- **A £220 million Clean Air Fund** - an opportunity for local authorities to implement additional measures tailored to their area which minimise the potential impact of local air quality plans - either by enabling the local authority to implement local plans that collectively impact on fewer people, or by providing direct support to those impacted.
- **Revenue from CAZ charges** - funding will become available from the charges that are applied to a CAZ or from a diesel car ban.
- **Low Emission Bus Fund 2018** – funding became available in 2018 to support delivery of low emission buses.

¹ Public Health England (2014) Estimating local mortality burdens associated with particular air pollution.

<https://www.gov.uk/government/publications/estimating-local-mortality-burdens-associated-with-particulate-air-pollution>

² <https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017>

1.2 Source Apportionment

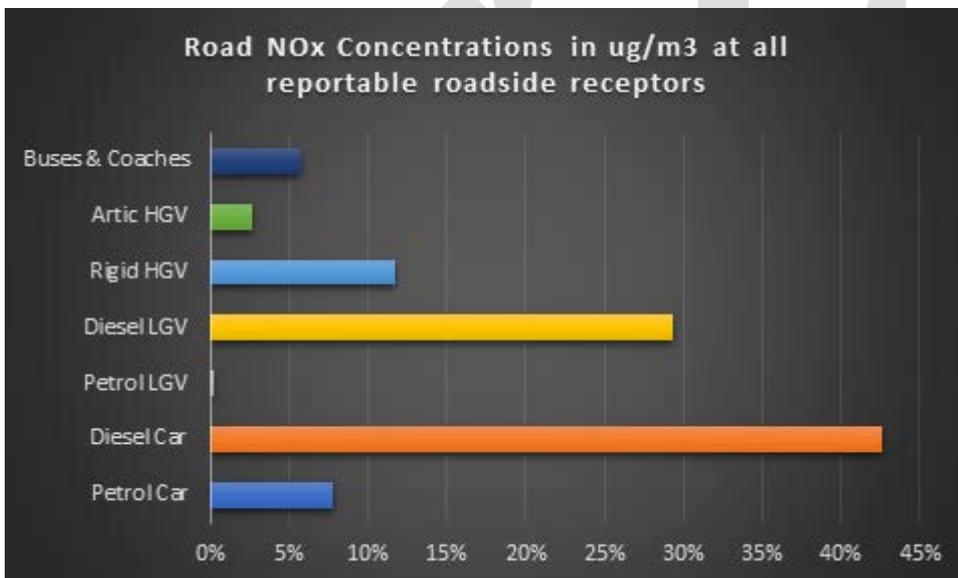
There are many sources of NO_x and PM₁₀ in the UK, including, but not limited to, power stations, transport, domestic combustion (including wood burning stoves), agriculture and industrial processes. The National Atmospheric Emissions Inventory (NAEI) provides estimates of the amount of different pollutants that are emitted to the air each year from human activity in the UK. Road transport is the main contributor of emissions of nitrogen oxides (NO_x), particularly at roadside locations, and therefore the predominant cause in locations where NO₂ concentrations are not complying with Limit Values or Air Quality Objectives.

Nitrogen oxides is a generic term which includes both NO_x and NO₂. According to NAEI estimates, around a third of the UK NO_x emissions in 2015 arose from road transport, most of which came from diesel vehicles (NAEI, 2017)³. Some disparities exist due to the increase in the proportion of NO_x emitted directly as NO₂ (also known as primary NO₂) from the exhausts of modern diesel vehicles, as a result of emission control systems that aim to reduce total NO_x and particulate matter emissions.

No other major sources of NO_x emitters that impact on roadside concentrations (e.g. from energy production, domestic combustion or other industrial processes) have been identified within the Bristol area, and other sources of NO_x are included in the background concentrations. Background concentrations are those measured well away from any significant sources of pollution, such as busy roads, railway lines or industrial sites with emissions to air, or modelled based on monitored background concentrations.

Emissions of NO_x are a combination of nitrogen oxide (NO) and NO₂ and are dependent on the type of vehicle (in terms of size, fuel type and age of the vehicle). Figure 1.1 shows the anticipated proportion of NO_x emissions by the vehicle fleet in the centre of Bristol in 2021, calculated from the vehicle movements in the GBATS baseline model, and the latest vehicle emission factors provided by Defra specifically for work contributing to the National Air Quality Plan. The graph shows that diesel cars and LGVs in the City Centre are the dominant source of NO_x.

Figure 1.1: NO_x source apportionment by vehicle category across Bristol city centre (g/km/s) – 2021 baseline



³ NAEI, Air Quality Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2015 (August 2017)

1.3 Optioneering Background - Strategic Outline Case Selection Process

An initial option selection process was undertaken and reported in the Strategic Outline Case (SOC) which identified a shortlist of packages including both charging and non-charging measures. The shortlist was developed by assessing each of the potential options against a list of Critical Success Factors (CSFs), which were defined in accordance with the Joint Air Quality Unit (JAQU) guidance. The Critical Success Factors are listed below:

Primary Critical Success Factor

- Deliver compliance with NO₂ air quality Limit Values and Air Quality Objectives in the shortest possible timescales

Secondary Critical Success Factors

- **Strategic**
 - Provide equity across different vehicle type and trip purpose
 - Compliance with Defra Draft CAZ framework, including minimum requirements
- **Economic**
 - Mitigate financial impact on low income households
 - Improve health of low income households
 - Maximise positive effects on the economy, whilst minimizing any negative impacts
 - Improve public health across Bristol
- **Commercial**
 - Delivery timescale risks of procurement
- **Financial**
 - Likelihood of revenue equating to implementation/operational costs⁴
 - Upfront capital required for scheme
 - Risk of financial penalty to the Council/s
- **Management**
 - Public acceptability which could impact on the option's deliverability
 - Political acceptability which could impact on the option's deliverability

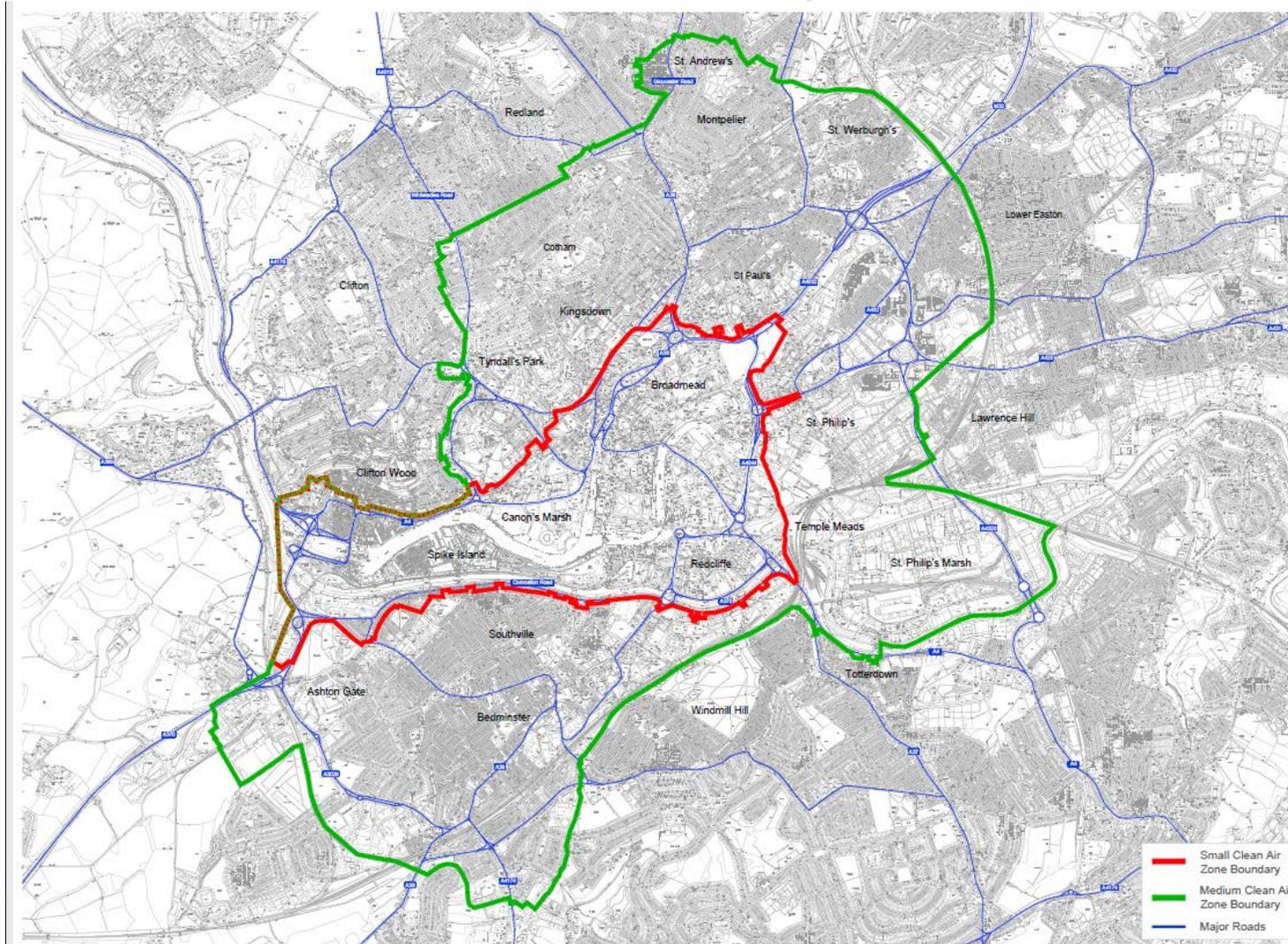
After applying the CSFs to the CAZ charging measures and non-charging measures, the final shortlist of CAZ packages presented in the SOC were:

