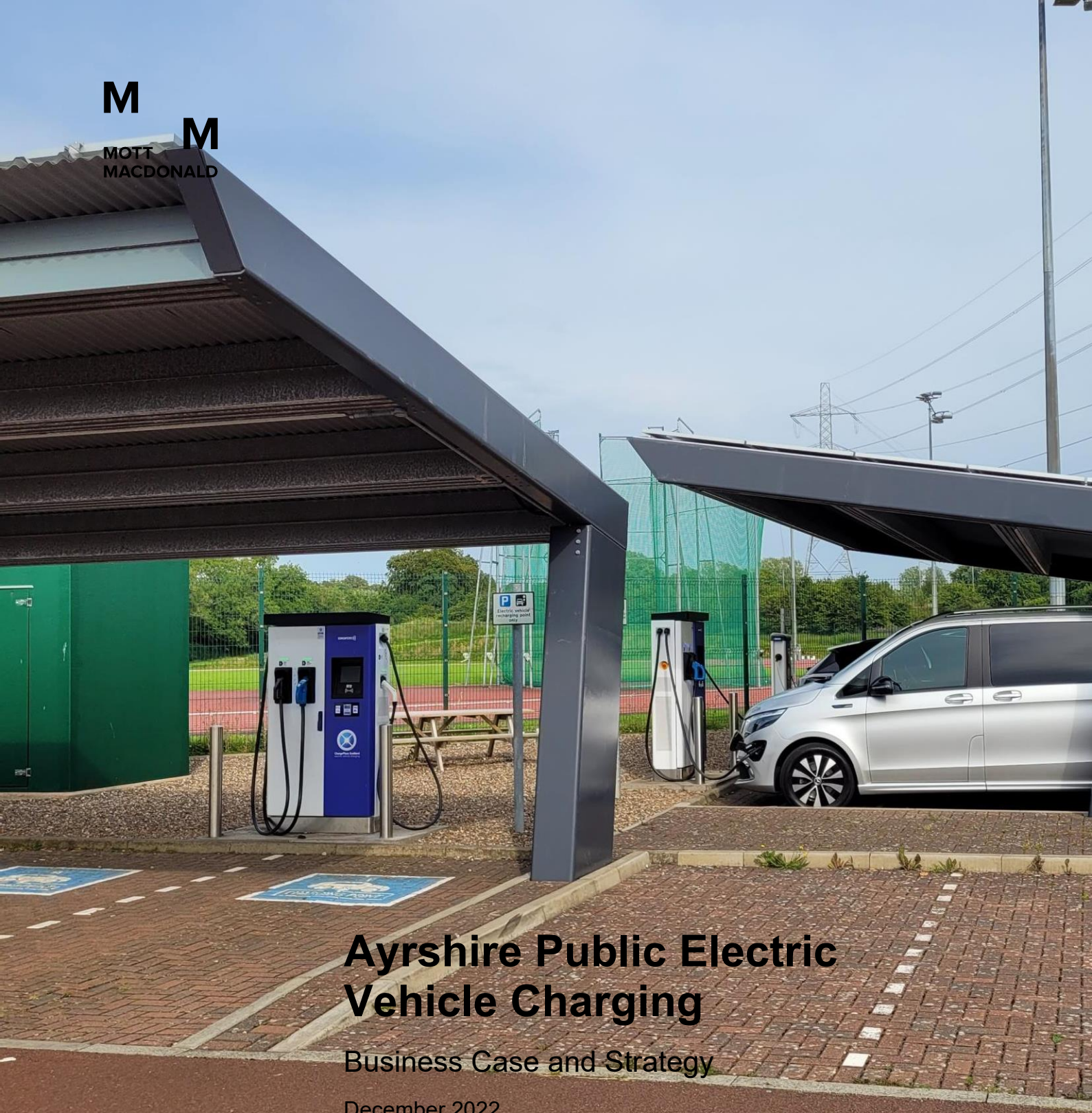

MOTT MACDONALD

Ayrshire Public Electric Vehicle Charging

Business Case and Strategy

December 2022

Confidential

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Contents

Executive summary 1

1 Introduction 6
1.1 Purpose of the Business Case 6
1.2 Structure of the Business Case 6
1.3 Limitations 6

2 Background and Scope 8
2.1 Study Area 8
2.2 Scope 16

3 Baseline Position at March 2022 18
3.1 Existing Electric Vehicle Ownership 18
3.2 Current Approach to Service Delivery 21
3.3 Electric Vehicle Infrastructure (EVI) 22
3.4 Revenue and Operations 28

4 Consultation and Stakeholder Engagement 30
4.1 Stakeholder Workshop 30
4.2 Residents and Businesses Survey 31
4.3 Non-domestic Tenants and Community Groups Webinar 32

5 The Strategic Case 33
5.1 Policy Context 33
5.2 Vision, Outcomes and Objectives 40

6 The Economic Case 43
6.1 Demand Forecast Methodology 43
6.2 Preferred Charge Point Mix 50
6.3 Site Identification and Grid Connection 55
6.4 Capital Investment Pipeline and Estimated Costs 72
6.5 Analysis of Proposed Network 76

7 The Commercial Case 80
7.1 Commercial model objectives 80
7.2 EVCI market landscape 84
7.3 Commercial Model Options 88
7.4 Commercial Model Assessment 91

7.5 Procurement Considerations 93
7.6 Summary 94

8 The Financial Case 95
8.1 Funding Sources 95
8.2 Financial Viability of Service / Concession Type Contracts 95
8.3 SFT Recommended Values 98
8.4 Summary 100

9 The Management Case 101
9.1 Introduction 101
9.2 Governance and Management 101
9.3 Risk Management and Mitigation 103
9.4 Timetable and Next Steps 106
9.5 Summary 106

Appendices 107

A. Existing EV Charger Locations 108
A.1 North Ayrshire 109
A.2 East Ayrshire 110
A.3 South Ayrshire 111

B. Vision Workshop 112

C. Survey Results 113
C.1 Introduction 113
C.2 Methodology 113
C.3 Survey Results 113
C.4 Conclusion 116
C.5 Survey Questions - Residents 117
C.6 Survey questions – Businesses 119

D. Assumption Log 121

E. Electric Vehicle Charging Infrastructure Forecast Methodology 126
E.1 Electric Vehicle Forecast Methodology 126
E.2 Electric Vehicle Charging Infrastructure Forecast Methodology 133

F. Grid Capacity Assessment 137
F.1 North Ayrshire 137
F.2 East Ayrshire 138

F.3 South Ayrshire 139

G. Identified Potential Charger Locations 140

G.1 North Ayrshire 140
G.2 East Ayrshire 145
G.3 South Ayrshire 150

Tables

Table 0.1: Summary of Total Proposed EVCI to be Procured 1
Table 0.2: Summary of Total Proposed EVCI Capital Costs 1
Table 0.3: Forecast Number of Plug-in Vehicles in Ayrshire 2
Table 0.4: Forecast Number of Plug-in Vehicles in North Ayrshire 3
Table 0.5: Forecast Number of Plug-in Vehicles in East Ayrshire 3
Table 0.6: Forecast Number of Plug-in Vehicles in South Ayrshire 3
Table 0.7: Forecast Ayrshire Charge Points per 100,000 Population 3
Table 0.8: Forecast Ayrshire EV to Charge Point Ratio 4
Table 0.9: Summary of Total Proposed EVCI to be Procured 4
Table 0.10: Summary of Cost Estimates for the Proposed Network 4
Table 2.1: Mid-year Population Estimates, 2020 10
Table 2.2: Number of dwellings, 2020 12
Table 2.3: Proportion of employees by industry (%) 13
Table 2.4: EV Charger Types 17
Table 3.1: Registered ULEV, BEV and PHEV Rate of Increase in Ayrshire 18
Table 3.2: North Ayrshire Council Owned Existing Public EVCI 24
Table 3.3: North Ayrshire Council Proposed 2022/2023 Public EVCI 25
Table 3.4: East Ayrshire Council Owned Existing Public EVCI 26
Table 3.5: South Ayrshire Council Owned Existing Public EVCI 28
Table 6.1: Forecast Number of BEVs in Ayrshire 45
Table 6.2: Forecast Number of PHEVs in Ayrshire 45
Table 6.3: North Ayrshire BEV Forecast by 2025 and 2030 45
Table 6.4: North Ayrshire PHEV Forecast by 2025 and 2030 46
Table 6.5: East Ayrshire BEV Forecast by 2025 and 2030 46
Table 6.6: East Ayrshire PHEV Forecast by 2025 and 2030 46
Table 6.7: South Ayrshire BEV Forecast by 2025 and 2030 47
Table 6.8: South Ayrshire PHEV Forecast by 2025 and 2030 47
Table 6.9: Ayrshire Council Area EVCI Variables 51
Table 6.10: Ayrshire Surveyed Charging Preferences 51
Table 6.11: Utilisation Values for EV Charging Infrastructure by Type 52
Table 6.12: North Ayrshire Forecast EV Infrastructure Requirements 53
Table 6.13: East Ayrshire Forecast EV Infrastructure Requirements 54
Table 6.14: South Ayrshire Forecast EV Infrastructure Requirements 55

Table 6.15: Primary Substations Identified with Potentially Limited Capacity 56
Table 6.16: North Ayrshire Council Proposed Public Sector Residential EVCI Sites 57
Table 6.17: North Ayrshire Identified Public Sector Destination EVCI Sites 59
Table 6.18: North Ayrshire Public and Private Sector EVCI Summary 61
Table 6.19: East Ayrshire Council Proposed Public Sector Residential EVCI Sites 62
Table 6.20: East Ayrshire Identified Public Sector Destination Sites 64
Table 6.21: East Ayrshire Public and Private Sector EVCI Summary 65
Table 6.22: South Ayrshire Council Proposed Public Sector Residential EVCI Sites 67
Table 6.23: South Ayrshire Identified Public Sector Destination Sites 69
Table 6.24: South Ayrshire Public and Private Sector EVCI Summary 71
Table 6.25: Summary of Ayrshire Existing and Proposed Public Sector EVCI 71
Table 6.26: Summary of Identified Additional Public Sector EVCI in Ayrshire 71
Table 6.27: Summary of Ayrshire Existing and Forecast CPO EVCI 72
Table 6.28: Estimated DNO Costs based on Charger Output 74
Table 6.29: Driving Catchment Analysis 78
Table 6.30: Comparison between Field Dynamics Analysis and Proposed EVCI Network for North Ayrshire 79
Table 7.1: Examples of delivery and operating risks in EVCI market 82
Table 7.2: Commercial model objectives 83
Table 7.3: Chargepoint typology distribution by sector 86
Table 7.4: Commercial model options 89
Table 7.5: Commercial model scoring – weighted results 92
Table 8.1: Funding sources 96
Table 8.2: Commercial model comparison RAG analysis 97
Table 8.3: Model input values 98
Table 9.1: High-Level Risk Register 104

Figures

Figure 0.1: Meeting SFT's Strategic Aims 2
Figure 2.1: Ayrshire study area 8
Figure 2.2: Population density 10
Figure 2.3: Indices of Multiple Deprivation 11
Figure 2.4: Dwellings 12
Figure 2.5: Employment Centres 14
Figure 2.6: North Ayrshire Housing Allocations 15
Figure 3.1: Ayrshire and Scotland BEV and PHEV Year on Year Registrations 19
Figure 3.2: Total Number of ULEVs by Local Authority 19
Figure 3.3: Total Number of BEVs by Local Authority 20
Figure 3.4: Total Number of PHEVs by Local Authority 20
Figure 3.5: Charge Place Scotland network by postcode 21
Figure 3.6: Ayrshire EVCI – Council owned by charger type 22

Figure 3.7: Ayrshire EVI Council and privately owned 23
Figure 3.8: North Ayrshire EVI Locations 24
Figure 3.9: East Ayrshire EVI Locations 26
Figure 3.10: South Ayrshire EVI Locations 27
Figure 5.1: Sustainable Transport Hierarchy 37
Figure 6.1: EVCI Forecast High-Level Methodology 43
Figure 6.2: EV Optimisation Model Residential Charging Analysis Methodology 49
Figure 6.3: EV Optimisation Model Destination Charging Analysis Methodology 50
Figure 6.4: North Ayrshire Potential Residential EV Charger Locations 57
Figure 6.5: North Ayrshire Potential Destination or Rapid EV Charger Locations 59
Figure 6.6: East Ayrshire Potential Residential EV Charger Locations 61
Figure 6.7: East Ayrshire Potential Destination or Rapid EV Charger Locations 64
Figure 6.8: South Ayrshire Potential Residential EV Charger Locations 66
Figure 6.9: South Ayrshire Potential Destination or Rapid EV Charger Locations 69
Figure 6.10: Example 7kW On-street Residential Charge Point 72
Figure 6.11: Example Fast Destination Charger Dual Post Installation 73
Figure 6.12: Example 50kW Rapid Charger Installation 73
Figure 6.13: Destination and Rapid EVCI Driving Catchment Analysis 78
Figure 6.14: Field Dynamics Zonal Analysis and Proposed Network in North Ayrshire 79
Figure 7.1: Case for local authority intervention 80
Figure 7.2: Local authority EVCI market position 81
Figure 7.3: EV adoption projection estimates 83
Figure 7.4: EVCI components 87
Figure 7.5: Chargepoint infrastructure components and typical ownership 88
Figure 8.1: Time profile of funding sources 96
Figure 9.1: SFT-Suggested Project Procurement & Development Organogram 103

Executive summary

Summary

This business case sets out how North, East and South Ayrshire Councils will work together to invest in Electric Vehicle Infrastructure (EVI) to meet projected demand over the next three-to-four years. The proposed EVI programme will enable these three local authorities to work with commercial suppliers to increase EVIs through this programme from an existing 126 publicly funded and managed charge points, to an estimated 433. This total figure includes existing (upgraded where required) and new charge points as summarised in Table 0.1 below. The application for funding covered by this business case includes funding to install the additional 307 charging points.

Table 0.1: Summary of Total Proposed EVCI to be Procured

	Residential AC (7kW)	Destination AC (7 – 22kW)	Rapid DC (50kW)	Total Proposed (Applied for)	Total Existing and Proposed EVCI
North Ayrshire	39	53	12	**104**	**150**
East Ayrshire	58	31	3	**92**	**146**
South Ayrshire	69	35	7	**111**	**137**
Total	**166**	**119**	**22**	**307**	**433**

The estimated capital investment required to achieve the above network is summarised in Table 0.2.

Table 0.2: Summary of Total Proposed EVCI Capital Costs

	Total Proposed EVCI Estimated Cost	Estimated DNO Cost	Estimated Total Capital Cost
North Ayrshire	£1,356,800	£532,800	**£1,889,500**
East Ayrshire	£905,600	£170,800	**£1,076,300**
South Ayrshire	£1,225,600	£355,800	**£1,581,400**
Total	**£3,488,000**	**£1,059,300**	**£4,547,200**

The Ayrshire Councils are seeking investment in this programme to enable their communities, businesses and visitors to play their role in the EV transition and in meeting the Scottish Government's target to "remove the need for petrol and diesel cars and vans by 2032" (Scottish National Transport Strategy 2, 2020). This business case demonstrates the strategic need for the programme, and the need for it to meet the Ayrshire EVI programme's objectives:

The EVI programme also aligns with and helps to deliver the wider Draft Vision for Scotland's Public Electric Vehicle Charging Network 'A Network fit for the Future' (Transport Scotland, 2022), and its four key principles underpinned by the need for a 'just transition': a people-focused network; accelerating commercial investment; coordinating with the electricity network; and integration with Scotland's sustainable transport system.

Scottish Futures Trust (SFT) are coordinating the nationwide programme of 'pathfinder' projects to significantly increase a sustainable, well-managed and user focussed EVI network for the pathfinder Councils. SFT have developed the business case template that this document follows and stipulated key metrics to be provided in the rest of this Executive Summary. The proposed programme of EVI in this business case meets SFT's strategic aims as follows:

Figure 0.1: Meeting SFT's Strategic Aims

SFT's Strategic Aims	How the Approach of the EVI Programme in this Business Case Meets Those Aims
A comprehensive network of public charge points	From 2025, the successful delivery of EVI programmed in this business case will result in there being a comprehensive charging network with c. 433 publicly funded and managed charging points in the three Ayrshire council areas. It is predicted that 99% of Ayrshire properties without off-street parking will be within a 10 min drive of a charge point as a result of the investment made through this business case. Five-minute walking catchments have been assumed to residential chargers where off-street parking is limited to help deliver the 'equitable' and 'usable' objectives. But for example, in rural locations local provision will be dependent given the need to meet the 'viable' objective.
Access, fairness and need	The vison of this programme is to provide a usable network, accessible for all and through the 'Place Principle' and 'Community Wealth Building' approach should ensure that rural and island communities are not left behind.
Leveraging private investment and approach to enabling this investment	A 20-year concession-type ('public sector ownership with private sector operation') contract is recommended for new and existing assets, and it is estimated that c.37% of the estimated capital cost will be secured from the private sector.
Enabling wider sustainable transport outcomes	This EVI programme aims to reduce private car use and integrate with the sustainable and active travel offering. The Scottish Government have published a target to reduce vehicle km by 20% by 2030, mainly targeted at towns and cities, and this business case is strategically aligned with that target.

Economic Case

From the baseline data and range of forecasts analysed, low, central and high EV uptake forecasts were derived for each of the three Ayrshire Councils. This data is summarised for the overall Plug-in Vehicle (PiV) uptake across the Ayrshire region in Table 0.3.