- **Option 1** – Benchmark option – Medium area Class D (Charging higher emissions buses, coaches, taxis, HGVs, LGVs and cars)
- **Option 2** – Package of non-charging interventions
- **Option 3** – Medium area Class C charging option with complimentary non-charging interventions (Charging higher emissions buses, coaches, taxis, HGVs and LGVs)
- **Option 4** – Medium area Class D charging option with complementary non-charging interventions D (Charging higher emissions buses, coaches, taxis, HGVs, LGVs and cars)
- **Option 5** – Small area Class C charging option with complementary non-charging interventions (Charging higher emissions buses, coaches, taxis, HGVs and LGVs)
- **Option 6** – Small area Class D charging option with complementary non-charging interventions – (Charging higher emissions buses, coaches, taxis, HGVs, LGVs and cars)

The current small and medium CAZ boundaries are shown in Figure. These have been refined since the SOC following further assessments of the infrastructure requirements, but reflect a very similar area and proportion of the city to the boundaries presented in the SOC.

⁴ Complying with the legal test which was set out by the High Court in November 2016 in R (ClientEarth) (NO₂) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin), only shortlisted options which achieve compliance with the NO₂ Limit Value in the shortest possible time, are appraised across this criterion. The relevant analysis is presented in the Financial Case chapter of the Strategic Outline Case.

Figure 1.2: Small and medium area CAZ geographies



1.4 Overview of the Option Development as Part of the Outline Business Case

The option development work that supports the Outline Business Case has been undertaken in a number of stages as summarised in Table 1.1. Table 1.2 sets out which schemes are included within each option.

Further details of these steps are presented in Sections 2 to 5 of this report.

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Table 1-1: Option Development During the Outline Business Case

Step	Options Considered	Process	Conclusion
1	<ul style="list-style-type: none"> Option 1 – Benchmark option – Medium area Class D. Option 2a – Package of non-charging interventions. Option 2b – Enhanced package of non-charging interventions Option 3 – Medium area Class C charging option with complimentary non-charging interventions Option 4 – Medium area Class D charging option with complementary non-charging interventions Option 5a – Small area Class C charging option Option 5b – Small area Class C charging option with complementary non-charging interventions Option 6 – Small area Class D charging option with complementary non-charging interventions 	<p>Transport and air quality modelling of all options (except for options 2b, 3 and 6 – for reasons set out in Table 3.1.)</p> <p>During this work a further option was developed: Option 2c Diesel car exclusion across small area with bus and taxi fleet improvement to Euro 6 or better</p>	Option 4 and Option 2c progressed to the next stage
2	<ul style="list-style-type: none"> Option 4 – Medium area Class D charging option with complementary non-charging interventions Option 2c – Diesel car exclusion over a small area with bus and taxi fleet improvement to Euro 6 or better 	Economic and social impact assessment work reported in a draft Economic Case	The impact of the two options on lower income households was considered by the Council. Further options were considered in Step 3 which would meet the Council's legal obligations whilst seeking to mitigate these impacts. In addition, legal advice identified the need to limit the timing of the ban in Option 2c from 24 hours to 8 hours a day because of legislative restrictions.
3	<ul style="list-style-type: none"> Variant 1 – freight consolidation, waste vehicle upgrades, localised HGV ban, car scrappage scheme, traffic management measures, M32 Park and Ride 	Development of an option that targeted HGVs, LGVs, taxis and buses as this was expected to lessen the impact on low income households. Transport and air quality modelling was undertaken for this option	The compliance year of Variant 1 was later than previous options so further scheme development was required, as set out in Step 4.
4	<ul style="list-style-type: none"> New Option 1 – Medium CAZ C, localised HGVs ban, localised diesel car ban, car scrappage scheme, traffic management measures, M32 Park and Ride New Option 2 – Diesel car exclusion over a small area (7am-3pm) New Benchmark Option - Medium CAZ D, localised HGVs bans, localised diesel car ban, city centre traffic management scheme, car scrappage scheme Hybrid - New Option 1 and New Option 2 combined 	Transport and air quality modelling of all four options. Public consultation on Option 1 and Option 2. External review of the modelling of the hybrid option undertaken by AQC.	The result of this work was that the Hybrid Option was identified as the preferred option. The Outline Business Case reported the economic case for all four options, the financial case for the hybrid and new Benchmark Option – medium CAZ D + Option 1.

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Table 1-2: Summary of schemes included in each option

	Medium CAZ Class D	Medium CAZ Class C	Small CAZ Class D	Small CAZ Class C	Package of non-charging Interventions (not identical for all options)	Diesel car exclusion – small area	Localised diesel car ban	Localised HGV ban	Bus & taxi fleet improvement	Freight consolidation	Waste vehicle upgrades	City centre traffic management scheme	Car scrappage scheme	M32 Park and Ride
Option 1	✓				✓									
Option 2a					✓									
Option 2b					✓									
Option 2c					✓	✓								
Option 3		✓			✓									
Option 4	✓				✓									
Option 5a				✓	✓									
Option 5b				✓	✓									
Option 6			✓		✓									
Variant 1					✓			✓	✓	✓	✓	✓	✓	✓
New Option 1		✓			✓		✓	✓	✓	✓	✓	✓	✓	✓
New Option 2					✓	✓							✓	
New Benchmark Option	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓
Hybrid		✓			✓	✓		✓	✓	✓	✓	✓	✓	✓

2. Step 1 – Development of charging CAZ options

2.1 Strategic Outline Case Shortlist

The SOC identified charging CAZ measures which should be further assessed to determine whether they could achieve compliance by 2021. These options have been developed further during the options assessment process and are:

- **Option 1** – Benchmark option – medium area Class D charging zone. In line with JAQU's' Option Appraisal Guidance, the lowest class required to achieve compliance in the shortest possible timescales.
- **Option 2a** – Package of non-charging interventions. Having reviewed the effectiveness of the non-charging measures, the single most effective measure would be the prohibition of diesel cars from polluted parts of the city, which has been assumed to be the small zone.
- **Option 2b** – Enhanced package of non-charging interventions (when defined)
- **Option 3** – Medium area Class C charging option with complimentary non-charging interventions – Class C CAZ at Medium geography level with the addition of complimentary non-charging measures.
- **Option 4** – Medium area Class D charging option with complementary non-charging interventions – Class D CAZ at Medium geography level.
- **Option 5a** – Small area Class C charging option – Class C CAZ at Small geography level. This was developed to understand the effectiveness of the CAZ in isolation from complementary measures.
- **Option 5b** – Small area Class C charging option with complementary non-charging interventions – Class C CAZ at Small geography level, with the addition of non-charging measures.
- **Option 6** – Small area Class D charging option with complementary non-charging interventions – Class D CAZ at Small geography level, with the addition of the non-charging measures

Non-charging measures could include:

- Introduction and enforcement of anti-idling zones for buses in the city centre
- Increased Euro Standard requirements for taxis and private hire vehicles in licensing agreements
- Restrictions on goods vehicles movements in the City Centre and / or AQMA during peak hours

Assessment work has determined the following charges applied to the relevant scenarios:

- Cars, Taxis, PHVs, LGVs £9.00
- HGVs, Buses and Coaches £100.00

2.2 Assessment of options based on modelling

To identify option(s) that deliver compliance with NO₂ air quality Limit Values and Air Quality Objectives in line with legal obligations, transport and air quality modelling was undertaken to calculate the impacts of the schemes. The details of the transport and air quality modelling are reported fully in the OBC. This Option Assessment Report presents a summary the results of this work, which informed the option sifting work for the scheme. The results of the traffic and air quality models are summarised in Table 2.1.