Table 0.3: Forecast Number of Plug-in Vehicles in Ayrshire

Ayrshire Total PiV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	3,882	7,604	11,582	14,674	23,175	39,205
LGV	591	1,078	2,158	2,284	6,029	10,002
Taxi	29	63	111	88	196	342
Private Hire	29	63	106	88	196	336
Total	**4,531**	**8,807**	**13,957**	**17,134**	**29,596**	**49,885**

Source: Mott MacDonald

The overall PiV forecast is then broken down into each of the local authorities, with North Ayrshire shown in Table 0.4, East Ayrshire in Table 0.5 and South Ayrshire in Table 0.6.

Table 0.4: Forecast Number of Plug-in Vehicles in North Ayrshire

North Ayrshire PiV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	1,009	2,081	2,903	3,709	7,082	9,355
LGV	195	399	748	848	2,095	3,687
Taxi	10	22	35	29	69	122
Private Hire	13	25	35	38	83	116
Total	**1,225**	**2,527**	**3,722**	**4,624**	**9,329**	**13,281**

Source: Mott MacDonald

Table 0.5: Forecast Number of Plug-in Vehicles in East Ayrshire

East Ayrshire PiV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	1,009	2,002	3,352	3,709	6,610	11,721
LGV	159	310	799	620	1,605	3,624
Taxi	10	20	37	29	69	117
Private Hire	12	25	37	36	84	130
Total	**1,189**	**2,357**	**4,225**	**4,395**	**8,368**	**15,592**

Source: Mott MacDonald

Table 0.6: Forecast Number of Plug-in Vehicles in South Ayrshire

South Ayrshire PiV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	1,454	2,938	4,539	5,381	8,985	15,531
LGV	235	370	692	684	1,776	2,805
Taxi	10	15	37	28	53	101
Private Hire	10	22	42	29	83	156
Total	**1,707**	**3,346**	**5,310**	**6,122**	**10,897**	**18,593**

Source: Mott MacDonald

Charge Points per 100,000 Population

The current charge point provision within the Ayrshire region and Councils were compared to the 2019 mid population estimates for each local authority area. The subsequent EVCI forecasts for 2025 and 2030 were then also compared to the 2019 population to derive the forecast charge points per 100,000 population. The results are shown in Table 0.7.

Table 0.7: Forecast Ayrshire Charge Points per 100,000 Population

	2022	2025	2030
North Ayrshire	33	284	991
East Ayrshire	44	210	811
South Ayrshire	23	292	1,037
Overall	**46**	**262**	**945**

Source: Mott MacDonald and Office for National Statistics

Note that these statistics are not based on the proposed network, only the forecast requirement.

EV to Charge Point Ratio

The existing number of EV within the Ayrshire region and Councils as observed at the end of Q4 2021 was compared with the number of publicly accessible EVCI to derive the EV to charge point ratio. This was then compared for the central forecasts in 2025 and 2030 and are summarised in Table 0.8.

Table 0.8: Forecast Ayrshire EV to Charge Point Ratio

	2021	2025	2030
North Ayrshire	11	7	7
East Ayrshire	10	9	8
South Ayrshire	22	10	9
Overall	**9**	**9**	**8**

Source: Mott MacDonald and Department for Transport

Note that these statistics are not based on the proposed network, only the forecast requirement.

Proposed Publicly Procured Charging Infrastructure

A summary of the proposed EVCI to be procured by the respective Councils is summarised in Table 0.9below.

Table 0.9: Summary of Total Proposed EVCI to be Procured

	Residential AC (7kW) EVCI	Destination AC (7 – 22kW) EVCI	Rapid DC (50kW) EVCI	Total Proposed EVCI	Total Existing and Proposed EVCI
North Ayrshire	39	53	12	**104**	**150**
East Ayrshire	58	31	3	**92**	**146**
South Ayrshire	69	35	7	**111**	**137**
Total	**166**	**119**	**22**	**307**	**433**

The associated cost estimates for the proposed network are summarised in Table 0.10.

Table 0.10: Summary of Cost Estimates for the Proposed Network

	Residential AC (7kW) Estimated Cost	Destination AC (7 – 22kW) Estimated Cost	Rapid DC (50kW) Estimated Cost	Total Proposed EVCI Estimated Cost	Estimated DNO Cost	Estimated Total Capital Cost
North Ayrshire	£334,600	£461,100	£561,100	**£1,356,800**	£532,800	**£1,889,500**
East Ayrshire	£497,600	£267,600	£140,400	**£905,600**	£170,800	**£1,076,300**
South Ayrshire	£592,000	£306,200	£327,400	**£1,225,600**	£355,800	**£1,581,400**
Total	**£1,424,200**	**£1,034,900**	**£1,028,900**	**£3,488,000**	**£1,059,300**	**£4,547,200**

These cost estimates are based on £8,580 for 7kW AC chargers, £8,910 for 22kW AC chargers and £46,760 for 50kW DC chargers. DNO cost estimates are variable depending on the proposed EVCI location and the associated power output.

Commercial Case

Local authorities have an interest in intervening in the EVI market, both in order to promote EV uptake towards Net Zero targets and to ensure a socially equitable network. They also have several strengths to bring to the market. However, it is also recognised that local authorities are not as well placed as the private sector for borrowing capital and responding to the significant delivery and operating uncertainties associated with this emerging market. After considering four different commercial models in terms of affordability, risk allocation, social outcomes, contestability, procurement, resources and revenue, the Commercial Case recommends a concession-based contract (public sector ownership with private sector operation). It is likely that the three Ayrshire councils will work together to procure EVI, but this is yet to be finalised.

Financial Modelling

At present, only North Ayrshire Council has a tariff regime in place for EVCI owned by the Council. This is currently set at £0.19 for AC charging and £0.30 for DC charging.

It is proposed that a new tariff is implemented across the three council areas for price synergies and consistency within the region. This is anticipated to be £0. 50 for AC charging and £0.60 for DC charging, with the rate competitive with the private sector.

The proposed network for the Ayrshire region is anticipated to mobilise £2.0M of private sector capital, based on a capital subsidy sought of £3.2M for the three local authorities.

Approvals and Next Steps

The next steps for the EVI programme, prior to commencing procurement are as follows:

- Approval of this business case document by each Council's Executive Leadership Team (or equivalent) and Cabinet. This process is expected to take two-to-three months.
- Concurrently, development of an Inter-Entity Agreement between the three Councils (with East and South Ayrshire represented by the Ayrshire Roads Alliance), to allow for joint-working to deliver the EVI programme set out in this business case.
- Also concurrently, undertaking more detailed feasibility work and develop procurement/tendering documentation to allow for the EVI programme to be procured from commercial operators. This includes market testing and establishing the infrastructure requirements at each site in greater detail.
- Development of the procurement and tendering information to offer the EVI programme (inclusive of existing and new assets) to the market, aiming for early in the 2023-24 financial year for procurement to commence.
- The three Councils will procure commercial suppliers to upgrade existing EVI and install new EVI in the locations set out in this business case (subject to feasibility considerations), and manage all these assets, such that a total of 433 charge points will be available through this EVI programme by the end of 2025-26.

1 Introduction

1.1 Purpose of the Business Case

This business case presents the proposed package of public Electric Vehicle (EV) charging infrastructure requirements for Ayrshire, required to service the predicted growth in EVs resulting from the UK and Scottish Governments' commitment to transitioning to EVs. It considers the need for additional Electric Vehicle Infrastructure (EVI) throughout North, South and East Ayrshire. It sets out how it is planned to fund and deliver Ayrshire's future EV network, to be delivered collaboratively by the Councils and the market by blending required public investment for EVI with commercial EVI investment. The Scottish Government has mandated Scottish Futures Trust (SFT) to undertake programme management of the Electric Vehicle Infrastructure Fund (EVIF), including providing the framework for local authorities to bid to the fund, and making recommendations to the Scottish Government on funding awards.

In the scope of this business case is provision of EVI for electric passenger cars and light goods vehicles (LGVs) to charge. Charging facilities for other vehicles, e.g. motorcycles, Heavy Goods Vehicles (HGVs) and Passenger Carrying Vehicles (PCVs), are out of scope.

1.2 Structure of the Business Case

The structure of this business case follows the SFT template and is outlined below, for the sections following this introduction:

- Background and scope
- Baseline position
- The Strategic Case
- Consultation and Stakeholder Engagement
- The Economic Case
- The Commercial Case
- The Financial Case
- The Management Case

1.3 Limitations

We accept no responsibility for any error or omission in the Report which is due to an error or omission in data, personal data (as defined in the Data Protection Act 2018), information or statements supplied to us by other parties including the Client (the 'Data'). We have not independently verified the Data or otherwise examined it to determine the accuracy, completeness, sufficiency for any purpose or feasibility for any particular outcome including financial.

Forecasts presented in this document were prepared using the Data and the Report is dependent or based on the Data. Inevitably, some of the assumptions used to develop the forecasts will not be realised and unanticipated events and circumstances may occur. Consequently, we do not guarantee or warrant the conclusions contained in the Report as there are likely to be differences between the forecasts and the actual results and those differences may be material. While we consider that the information and opinions given in this Report are sound all parties must rely on their own skill and judgement when making use of it.

Information and opinions are current only as of the date of the Report and we accept no responsibility for updating such information or opinion. It should, therefore, not be assumed that any such information or opinion continues to be accurate subsequent to the date of the Report.

Under no circumstances may this Report or any extract or summary thereof be used in connection with any public or private securities offering including any related memorandum or prospectus for any securities offering or stock exchange listing or announcement.

2 Background and Scope

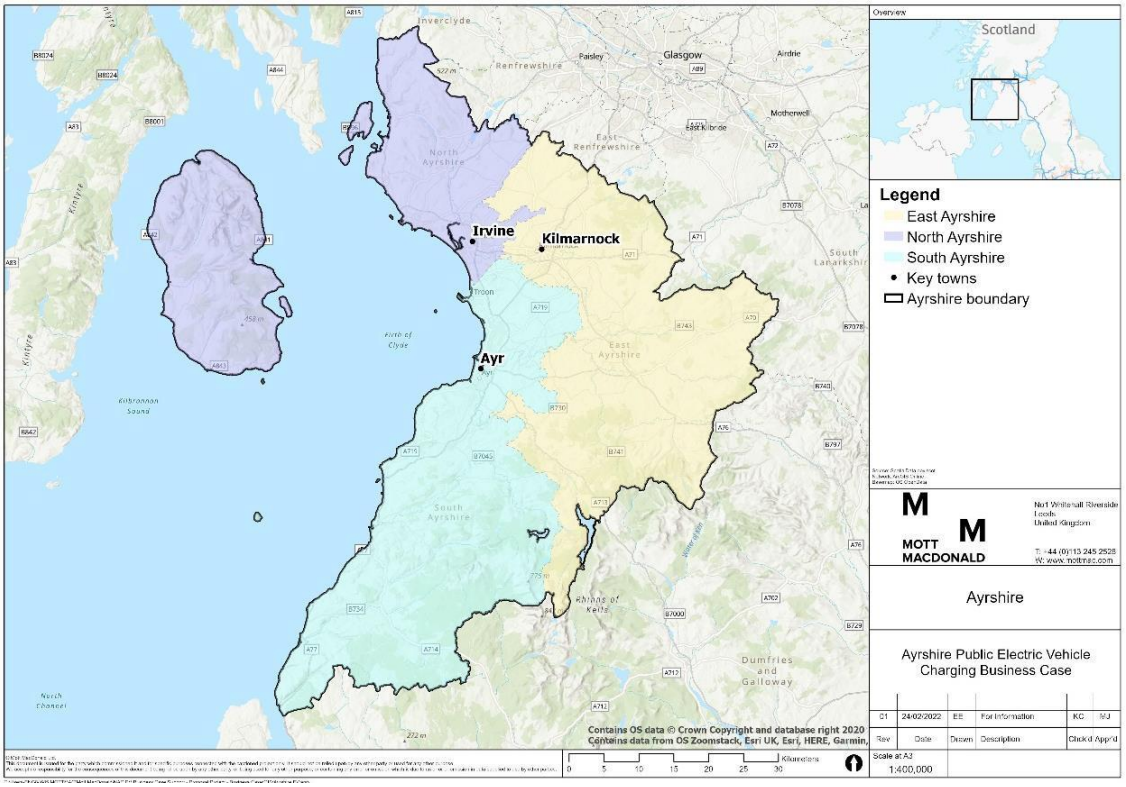
The Scottish Government set a target to "remove the need for petrol and diesel cars and vans by 2032"[1] and the number of plug-in cars and light goods vehicles licenced in Scotland has increased by over 3,700% between 2012 and 2019[2]. It is important that Scotland develops its Electric Vehicle Infrastructure (EVI) to meet the growing demand for electric vehicles.

This section sets out the background to current EVI and Electric Vehicle (EV) use in Ayrshire (comprising of North, South and East Ayrshire Council areas), and the scope of this business case to request public funding to deliver a future Ayrshire EVI network.

2.1 Study Area

Figure 2.1 shows the study area, Ayrshire, which is split into three Councils: North Ayrshire, South Ayrshire and East Ayrshire; it also encompasses the islands of Isle of Arran, Great Cumbrae, and Little Cumbrae. Ayrshire covers an area of 3,370km^2 and includes both urban and rural communities. The principal towns are Ayr in the south, Kilmarnock in the east, and Irvine in the north. There is 3,592km of road network in Ayrshire, of which 15% are trunk roads including the A70, A75 A76, A77 and A737.

Figure 2.1: Ayrshire study area



Source: Data from SpatialData.gov.scot. Map produced by Mott MacDonald

[1] Scottish National Transport Strategy 2 (2020)

[2] Ultra-Low Emission Vehicle (ULEV) Skills Baselining Study, Optimat Limited (on behalf of Transport Scotland and Skills Development Scotland), 202

2.1.1 Tourism

Ayrshire is a well-frequented tourist destination. In 2019, there were nearly 740,000 overnight trips and 10.4-million-day visits to Ayrshire and Arran[3]. There are several popular destinations in Ayrshire, particularly on the coast including Ardrossan, Ballantrae, Brodick, Largs and Troon. It is easily accessible, with Glasgow just a 30-minute drive from Ayrshire.

The most popular visitor attractions were Dean Castle Country Park, Culzean Castle and Country Park and Robert Burns Birthplace Museum. Ayrshire is also one of Scotland's top regions for golf, with nearly 50 courses, including 5 of the UK's top 100 courses and 3 Open Championship venues.

With a large number of tourists travelling into Ayrshire, public EV charging facilities are vital to enable visitors to charge their vehicles for travelling around Ayrshire and onward journeys.

2.1.2 Population

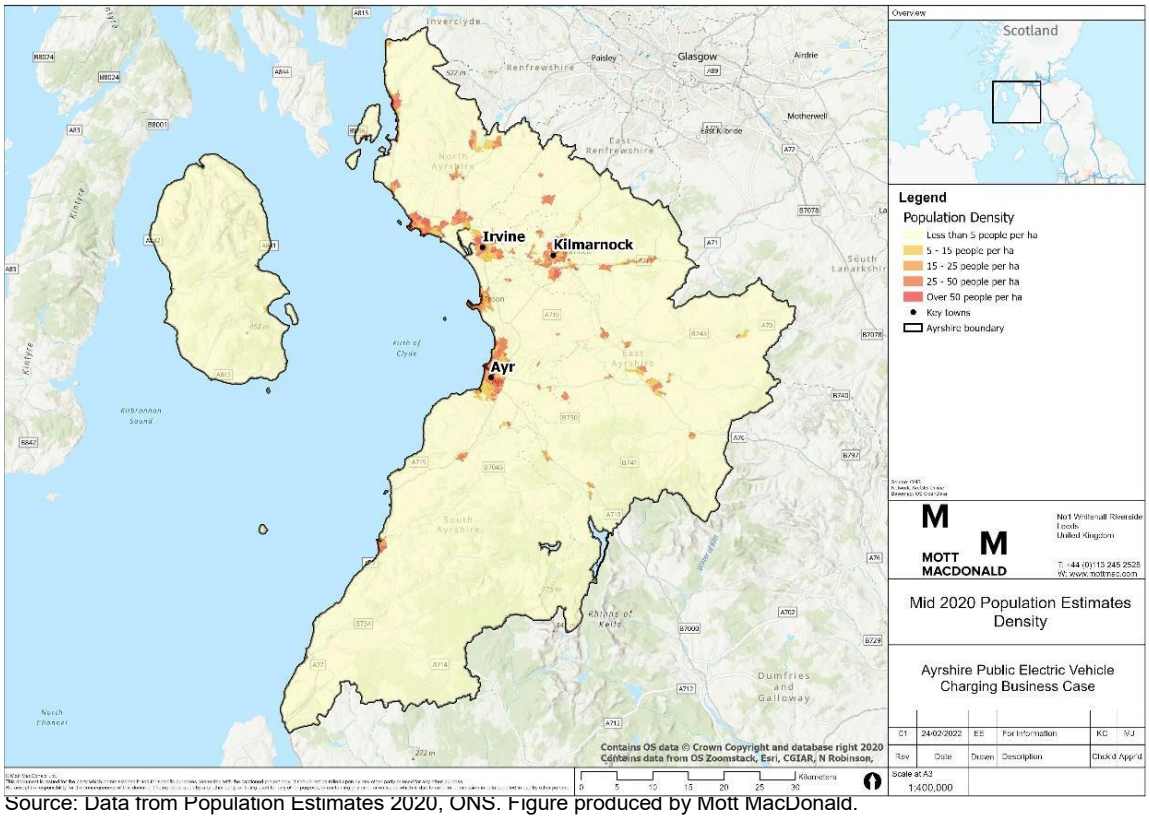
Figure 2.2 illustrates mid-2020 population estimates, in density per hectare (ha). The majority of Ayrshire has less than 5 people per ha, however there are small concentrations of high population density throughout Ayrshire, particularly in Ayr, Kilmarnock and Irvine. For comparison, Glasgow's average population density in mid-2020 was estimated at 3,640 people per square kilometre, making the city the largest Scottish City based on population density.