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Not all complementary measures were explicitly modelled within these initial tests because these measures were not all currently defined to a sufficient level and require significant adjustments to the transport model in order to represent them accurately. For these initial tests understanding the impact of the largest elements of the scheme was the priority, with most complementary measures intended to be used to tackle minor remaining exceedances and/or provide mitigation for any adverse impacts.

The development of mitigation measures is documented in the Clean Air Fund proposal appended to the OBC.

Table 2-1: Summary of air quality impacts

Option	Has the option been modelled?	Does the option achieve compliance in BCC by 2021?	Number of sites not meeting compliance by 2021
Option 1 – Benchmark option – medium area Class D.	Yes	No	7 locations
Option 2a – Package of non-charging interventions	Yes, the Diesel car exclusion over a small area has been modelled in isolation to understand benefits	No	7 locations
Option 2b – Enhanced package of non-charging interventions	No. Package to be defined	-	-
Option 3 – Medium area Class C charging option with complimentary non-charging interventions	No. Medium area CAZ class D does not meet compliance, so lesser scheme will not	-	-
Option 4 – Medium area Class D charging option with complementary non-charging interventions	Yes	No	6 locations
Option 5a – Small area Class C charging option	Yes	No	10 locations
Option 5b – Small area Class C charging option with complementary non-charging interventions (Diesel car exclusion over a small area)	Yes	No	7 locations
Option 6 – Small Area Class D charging option with complementary non-charging interventions	No. Medium area CAZ class D does not meet compliance, so lesser scheme will not	-	-

After the initial analysis, a further scenario was developed to improve compliance, this was:

- **Option 2c** – Diesel car exclusion over a small area with bus and taxi fleet improvement to Euro 6 or better

This option was developed to provide an alternative to a charging CAZ, that still had the potential to have comparable impact to charging CAZ options.

The air quality impacts of Option 2c are presented in Table 2.2.

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Table 2-2: Summary of air quality impacts – option 2c

Option	Has the options been modelled?	Does the option achieve compliance in BCC by 2021?	Number of sites not meeting compliance by 2021
Option 2c – Diesel car exclusion across small area with bus and taxi fleet improvement so that everything is Euro 6 or better	Yes, the Diesel car exclusion over a small area together with taxi and bus fleet improvements	No	4 locations

A summary of remaining exceedances is provided in Table 2.3 and these locations are shown on a plan in Figure 2.6. Plans showing the air quality impacts across the city are presented in Figures 2.1 to 2.5.

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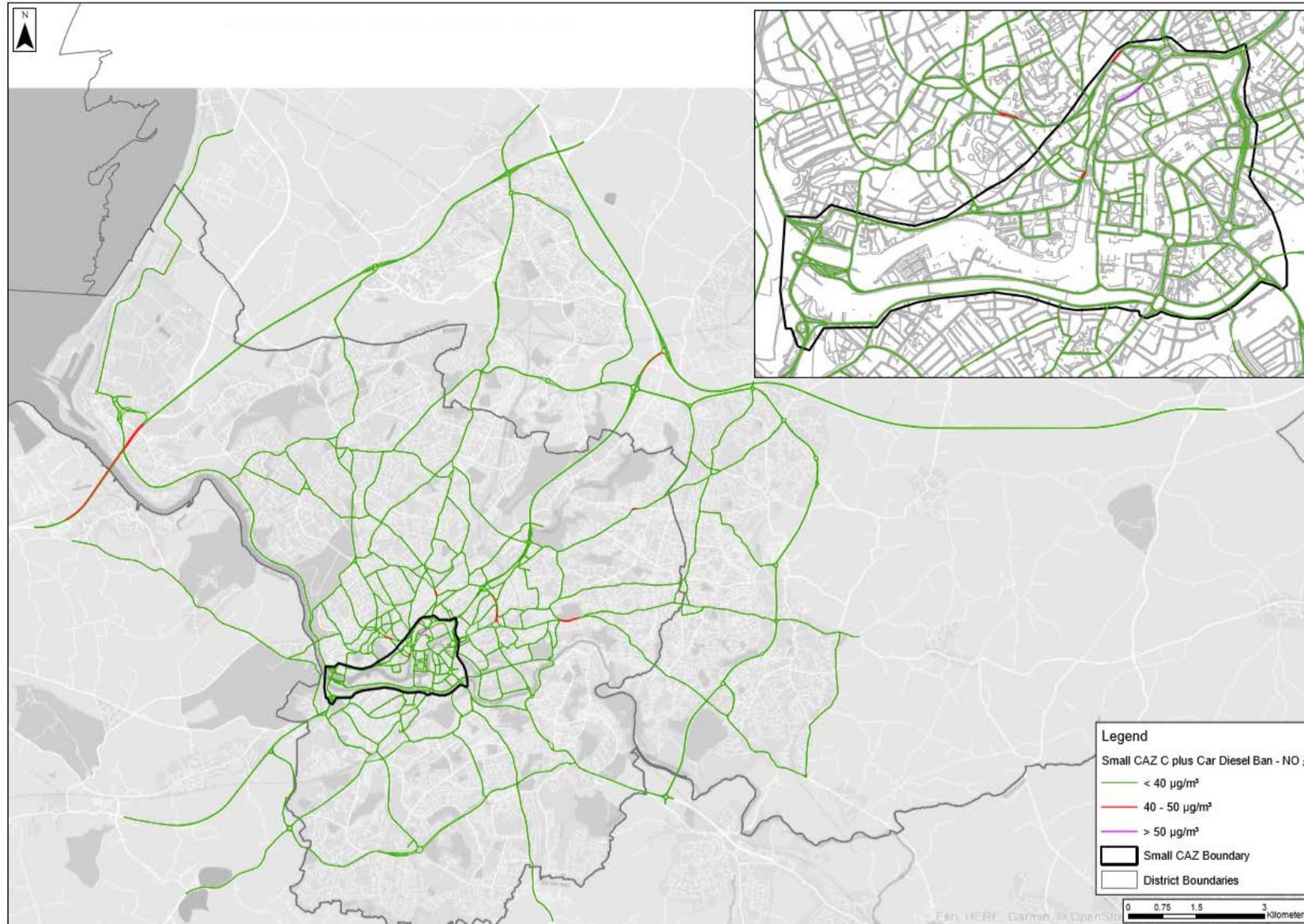
Table 2.3: Comparison of modelled option at locations with exceedances at one of more location, ($\mu\text{g}/\text{m}^3$) in 2021

Modelled Scenario	Rupert Street	Marlboro' Street	Upper Maudlin Street	Park Row	Park Street	Queen's Road	College Green	A38 Chelt' Road	Newfoun' Way	Church Road
Baseline	54.88	67.2	51.6	48.1	52.2	58.8	52.1	41.1	47.3	50.5
Option 1- Medium area Class D charging option	47.4	55.11	43.37	39.6	39.40	47.63	40.1	36.0	42.0	45.8
Option 2a - Small area diesel car ban	52.45	47.17	38.44	33.9	38.9	46.8	40.8	42.4	37.7	49.1
Option 5a - Small area Class C charging option	50.48	60.35	46.59	43.6	42.74	50.7	41.8	41.4	44.6	49.7
Option 5b - Small area Class C charging option with complementary non-charging interventions (Diesel car exclusion over a small area)	52.0	45.2	37.2	32.4	39.3	46.2	41.4	42.6	36.7	49.5
Option 4 - Medium area Class D charging option with complementary non-charging interventions	46.09	52.4	41.4	38.9	40.5	47.9	39.1	35.7	41.4	45.6
Option 2c - Diesel car exclusion over a small area with bus and taxi fleet improvement to Euro 6 or better	42.84	45.4	36.8	33.5	36.3	43.0	39.1	37.7	36.3	45.2