Table 2.1 illustrates the mid-year population estimates by age for North Ayrshire, South Ayrshire, East Ayrshire, and Ayrshire as a whole, and for comparison Scotland and the United Kingdom. Ayrshire has a slightly higher than UK average population aged 25-44, however this is lower than Scotland's percentage. The percentage working age population in Ayrshire is also lower than Scotland as a whole.

Areas with a low population density means that EV charging sites located there are likely to be less commercially viable due to fewer people requiring the use of them. However, the area will still require charging facilities for those with an EV and to encourage a shift to EVs.

[3] VisitScotland

Figure 2.2: Population density



Source: Data from Population Estimates 2020, ONS. Figure produced by Mott MacDonald.

Table 2.1: Mid-year Population Estimates, 2020

Parameter	North Ayrshire	South Ayrshire	East Ayrshire	Ayrshire	Scotland	UK
% Population aged 0-14	15%	14%	16%	15%	16%	15%
% Population aged 15-24	11%	10%	11%	11%	11%	11%
% Population aged 25 – 44	21%	20%	23%	22%	26%	21%
% Population aged 45 – 64	29%	29%	29%	29%	27%	29%
% Population aged 65+	23%	26%	21%	23%	19%	23%
% Working age (16 - 64)	60%	59%	62%	60%	64%	60%

Source: Population Estimates 2020, ONS. Shading denotes where % is higher than the UK average

2.1.3 Indices of Multiple Deprivation

To aid understanding of deprivation and economic disadvantage, Indices of Multiple Deprivation (IMD) were mapped to acquire a spatial understanding of the socio-economic problems in the study area, as shown in Figure 3.1.

Deciles are calculated by ranking the data zones from most deprived to least deprived and dividing them into 10 equal groups. Zones in decile 1 fall within the 10% most deprived zones nationally, whilst zones in decile 10 fall within the 10% least deprived of data zones nationally.

The IMD is the official measure of deprivation and combines information from the following:

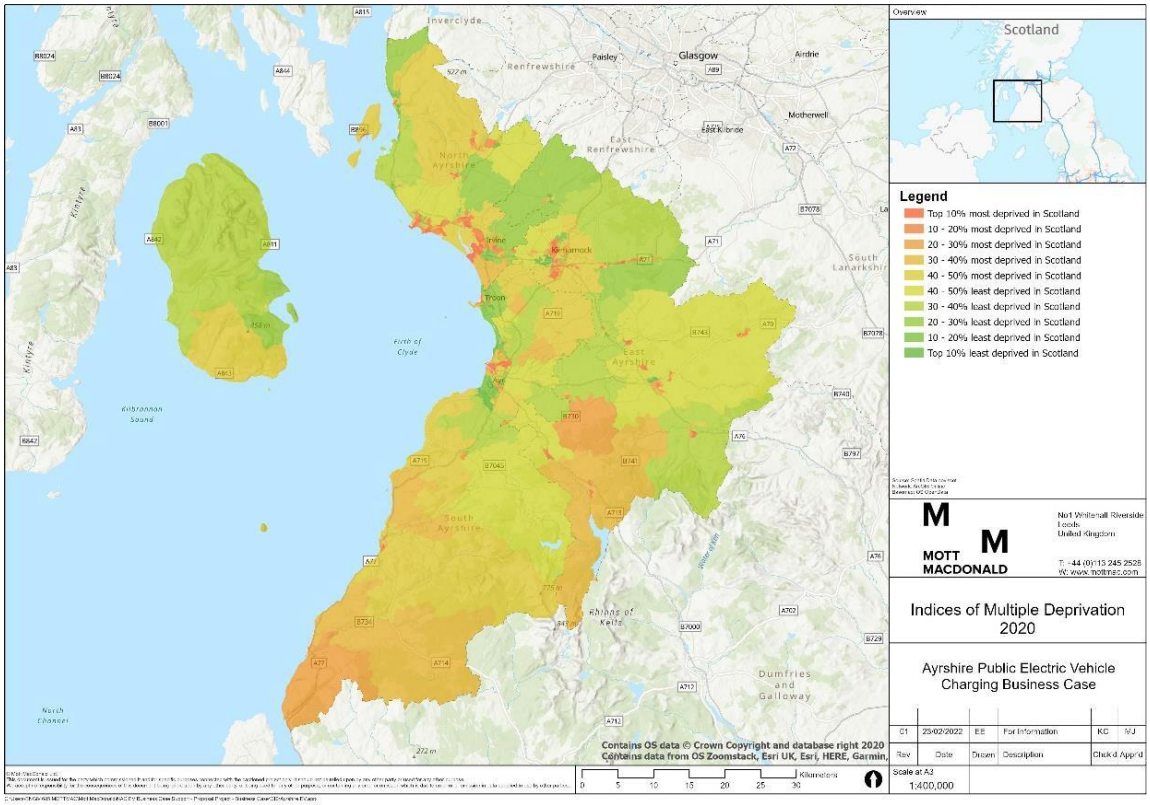
- Employment Deprivation;
- Education, Skills and Training Deprivation;

- Health Deprivation and Disability;
- Crime;
- Barriers to Housing and Services; and
- Living Environment Deprivation.

Figure 2.3 illustrates that deprivation is relatively low throughout Ayrshire however some areas in South Ayrshire fall within the top 40% most deprived zones in Scotland. Several areas are also in the top 10% most deprived in Scotland in Ayr, Kilmarnock and Irvine as well as in smaller villages such as Kilwinning, Newmilns, Catrine and Cumnock.

The purchase price of EVs is currently a significant barrier to uptake, meaning the socioeconomic context represents an important consideration for charging infrastructure. Demand for EVI may therefore increase sooner in higher decile zones, and so be more attractive to private sector investment. In turn, this may mean that lower decile areas may be less attractive to the private market. These are important considerations to ensure that the decarbonisation of transport is fair and just.

Figure 2.3: Indices of Multiple Deprivation



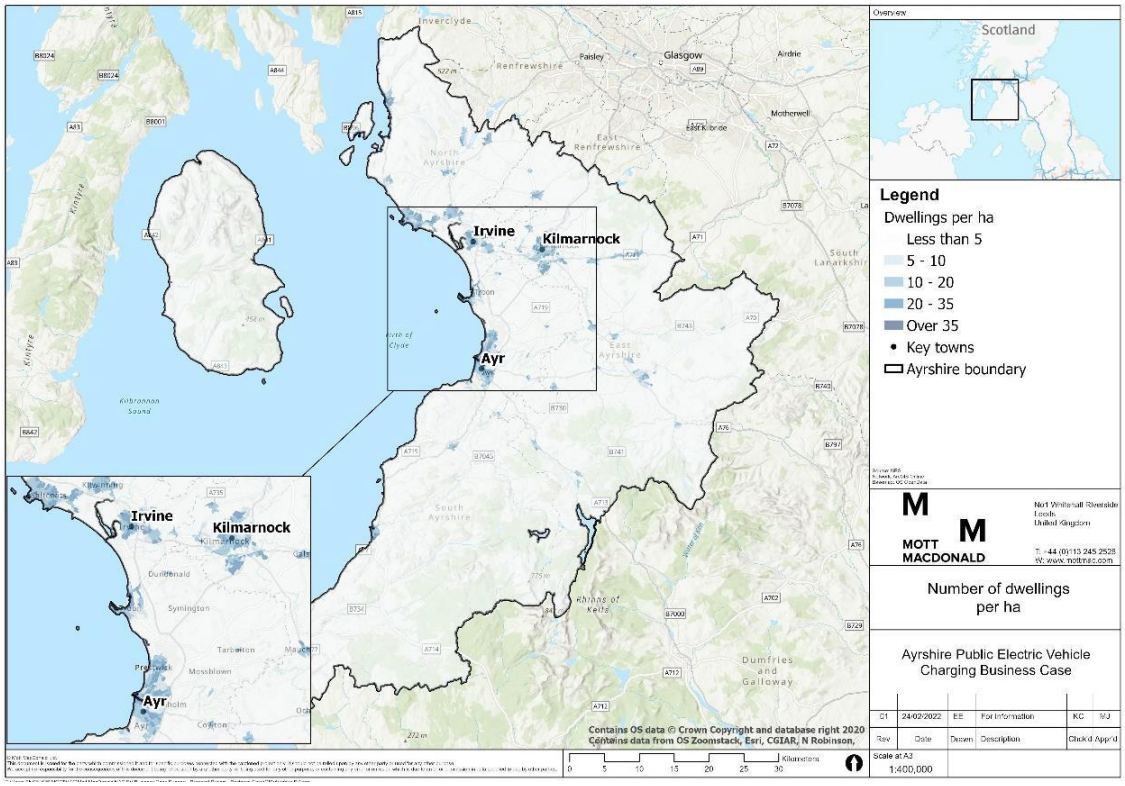
Source: Data from Scottish Index of Multiple Deprivation. Map produced by Mott MacDonald

2.1.4 Dwellings

Figure 2.4 shows the number of dwellings per hectare throughout Ayrshire. The highest number of dwellings per hectare are located in the three principal towns. Table 2.2 shows the total number of dwellings per area, there are around 183,000 dwellings in Ayrshire as a whole and North Ayrshire has the largest number.

Where there is a lower density of dwellings, commercial viability becomes an issue as there is likely to be less demand for EVI. Additionally, individuals are likely to be required to travel further to access EVI and therefore potentially less likely to use public EVI.

Figure 2.4: Dwellings



Source: Data from National Records of Scotland (NRS). Map produced by Mott MacDonald

Table 2.2: Number of dwellings, 2020

	Number of dwellings
North Ayrshire	68,923
South Ayrshire	55,358
East Ayrshire	58,844
Ayrshire Total	**183,125**

Source: NRS, 2020

2.1.5 Employment Characteristics

Table 2.3 identifies the proportion of employees by industry. Most people in Ayrshire work in health (Q) and retail (G) industries. Around 10% of people in East and South Ayrshire work in the manufacturing (C) industry. There are also several people working in Accommodation & food services (I), Business administration & support services (N), Public administration & defence (O) and Education (P).

This analysis aids understanding of employment trends and the industry types which underpin economic activity in the region, including the likely vehicle types used/required for different industries (such as delivery vans, fleets etc.), commuting patterns and types of employment land which can be used to identify charging locations. The majority of people in Ayrshire work in employment areas likely to have a higher number of shift workers, and this suggests they likely

have a greater need to travel to work via car. Therefore, there is likely to be both the need and potential to encourage EV uptake, and reliable EVI network is required.

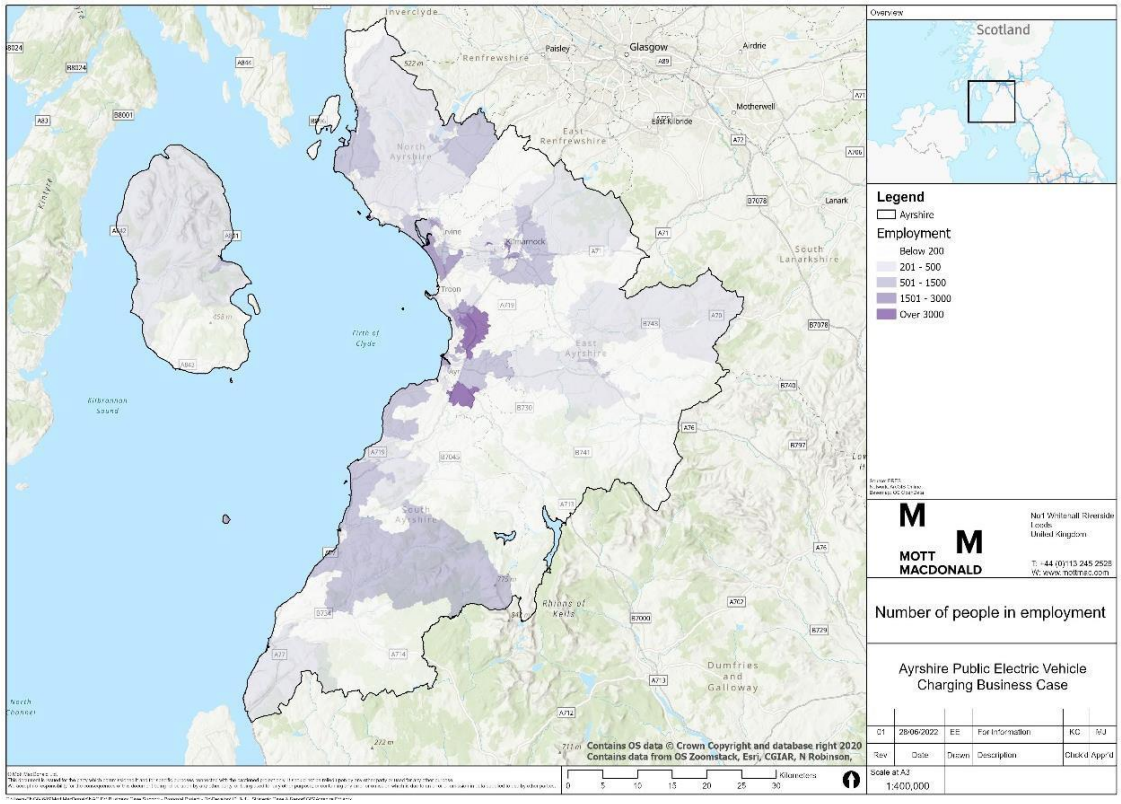
Table 2.3: Proportion of employees by industry (%)

	North Ayrshire %	South Ayrshire %	East Ayrshire %
Agriculture, forestry & fishing (A)	2.1	1.0	1.6
Mining, quarrying & utilities (B,D and E)	1.8	3.2	0.9
Manufacturing (C)	6.4	11.5	10.2
Construction (F)	4.5	6.4	4.0
Motor trades (Part G)	2.1	1.5	2.8
Wholesale (Part G)	2.1	3.2	2.3
Retail (Part G)	10.3	12.8	13.6
Transport & storage (inc postal) (H)	4.5	3.8	5.7
Accommodation & food services (I)	6.4	7.7	9.1
Information & communication (J)	1.3	0.9	1.1
Financial & insurance (K)	1.0	1.0	1.1
Property (L)	0.9	1.5	1.4
Professional, scientific & technical (M)	4.5	3.8	5.1
Business administration & support services (N)	7.7	6.4	3.4
Public administration & defence (O)	7.7	6.4	5.1
Education (P)	6.4	9.0	8.0
Health (Q)	25.6	15.4	20.5
Arts, entertainment, recreation & other services (R,S,T and U)	3.8	3.8	4.5

Source: Business Register and Employment Survey (BRES), 2020

Figure 2.5 shows the number of people who are employed throughout Ayrshire and highlights the key employment centres such as Ayr.

Figure 2.5: Employment Centres



Source: Data from BRES. Map produced by Mott MacDonald

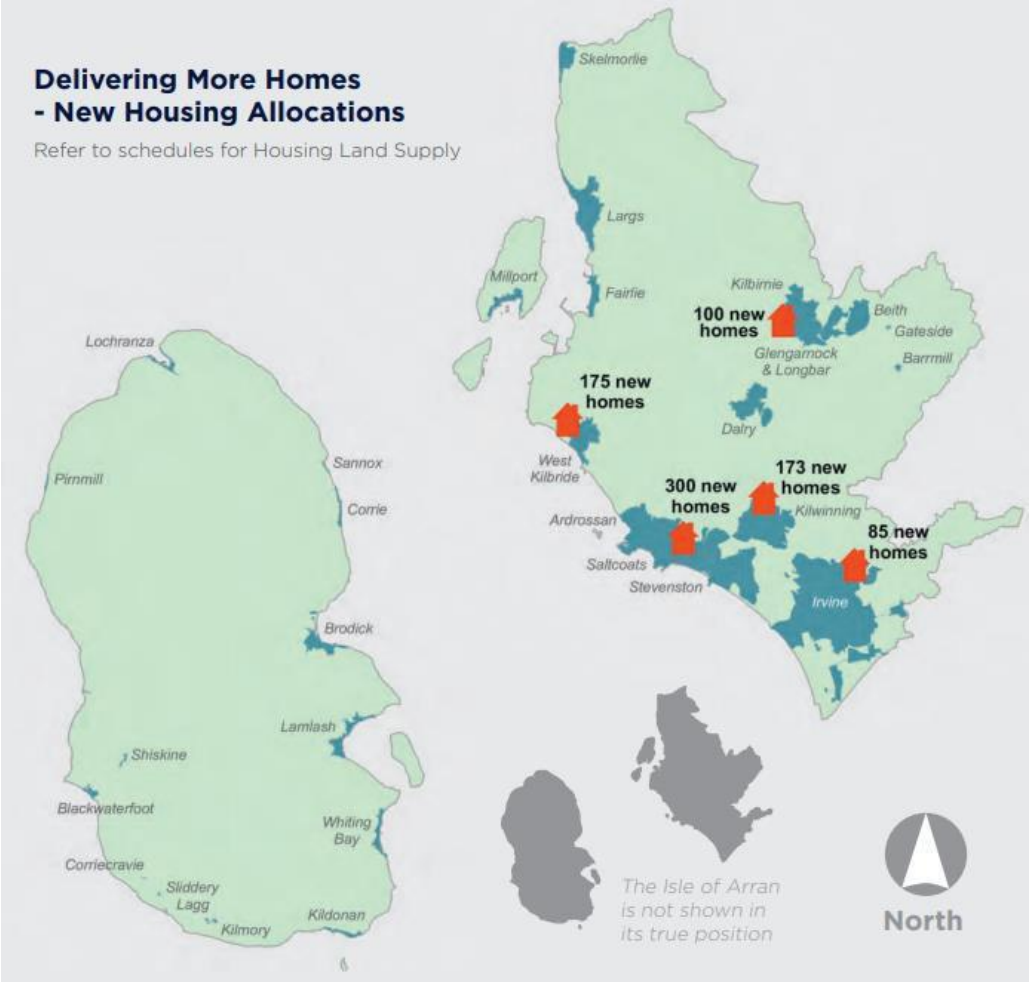
2.1.6 Housing and Commercial Development

2.1.6.1 North Ayrshire

New housing allocations have been identified throughout the district with 2,810 new homes expected to be delivered between 2019-2024. There are currently five sites identified with capacity of 830 new homes which will address shortfall and up to 4,319 indicative capacity identified elsewhere as potential development. These can be seen in Figure 2.6.