Figure 2.1 Air quality impacts of Option 1: Medium area Class D charging option

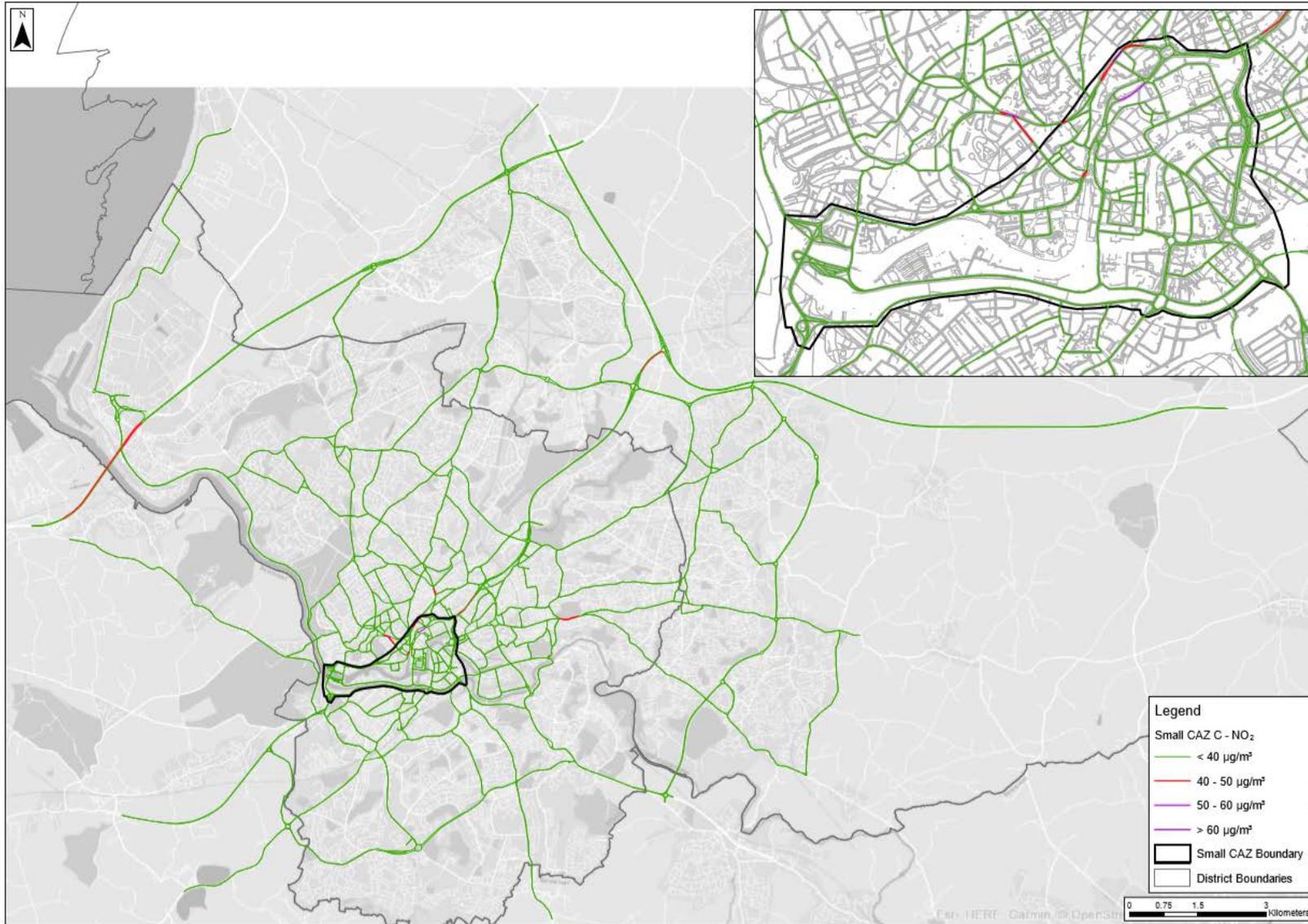


Figure 2.2: Air quality impacts of Option 2a – Small CAZ C plus diesel car exclusion over a small area



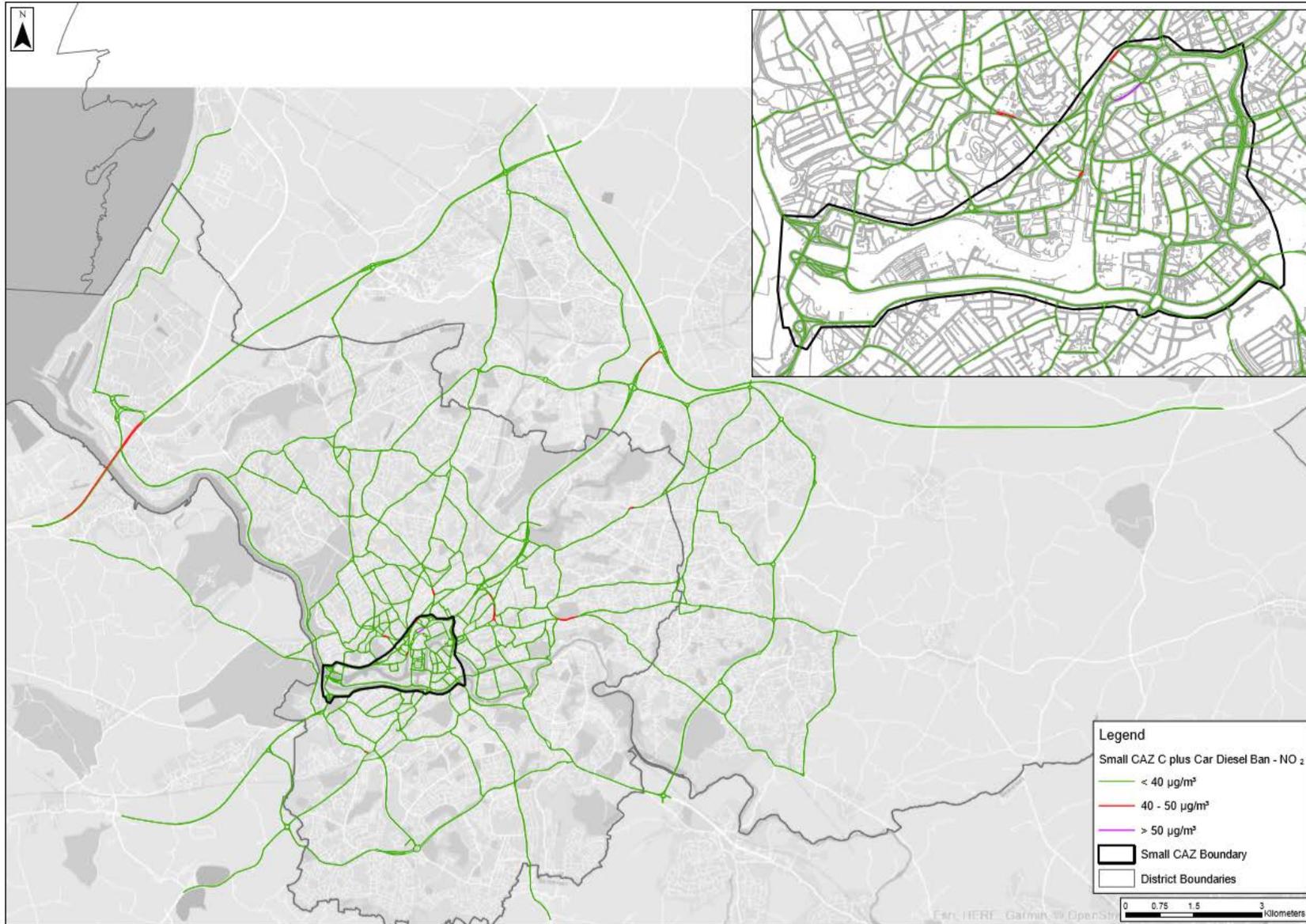
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Figure 2.3: Air quality impacts of Option 5a: Small area Class C charging option