There are also 517 hectares of employment locations identified for development for business and industry uses. These are located in Garnock Valley, Irvine/Kilwinning, North Coast and Cumbrae and Three Towns.

Figure 2.6: North Ayrshire Housing Allocations



Source: North Ayrshire Local Development Plan

2.1.6.2 South Ayrshire

South Ayrshire Council published its Local Development Plan 2 in August 2022. The following are identified as future housing allocation sites:

- Dunlop Terrace AYR AH1
- Westwood Avenue AYR AH2
- Afton Avenue and Afton Park PRES AH1
- St Cuthbert Golf Club PRES2
- Aldersyde Avenue TRO AH1
- Buchan Road TRO AH2

Most of these sites are relatively small-scale with capacities ranging from 10-45 each[4]. However, it is likely every new home with associated parking must include an EV charge point in Scotland following a similar building regulation change in England, and in line with the Scottish Government's targets and plans for the EV transition. These sites will present opportunities to provide on-street or driveway EV charging.

[4] South Ayrshire Local Development Plan 2 - Proposals Map(s)(accessed September 2022).

2.1.6.3 East Ayrshire

The following areas are identified in the Local Development Plan 1 as current future housing growth areas beyond 2025[5].

- FGA1: East of Maxwood Road, Galston
- FGA2: West of Altonhill, Kilmarnock
- FGA3: South of A71 near to Moorfield Roundabout, Kilmarnock
- FGA4: Land between Dalry Road and Kilwinning Road, West of Stewarton

An understanding of future housing growth helps to inform the likely areas for future EV demand and provides an opportunity to encourage the uptake of EV. Furthermore, it is likely every new home with associated parking must include an EV charge point in Scotland following a similar building regulation change in England. New housing with EV charge points will therefore reduce the need of these vehicles to use the public network to fulfil most of their charging needs – but conversely, will increase the uptake of EVs and some residents may also have a need to charge their vehicles elsewhere during the day.

2.2 Scope

The scope of this EV Business Case is outlined in this section, detailing the vehicle and charger types analysed within this study.

2.2.1 Vehicle Types

The following vehicles types have been assessed as part of this business case:

- Cars
- Light Goods Vehicles (LGVs)
- Taxis
- Private Hire Vehicles (PGVs)

Motorcycles, Heavy Goods Vehicles (HGVs) and Passenger Carrying Vehicles (PCVs) have not been analysed as electrification technologies for these types of vehicles are still in development, and therefore out of scope for the SFT programme.

The following classifications of Ultra Low Emission Vehicles (ULEV) have been analysed for the purposes of this report:

- **Battery Electric Vehicle (BEV):** a vehicle powered by electricity, with energy stored in a battery. The vehicle is recharged by plugging it into a source of electricity such as a dedicated EV charging point or a standard 3-pin plug, with regenerative braking recapturing some energy when slowing. The range is dependent on the battery size, the vehicle efficiency and drag coefficient, but most BEVs on sale currently have a 200-mile range assuming a 50kWh battery.
- **Plug-in Hybrid Electric Vehicle (PHEV):** a vehicle primarily powered by an Internal Combustion Engine (ICE) with a supplementary battery and electric motor. PHEVs can travel on electric-only for around 30 miles, depending on the size of the battery. The battery is recharged by the ICE, plugging into a source of electricity or by regenerative braking.

There are other types of ULEV that are out of scope of this commission. These include Hybrid Electric Vehicles (HEV) and Hydrogen Fuel Cell EV (FCEV).

[5] East Ayrshire Local Development Plan 2 – Main Issues Report

2.2.2 Charging Types

There are a range of charger types that provide power to EVs, which are categorised based on the power output of the charger. These are summarised in Table 2.4.

Table 2.4: EV Charger Types

Charger Type	Output (kW)	Typical Time to Fully Recharge BEV	Examples of Location Suitability
Slow (AC)	Up to 7kW	6 to 12 hours	Residential on-street, workplace, private driveway, car parks, transport hubs.
Fast (AC)	7kW to 22kW	2 to 5 hours	Destinations including car parks, supermarkets, leisure centres, retail parks, transport hubs.
Rapid (DC)	43kW to 100kW	20 to 60 minutes	Destinations such as supermarkets, retail parks and transport hubs, or en-route journey charging like motorway services and service stations
Ultra-rapid (DC)	100kW to 350kW	15 to 30 minutes	En-route journey charging such as motorway services and service stations.

The range of power outputs are dependent on the method of charging up an EV. Alternating Current (AC) chargers use power supplied directly from the grid and typically output under 22kW. The amount of AC that an EV can accept is limited by the vehicle's onboard charger, which converts AC to Direct Current (DC) to store in the battery. Rapid chargers use DC to directly recharge the battery and so are quicker to charge the vehicle.

The higher the charger output, the greater capacity required in the local electricity grid. AC slow and fast chargers are typically the lowest installation cost by utilising existing power supplies, while DC rapid and ultra-rapid chargers cost more due to the electricity grid upgrades required.

AC chargers typically have a Type 2 socket. This type of charging typically requires the driver to use their own cable included with the car, and so the charger is 'untethered'. Tethered chargers are typically rapid or ultra-rapid, meaning the charger has cables built in. Power is delivered via CHAdeMO or Combined Charging Standard (CCS), depending on the vehicle type. In the EU, CCS is the preferred charging standard and CHAdeMO is gradually being phased out. Most EVCI offers a range of connector types and are interoperable with most EV models.

3 Baseline Position at March 2022

This section summarises the baseline position of EVs and associated charging infrastructure within the Ayrshire region as of March 2022, along with the current service delivery of EVCI by the councils.

3.1 Existing Electric Vehicle Ownership

The Department for Transport (DfT) VEH01 statistical dataset [6] was utilised to analyse the existing number of registered EVs within the study area. As of Q4 2021, there were 43,496 ULEV, including BEV, PHEV and Fuel Cell Electric Vehicles (FCEV) registered in Scotland. Within this number, there were approximately 1,592 ULEVs registered in Ayrshire consisting of 1,039 BEVs and 707 PHEVs.

As shown Table 3.1, the total number of ULEV registered in the Ayrshires has increased since 2015. The number of PHEV in the region increased at a greater rate than BEV prior to 2019, however since the number of BEV has outstripped the number of PHEV on the road, with PHEV registrations declining until 2021.

Table 3.1: Registered ULEV, BEV and PHEV Rate of Increase in Ayrshire

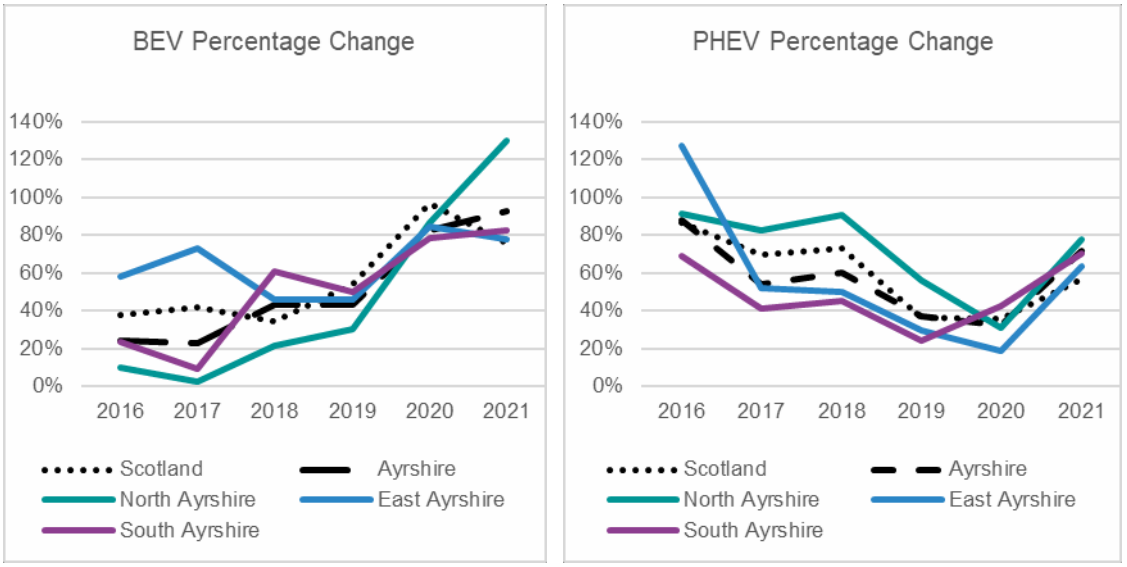
Year	Total Registered ULEVs	ULEV Percentage Increase	Total Registered BEVs	BEV Percentage Increase	Total Registered PHEVs	PHEV Percentage Increase
2015	156	-	102	-	45	-
2016	221	42%	124	22%	85	89%
2017	295	33%	152	23%	121	42%
2018	440	49%	215	41%	191	58%
2019	571	30%	305	42%	230	20%
2020	901	58%	550	80%	314	37%
2021	1,592	77%	1,039	93%	707	72%