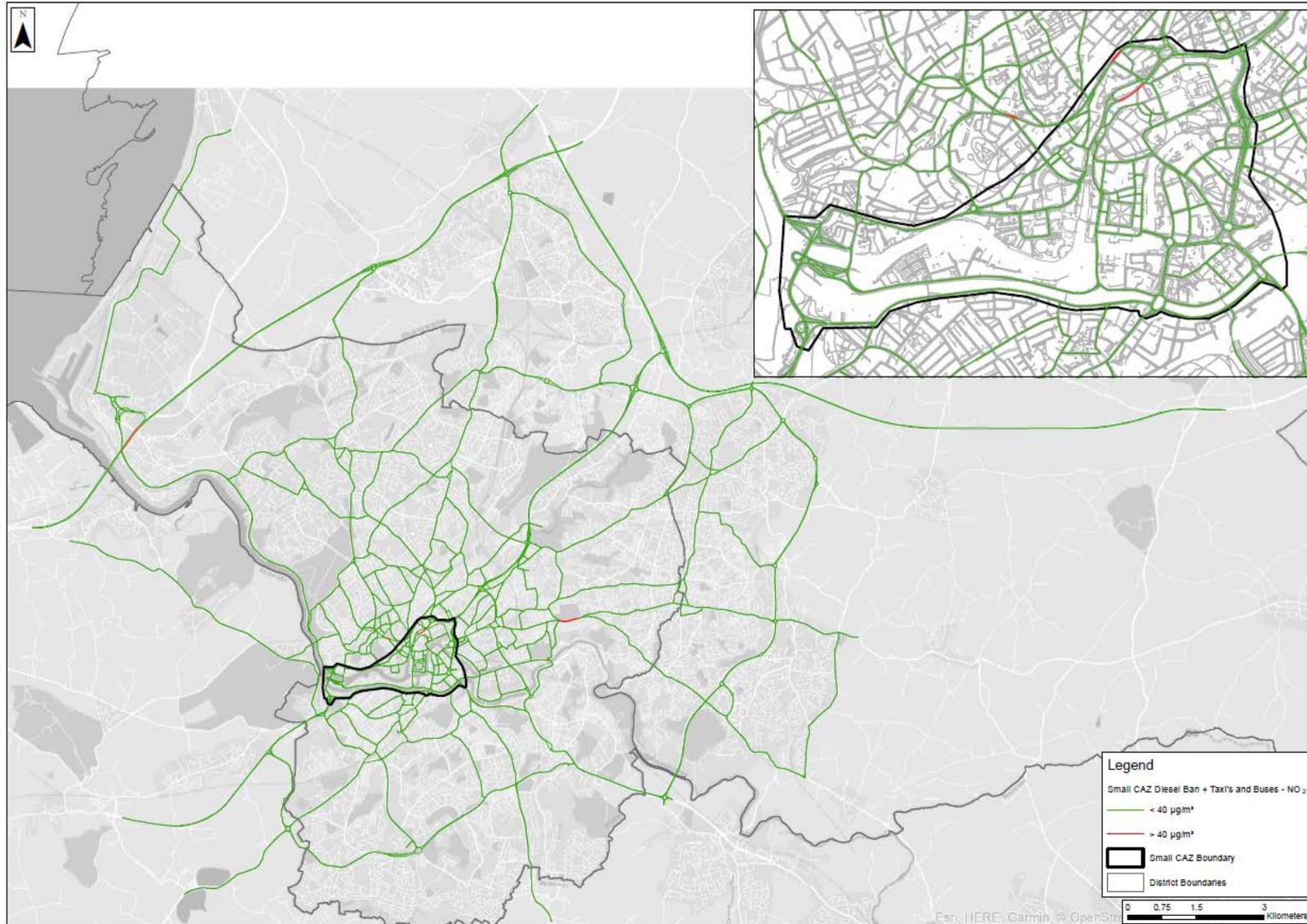
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Figure 2.4: Air quality impacts of Option 5b – Small area Class C charging option with complementary non-charging interventions (Diesel car exclusion over a small area)



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Figure 2.5: Air quality impacts of Option 2c – Package of non-charging interventions with taxi and bus fleet improvements



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Figure 2.6 Road Names of Key Links Experiencing Non-Compliance



Below is a description of the air quality issues at locations in the City with exceedances in one of more options. Note that following this work, AQC undertook a review of the Hybrid option, some of the conclusions of this work have relevance to the comments below, but would not change the option selection.

2.2.1 Rupert Street

Rupert Street (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in all scenarios.

The topography along Rupert Street is relatively flat. As a result of the tall buildings along the route, a canyoning effect is created, reducing the dispersion of pollutants.

Traffic models indicate an increase in the proportion of LGVs (petrol and diesel), as well as buses and coaches entering the area in the small area diesel car exclusion and small area Class C charging option with diesel car exclusion over small area scenarios - potentially as a result of less congestion in the area when diesel cars are prohibited.

The best performing scenario is Option 2c, the small area diesel car exclusion (including taxi and bus fleet upgrades) which results in a significant reduction in emissions from diesel cars, as well as buses, with the highest emission remaining apportionment (as calculated in the EFT) being linked to diesel LGVs (42.1%).

2.2.2 Upper Maudlin Street/Marlborough Street

Upper Maudlin Street (north of Lower Maudlin Street) (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in all scenarios. However, the modelling indicates significant reductions in emissions in the small area diesel car exclusion (Option 2a), small area Class C CAZ with diesel car exclusion over small area scenarios (Option 5b) and the small area diesel car exclusion with taxi and bus fleet upgrades (option 2c).

There is a relatively steep gradient along the route, and as a result of the tall buildings alongside (Bristol Royal Infirmary), a canyoning effect is created, reducing the dispersion of pollutants.

Traffic models indicate an increase in the proportion of LGVs (petrol and diesel), in the small area diesel car exclusion (Option 2a) and small area CAZ C with diesel car exclusion scenario (Option 5b) - potentially as a result of less congestion in the area.

The best performing scenario is Option 2c, the small area diesel car exclusion (including taxi and bus fleet upgrades), which results in a significant reduction in emissions from diesel cars, with the highest remaining emission apportionment (as calculated in the EFT) being linked to diesel LGVs (67%).

2.2.3 Park Row

Park Row (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ only in the small area CAZ C scenario (Option 5a).

There is a relatively steep gradient commencing from the intersection of Park Row and Lodge Street, and with the buildings along the route (mostly residential) creating a canyoning effect is created, reducing the dispersion of pollutants.

Traffic models indicate an increase in the proportion of LGVs (petrol and diesel) as a result of less congestion in the area. Traffic model results also indicate an increase in diesel cars in the small area CAZ C with diesel car exclusion scenario (Option 5b), as this area would serve as a diversion route to avoid entering the small area CAZ.

The best performing scenarios are the small area CAZ C with diesel car exclusion (Option 5b) and the small area diesel car exclusion (including taxi and bus fleet upgrades) (Option 2c) which results in a

significant reduction in emissions from diesel cars, with the highest remaining emission apportionment (as calculated in the EFT) being linked diesel to LGVs.

2.2.4 Park Street

Park Street (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in the small area CAZ C (Option 5a) and the medium area CAZ D plus complementary measures scenarios (Option 4). The exceedance in the medium area CAZ D plus complementary measures (Option 4) can be attributed to the increase in diesel cars and HGV movements.

There is a steep gradient along this street, and with the buildings along the route (mostly residential) a canyoning effect is created, reducing the dispersion of pollutants.

Traffic models indicate an increase in the proportion of LGVs (petrol and diesel), in the small area diesel car exclusion (Option 2a) and small area CAZ C with diesel car exclusion scenario (Option 5b) - potentially as a result of less congestion in the area. Traffic model results also indicate an increase in diesel cars in the small area CAZ C with diesel car exclusion scenario (Option 5b), as this area would serve as a diversion route to avoid entering the small area CAZ.

The best performing scenario is the small area diesel car exclusion (including taxi and bus fleet upgrades) (Option 2c) which results in a significant reduction in emissions from diesel cars, with the highest remaining emission apportionment (as calculated in the EFT) being linked to diesel LGVs (45.7%).

2.2.5 Queen's Road

Queen's Road (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in all scenarios.

There is a relatively steep gradient along the route, and as a result of the buildings along the route a canyoning effect is created, reducing the dispersion of pollutants.

Traffic models indicate an increase in the proportion of LGVs (petrol and diesel), in the small area diesel car exclusion (Option 2a) and small area CAZ C with diesel car exclusion scenario (Option 5b) - potentially as a result of less congestion in the area.

The best performing scenario is the small area diesel car exclusion (including taxi and bus fleet upgrades) (Option 2c) which results in a significant reduction in emissions from diesel cars, with the highest remaining emission apportionment (as calculated in the EFT) being linked to diesel LGVs and buses and coaches (44.1% / 26.7%).

2.2.6 College Green

College Green (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in all scenarios, with the exception of the medium area CAZ D with complementary measures (Option 4) and the small area diesel car exclusion including taxi and bus fleet upgrades scenarios (Option 2c).

There is a gradient along the route, and a canyoning effect reducing the dispersion of pollutants.

The best performing scenarios are the medium area CAZ D plus complementary non-charging measures (Option 4) and the small area diesel car exclusion (including taxi and bus fleet upgrades) (Option 2c) which both result in compliance being achieved as a result of the significant reduction in emissions from diesel cars. The highest remaining emission apportionment (as calculated in the EFT) is linked to diesel LGVs (48.3%).

2.2.7 A38 Cheltenham Road (Between B4051 junction and Arley Hill junction)

A38 Cheltenham Road (Between B4051 junction and Arley Hill junction) (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in all scenario, with the exception of the medium area CAZ D (Option 1), medium area CAZ D plus complementary non-charging measures (Option 4) and the small area diesel car exclusion including taxi and bus fleet upgrades scenarios (Option 2c).

There is a gradient along the route, and a canyoning effect reducing the dispersion of pollutants.

Traffic models indicate an increase in the proportion of LGVs (petrol and diesel), in the small area diesel car exclusion (Option 2a) and small area CAZ C with diesel car exclusion scenario (Option 5b) - potentially as a result of less congestion in the area.

The best performing scenarios are the medium area CAZ D (Option 1), medium area CAZ D plus complementary non-charging measures (Option 4) and the small area diesel car exclusion (including taxi and bus fleet upgrades) (Option 2c) which all result in compliance being achieved, as a result of the significant reduction in emissions from diesel LGVs. The highest remaining emission apportionment (as calculated in the EFT) is linked to diesel cars.

2.2.8 Newfoundland Way

Newfoundland Way (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in the medium area CAZ D (Option 1), Option 4 – medium D plus complementary measures and small area CAZ C (Option 5a), but achieves compliance in the small area diesel car exclusion (Option 2a), small area CAZ C with diesel car exclusion (Option 5b) and the small area diesel car exclusion including taxi and bus fleet upgrades scenarios (Option 2c).

There is a gradient along the route, and a canyoning effect reducing the dispersion of pollutants.

Traffic models indicate an increase in the proportion of LGVs (petrol and diesel), in the small area diesel car exclusion (Option 2a) and small area CAZ C with diesel car exclusion scenario (Option 5b) - potentially as a result of less congestion in the area.

The best performing scenarios are the small area diesel car exclusion (Option 2a), small area CAZ C with diesel car exclusion (Option 5b) and the small area diesel car exclusion (including taxi and bus fleet upgrades) (Option 2c) which all result in compliance being achieved, as a result of the significant reduction in emissions from diesel cars. The highest remaining emission apportionment (as calculated in the EFT) is linked to diesel LGVs .

2.2.9 Church Road

Church Road (based on PCM receptors) exceeds the Air Quality objective of 40 µg/m³ in all scenarios.

There is a gradient along this street, and canyoning effect reducing the dispersion of pollutants.

Traffic models indicate an increase in diesel cars in the small area CAZ C with diesel car exclusion scenario (Option 5b), as this area would serve as a diversion route to avoid entering the small area CAZ.

The best performing scenario is the small area diesel car exclusion (including taxi and bus fleet upgrades) (Option 2c) with the highest remaining emission apportionment (as calculated in the EFT) being linked to diesel cars (41.6%).

2.3 Better performing options

The results of the Air Quality modelling show that the better performing options are:

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- **Option 4** – Medium area Class D charging option with complementary non-charging interventions
- **Option 2c** – Diesel car exclusion over a small area with bus and taxi fleet improvement to Euro 6 or better

The economic and social impacts of these options were then assessed, and the results are summarised in chapter 3 of this report.

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3. Step 2 – Economic case for Option 4 and Option 2c

3.1.1 Scope of the assessment

As noted in Section 2 of this report, Options 4 and 2c were shortlisted as the two best performing options most likely to achieve NO₂ compliance within Bristol within the shortest possible time and reduce exposure as quickly as possible. Therefore, within the draft economic case of the OBC, a number of economic analyses were carried out on these options in order to assess their costs and benefits.

In addition to the core economic assessment, a Multi-Criteria Assessment (MCA) was conducted on the two options. This was used to compare the predicted impacts of each option on a number of economic factors that were not explicitly considered within the core economic modelling, for example employment markets, income deprivation, etc.

A Distributional and Equalities Assessment was also conducted. This work considered the locations where benefits and disbenefits of the scheme would accrue and how these benefits map to the individuals that live in those areas. In line with JAQU's Options Appraisal Guidance, three core distributional impact variables were identified as most relevant to the Bristol CAP proposals and were analysed within the Distributional and Equalities Assessment of the OBC. The assessment involved investigating whether changes to the impact variables would impact disproportionately on the socio-economic groups already disadvantaged. The impact variables which were investigated include:

- Air Quality (changes in the ambient concentrations of air pollutants that will affect the health of local people)
- Accessibility (changes to the ability and ease of individuals or businesses to get to places of work, social networks and public amenities)
- Affordability (changes in the costs of individuals or businesses using their vehicles or public transport).

Finally, a spatial analysis of the scheme options on low income households and businesses was completed.

3.1.2 Key results

Compliance Dates

The priority of the scheme is to be most likely to reduce NO₂ concentrations in Bristol to legal levels, within the shortest possible time and reduce exposure as quickly as possible. Therefore, the two preferred options were assessed in terms of speed to reach compliance compared to the Baseline (i.e. a scenario without any measures). The modelling results obtained for the years 2021 and 2031 were interpolated to identify the options that would achieve compliance with legal obligations at all locations.

It was found that Option 4 would achieve compliance at all locations by 2027, with the exception of the north section of Upper Maudlin Street, which would be compliant by 2030. Comparatively, Option 2c was expected to achieve compliance at all locations by 2023, with the exception of the north section of Upper Maudlin Street which would be compliant only by 2024.

The refinement of the Hybrid option included the creation of a 2025 model to assess the compliance year more accurately. If this technique were applied to the options modelled at this stage of the work, the compliance year could reduce from those reported.

Key Economic Impacts

Net economic impacts of both Option 4 and Option 2c are summarised in Table 3.1. As noted within Table 3-1, the combined economic impacts could generate an NPV of -£210m for option 4 (Medium area CAZ D) and -£22m for Option 2c (small area diesel car exclusion).

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The economic costs for the Medium CAZ D options outweigh the economic benefits by a considerable margin. This is primarily driven by the loss in consumer welfare associated with changing travel patterns and behaviours, as well as onerous set up and running costs.

The economic costs for the hybrid option outweigh the economic benefits but to a lesser extent than the Medium CAZ D option.

Table 3-1: Net economic impacts (2018 prices and values £)

Impact	Option 4 - Medium area CAZ D	Option 2c - Small area diesel car exclusion
Air Quality	£16,987,932	£20,948,332
No _x	£4,146,929	£3,888,265
PM	£12,841,002	£17,060,067
Consumer Welfare	£-239,840,698	£-35,097,830
Behavioural Response: Replace Vehicle	£-29,995,696	£-35,097,830
Behavioural Response: Cancel Trip/Avoid Zone/Re-mode	£-209,845,003	£0
Vehicle Scrappage	£-2,589,907	£-9,359,810
Transactions	£-148,586	£-82,831
Traffic Flow	£72,119,048	£21,957,816
GHGs	£1,153,292	£-116,651
Set Up	£-79,110,638	£-65,817,064
Running Cost	£-30,085,478	£-10,290,754
Active Mode Impacts	£51,258,892	£55,194,944
Accident Impacts	£314,154	£471,007
Net Present Value (NPV)	£-209,941,989	£-22,192,840

Overview of the Distributional Impacts for both options

The Distribution and Equalities Assessment concluded that air quality benefits of the scheme are felt by all neighbourhoods in Bristol. The positive impacts of improved air quality disproportionately fall on

the least income deprived communities alongside those communities with the most children and elderly residents.

Accessibility impacts are adverse across the full range of relevant socio-economic groups. These impacts fall most heavily on the middle quintiles of income deprived communities, those communities with the most children and those communities that have the lowest proportions of females. Further, impacts are disproportionately felt by those communities towards the higher quintiles in terms of concentration of ethnic minorities, middle quintiles for disabled residents and more evenly for elderly residents. It should be noted that this assessment considers a relative comparison between the quintiles of the various communities identified and does not consider the quantum of impacts themselves.

Affordability impacts are adverse across the full range of relevant socio-economic and business groups. Impacts are disproportionately felt by the most income deprived communities. They also fall on businesses operating non-compliant LGVs and HGVs who are either based in the CAZ areas or operate within central Bristol.

3.1.3 Conclusions and progression to the next step

Overall, the modelling suggests that Option 2c would provide compliance at all locations across the city faster than option 4 (2024 compared to 2030). Noting that the refinement of the Hybrid option included the creation of a 2025 model to assess the compliance year more accurately. If this technique were applied to the options modelled at this stage of the work, the compliance year could reduce from those reported.

In terms of key economic impacts, analysis indicates that Option 4 would result in a worse NPV (approximately -£210m), when compared to Option 2c (-£22m). Economic costs for both options are significantly greater than the benefits, which is particularly due to loss in consumer welfare associated with changing travel patterns and behaviours, as well as issues with set up and running costs.

The Distributional and Equalities Assessment found that the CAP should produce almost entirely positive impacts on air quality within Bristol, with particular benefits to communities with high numbers of children and elderly residents, as well as the least income deprived communities. It is important that communities with high numbers of young and elderly people see improvements to the air quality in their areas, as there is evidence that these groups are particularly vulnerable to health impacts of poor air quality⁵⁶.

The CAP would result in adverse accessibility impacts across all relevant socio-economic groups but particularly on certain groups including the middle quintiles of income deprived communities and communities with the most children.

The CAP is likely to have adverse impacts on affordability across all relevant groups but will impact disproportionately on the most income deprived communities. Low income households may be less likely to be able to afford to replace vehicles and less able to afford any increase in cost of travel due to changes in their journey, made necessary by the implementation of the CAP. Both of these factors would limit their accessibility and connectivity. Businesses based within, or who operate in the CAZ area and rely on non-compliant LGVs and HGVs, would also be impacted in terms of affordability. The high cost of replacing a non-compliant LGV/HGV vehicle could deter some businesses from operating within the CAZ area, or being forced to pay the CAZ charge, which would impact on business profitability and consumer choice.

Following consideration of these results, the BCC Mayor's Office decided that the impact of the identified options on lower income households was such, that there was a need to identify further options which would meet the air quality obligations of the Council, but avoid or reduce these impacts. Other options were therefore considered for further analysis – see Section 4 of this report.

⁵ World Health Organization (2013) *Review of evidence on health aspects of air pollution – REVIHAAP Project: final technical report*. <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/2013/review-of-evidence-on-health-aspects-of-air-pollution-revihaap-project-final-technical-report>

⁶ Simoni et al., Adverse effects of outdoor pollution in the elderly, *Journal of Thoracic Disease*, January 2015 (URL:<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4311079/>)

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Other advice identified the need to refine the timing of the ban in Option 2c from 24 hours to 8 hours, so that Traffic Regulation Orders could be used to implement the diesel ban scheme. This would reduce the impact of the scheme, warranting further assessment (See Section 5 of this report). On the basis of time to compliance for both options, further options were then considered for further analysis which would aim to improve the time to compliance.

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4. Step 3 – Development of Variant 1

The premise of Variant 1 was to develop an option that targeted reduction of NO₂ from taxis, HGVs, LGVs, Buses/Coaches with a range of complimentary options that would improve time to compliance whilst also aiming to mitigate the impact on low income households. To understand the maximum benefit of such an option, a very crude assessment was undertaken comprising of removing the Taxis, HGVs, Buses/Coaches trips from the Medium CAZ area from existing baseline 2021 and 2031 model runs. Compliance was examined at known hotspots as shown in Table 4.1 below. Interpolating between the modelled years of 2021 and 2031 found that compliance could potentially be achieved by 2025.

Table 4-1: Results from crude assessment in development of Variant 1

Road Name	Baseline		Baseline (removal of Taxis, HGVs, Buses/Coaches)	
	2021	2031	2021	2031
Rupert Street	54.9	37.1	40.5	24.1
Marlborough Street	67.2	43.2	60.5	39.7
Upper Maudlin Street	51.6	32.9	47.1	30.6
Park Row	48.1	31.1	45.6	29.7
Park Street	52.2	35.6	35.0	19.7
Queen's Road	58.8	38.6	41.6	23.6
College Green	52.1	31.6	39.4	23.1
Newfoundland Way	47.3	30.4	45.9	30.0
Church Road	50.5	31.0	45.9	28.6

It is important to note that this assessment:

- Assumes there are no buses, taxi/HGV trips through/to/from the medium CAZ area;
- Assumes there is no re-routing of cars to make use of freed up road space;
- Does not consider alternative arrangements business would need to make to continue to service their operations; and
- Does not consider impacts of removing LGVs.

Following the assessment, the Variant 1 scheme was devised with the aspiration that it would achieve the level of benefit that could potentially be realised by removing all buses and taxi/HGV trips from the Medium CAZ area.

Variant 1 comprised of:

- Fleet improvements to all buses to Euro 6 (this will also be in the reference case);
- All BCC taxis and private hire vehicles are upgraded to compliance (this will also be in the reference case);
- Increased use of Avonmouth freight consolidation site;
- Upgrade all BCC waste vehicles to Euro 6 or better – (it should be noted that this component was not modelled);

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- Ban HGVs from NO₂ critical links;
- A car scrappage scheme;
- Bus and local traffic interventions in the most polluting areas; this includes a Park and Ride on the M32, an inbound bus lane on the M32 from Junction 2 to Cabot Circus car park, an inbound bus lane on Cumberland Road, and using existing traffic signals to control the amount of traffic entering congested areas with poor air quality.

As the scope of Variant 1 differed significantly from the crude modelling which assumed the removal of all buses, taxi and HGVs from the central area, the compliance year for Variant 1 was not 2025. The modelling work showed that Variant 1 would result in a compliance date of 2030 and the compliance was driven by compliance at Marlborough Street (i.e. this would be the location that meets compliance last). See results in Table 4.2.

Following this assessment, work was undertaken to develop new options that built on the outcomes of this and previous steps and seek to reach compliance sooner..

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Table 4-2: Variant 1 - exceedances at one of more location, ($\mu\text{g}/\text{m}^3$) in 2021

Modelled Scenario	Rupert Street	Marlboro' Street	Upper Maudlin Street	Park Row	Park Street	Queen's Road	College Green	Newfoun' Way	Church Road
Variant 1	44.8	52.2	41.5	42.4	43.1	38.0	42.7	44.5	50.1

5. Step 4 – Assessment of Refined Charging CAZ Options

5.1 Scope of options

5.1.1 Further option development

Following the assessment of Variant 1, the performance of all options to date was considered. The options most likely to achieve compliance in the shortest possible time, were considered to be:

- New Option 1: Enhancement of Variant 1 to include a Medium CAZ C
- New Option 2: Refinement of the small area diesel ban, to an 8 hour ban.

These options are discussed below.

5.1.2 Consultation

A public consultation exercise was carried out during the early part of this Step, during the early part of the refinement process. At the time the assessment work was associated with Option 1 and 2, and these were the options that were consulted on. Full details of the consultation work are set out in the Consultation Report appended to the OBC (OBC-37, Appendix N).

5.1.3 New Option 1 Clean Air Zone (private cars not charged)

Option 1 comprises of Variant 1 with a Medium CAZ C, and therefore includes:

- A charging scheme for non-compliant buses, taxis, HGVs and LGVs. This charge applies once a day regardless of how many times you go in or out of the medium zone.
 - Taxis, PHVs, LGVs £9.00
 - HGVs, Buses and Coaches £100.00
- A 24-hour a day seven days a week HGV weight restriction (3.5 tons) on some of the most polluted routes: Rupert St, Baldwin Street, Park Row/Upper Maudlin Street, Marlborough Street and Lewins Mead.
- A diesel car ban on Upper Maudlin Street and Park Row running from St James Barton roundabout to Park Street – not including James Barton roundabout itself. 7am-3pm, 7 days a week (does not apply to taxis, private hire vehicles or emergency vehicles).
- Bus and local traffic interventions in the most polluting areas; this includes a Park and Ride on the M32, an inbound bus lane on the M32 from Junction 2 to Cabot Circus car park, an inbound bus lane on Cumberland Road, and using existing traffic signals to control the amount of traffic entering congested areas with poor air quality.
- A scrappage scheme (up to £2,000) for private diesel cars. This would provide a grant towards a new vehicle or an alternative mode of transport. Vehicles belonging to residents in Bristol, Bath & North East Somerset, North Somerset and South Gloucestershire would be eligible – as long as their drive into work includes the New Option 1 charging zone area or they live in the area.

5.1.4 New Option 2: Diesel car ban over the small area

This option refines the 24 hour car diesel ban option modelled in Step 1 and 2 (Option 2c) with a 8 hour restriction. This was modelled because this previous diesel ban option had the shortest compliance date. The option comprises a diesel car ban over a specific small central area from 7am to 3pm, 7 days a week (does not apply to taxis, private hire vehicles or emergency vehicles). The scheme could be complemented by mitigation schemes including a local scrappage scheme.

5.1.5 New Benchmark Option: Medium CAZ D with New Option 1 components (private cars charged)

In line with JAQU's Option Appraisal Guidance, this option represents the "benchmark" option (the lowest class required to achieve compliance in the shortest possible timescales). BCC was instructed by the Government in July 2019 to model such an option (i.e. a Class D CAZ with additional measures)⁷.

This Option was developed after the consultation period, and as such, was not included as an option within the consultation. It includes:

- A charging scheme for non-compliant cars, buses, taxis, HGVs and LGVs. This charge applies once a day regardless of how many times you go in or out of the medium zone.
- A 24-hour a day seven days a week HGV weight restriction (3.5 tons) on some of the most polluted routes: Rupert St, Baldwin Street, Park Row/Upper Maudlin Street, Marlborough Street and Lewins Mead.
- A diesel car ban on Upper Maudlin Street and Park Row running from St James Barton roundabout to Park Street – not including James Barton roundabout itself. 7am-3pm, 7 days a week (does not apply to taxis, private hire vehicles or emergency vehicles).
- Bus and local traffic interventions in the most polluting areas; this includes a Park and Ride on the M32, an inbound bus lane on the M32 from Junction 2 to Cabot Circus car park, an inbound bus lane on Cumberland Road, and using existing traffic signals to control the amount of traffic entering congested areas with poor air quality.
- A scrappage scheme (up to £2,000) for private diesel cars. This would provide a grant towards a new vehicle or an alternative mode of transport. Vehicles belonging to residents in Bristol, Bath & North East Somerset, North Somerset and South Gloucestershire would be eligible – as long as their drive into work includes the Option 1 charging zone area or they live in the area. Further details of the scrappage scheme are set out in the Clean Air Fund Proposal, Appended to the OBC.

5.1.6 Hybrid Option of New Option 1 and New Option 2

The Hybrid Option was developed in order to improve the year of compliance and offer the best solution to the air quality problems within the city. It was also a response to a number of comments within the consultation (July/August 2019), suggesting that combining Option 1 and 2 would provide a better solution to the city's air quality issues. In addition, a new directive was issued to BCC by the Government in July 2019. This directive instructed the Council to model a Class C CAZ with additional measures, a Class D CAZ with additional measures and a city centre diesel car ban for eight hours.

On this basis, a Hybrid Option was developed which includes:

⁷ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/823783/air-quality-direction-bristol-city-council-2019.pdf

- A charging scheme for non-compliant buses, taxis, HGVs and LGVs. This charge applies once a day regardless of how many times you go in or out of the medium zone.
- A 24hr a day seven days a week HGV weight restriction (3.5 tons) on some of the most polluted routes: Rupert St, Baldwin Street, Park Row/Upper Maudlin Street, Marlborough Street and Lewins Mead.
- Bus and local traffic interventions in the most polluting areas; this includes a Park and Ride on the M32, an inbound bus lane on the M32 from Junction 2 to Cabot Circus car park, an inbound bus lane on Cumberland Road, and using existing traffic signals to control the amount of traffic entering congested areas with poor air quality.
- A scrappage scheme (up to £2,000) for private diesel cars. This would provide a grant towards a new vehicle or an alternative mode of transport. Vehicles belonging to residents in Bristol, Bath & North East Somerset, North Somerset and South Gloucestershire would be eligible – as long as their drive into work includes the Option 1 charging zone area or they live in the area.
- A diesel car ban over a specific small central area from 7am to 3pm, 7 days a week (does not apply to taxis, private hire vehicles or emergency vehicles).

5.1.7 Key results

Air quality and transport modelling work was undertaken for the four options and the compliance dates of the options are reported in Table 5.1

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Table 5-1: Comparison of Step 4 modelled options at locations with exceedances

	Rupert Street	Marlborough Street	Upper Maudlin Street	Park Row	Park Street	Queen's Road	College Green	Newfoun' Way	Church Road
2018 Monitoring									
2021 Results (ug/m3)									
Background NO ₂	19.0	19.2	19.4	18.9	18.0	17.8	18.3	17.6	15.7
Baseline (Updated Euro6)	50.0	59.4	46.9	47.5	49.1	41.9	49.2	50.6	53.3
Option 1 (Variant 1 & Small CAZ 8 Hour Diesel Ban)	45.4	47.6	39.2	36.8	48.0	40.2	43.6	44.2	50.3
Option 2 - Small CAZ 8hr Diesel Ban	46.2	51.1	41.9	40.3	47.1	38.9	46.3	45.8	53.9
Medium CAZ D + Option 1 components	43.5	44.5	36.7	34.0	44.4	38.5	42.1	41.3	48.5
Hybrid (Option 1 and 2)	41.7	44.2	36.7	35.6	41.4	35.0	39.8	39.3	50.8

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The technical assessment work for these options is set out in the Outline Business Case and supporting appendices. In addition, the OBC presents information about the economic assessment of options.

The assessment reported in the transport and air quality modelling reports appended to the OBC (Appendix D OBC -18 and OBC-19, Appendix E OBC-23 and OBC-27) showed that the Hybrid Option and the New Benchmark Option are expected to achieve compliance by 2027. The Hybrid Option compliance date is driven by exceedances at only one location - Church Road whereas the New Benchmark Option compliance date is driven by three locations (Marlborough Street, Park Street and Church Road). It was expected that the date of compliance can be brought forward for the Hybrid Option through further work at the Church Road site, for this reason, the BCC Project Board identified this option as the preferred option.

Following this work, a 2025 model scenario was developed, to provide more certainty of the compliance year. This work showed that compliance would be achieved by 2025 in the Hybrid scenario. This work is reported in the report Church Road assessment and 2025 modelling OBC-20 (Appendix D).

It should be noted that, all the options presented in this report have risks associated with them. The risks for the hybrid are set out in the quantified risk assessment appended to the OBC, OBC -35. Key top ten risks are:

1. Risk 30 - Inability to implement Hybrid option due to lack of appropriate legislation leading requirement to implement the benchmark option (Medium CAZ D+) by Government Ministers / JAQU This is the same as risk 24
2. Risk 27 - Successful challenges to the process for declaring the hybrid option at FBC
3. Risk 31 - TRO objections result in public inquiry
4. Risk 28 - Successful challenges to the process for making the Order (JR)
5. Risk 29 - Successful challenges to the process for enforcing the hybrid option leading to inability to enforce (e.g. location/quality of signage, ability to avoid zone, DVLA database inaccurate)
6. Risk 58 - General election
7. Risk 61 - Change in political leadership may mean a change in direction
8. Risk 64 - Mechanism of objecting to TROs used to delay scheme/object to the scheme as a whole
9. Risk 24 - Planned restrictions being unenforceable by BCC under the Traffic Management Act 2004
10. Risk 57 - Hybrid scheme refinement required to ease implementation