Source: DfT VEH01 Statistical Data

Figure 3.1 compares the BEV and PHEV annual vehicle registration percentage changes within Ayrshire in context with the trends from the rest of Scotland.

[6] Vehicle Statistics Collection, Department for Transport and Driver Vehicle Licensing Agency. January 2022. Available at: Vehicles statistics - GOV.UK (www.gov.uk)

Figure 3.1: Ayrshire and Scotland BEV and PHEV Year on Year Registrations

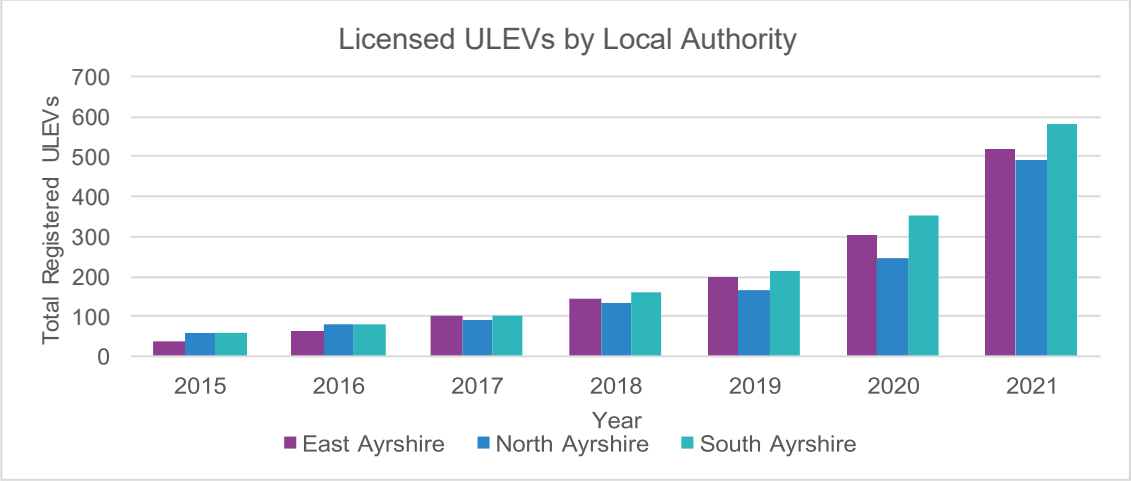


Source: DfT VEH01 Statistical Data

It is evident that the annual BEV registration percentage change in Ayrshire is slightly behind those in the rest of Scotland. This is potentially due to the area having a relatively low population density compared to the rest of Scotland, with sparse population centres and long distances between them. For PHEV registrations, the annual percentage change within the Ayrshire is the same rate as Scotland. All Ayrshire council areas broadly follow the same trends as observed Scotland-wide.

The cumulative total of ULEVs registered in each of the Ayrshire local authorities over the last five years is shown Figure 3.2.

Figure 3.2: Total Number of ULEVs by Local Authority

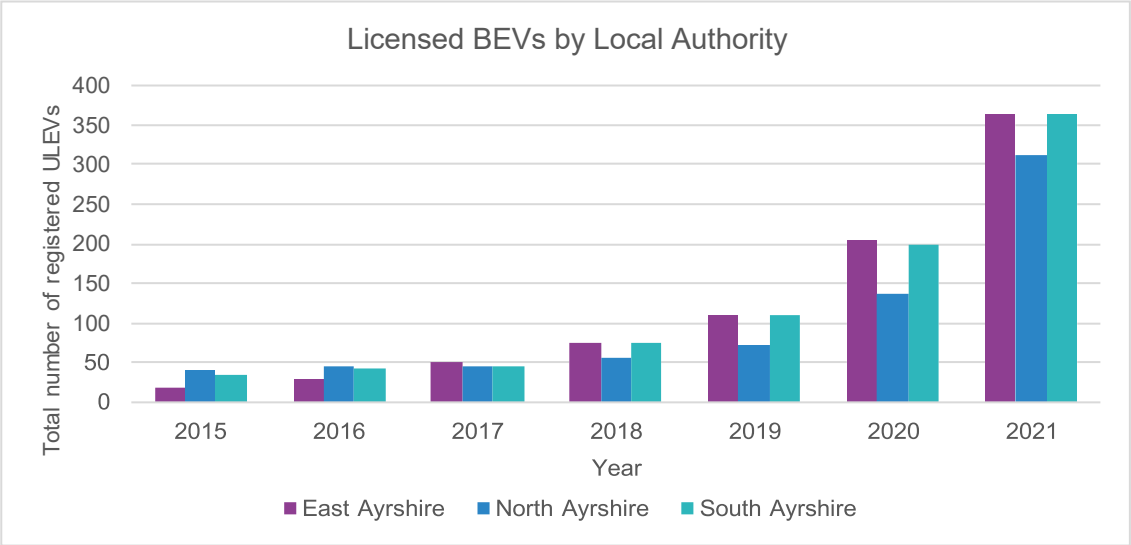


Source: DfT VEH01 Statistical Data

There is a greater uptake of ULEVs in both East Ayrshire and South Ayrshire, compared to North Ayrshire. From 2015 to 2019 the total number of registered ULEVs in East Ayrshire and South Ayrshire are comparable, however there is a noticeable in South Ayrshire in 2020. This increase is mainly due to the uptake of PHEVs as shown in Figure 3.1.

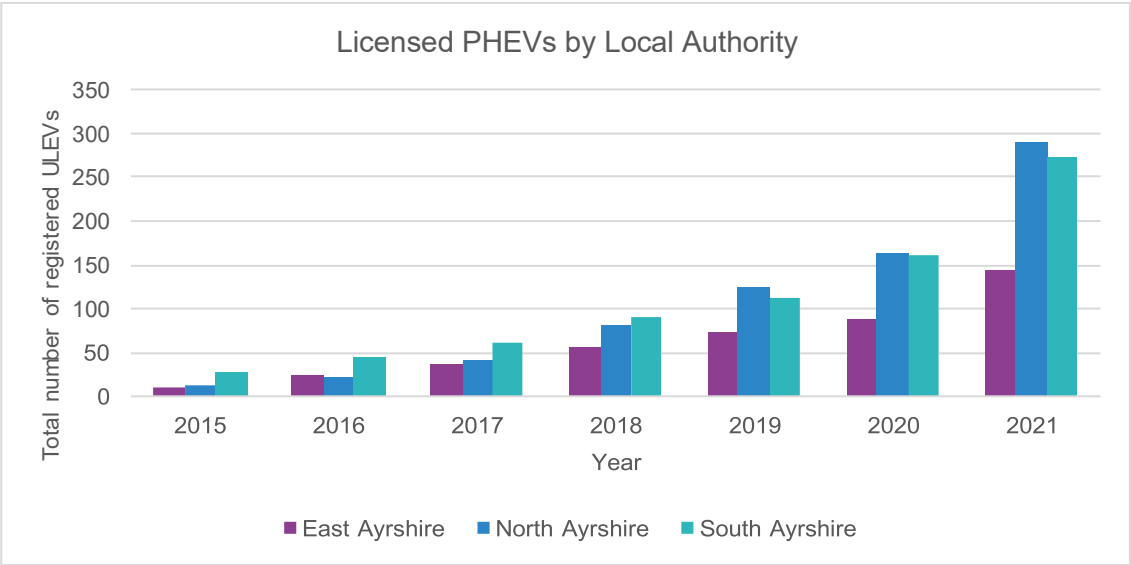
Figure 3.3 illustrates the number of registered BEVs in the Ayrshire local authorities while Figure 3.4 shows the number of registered PHEVs in the region.

Figure 3.3: Total Number of BEVs by Local Authority



Source: DfT VEH01 Statistical Data

Figure 3.4: Total Number of PHEVs by Local Authority

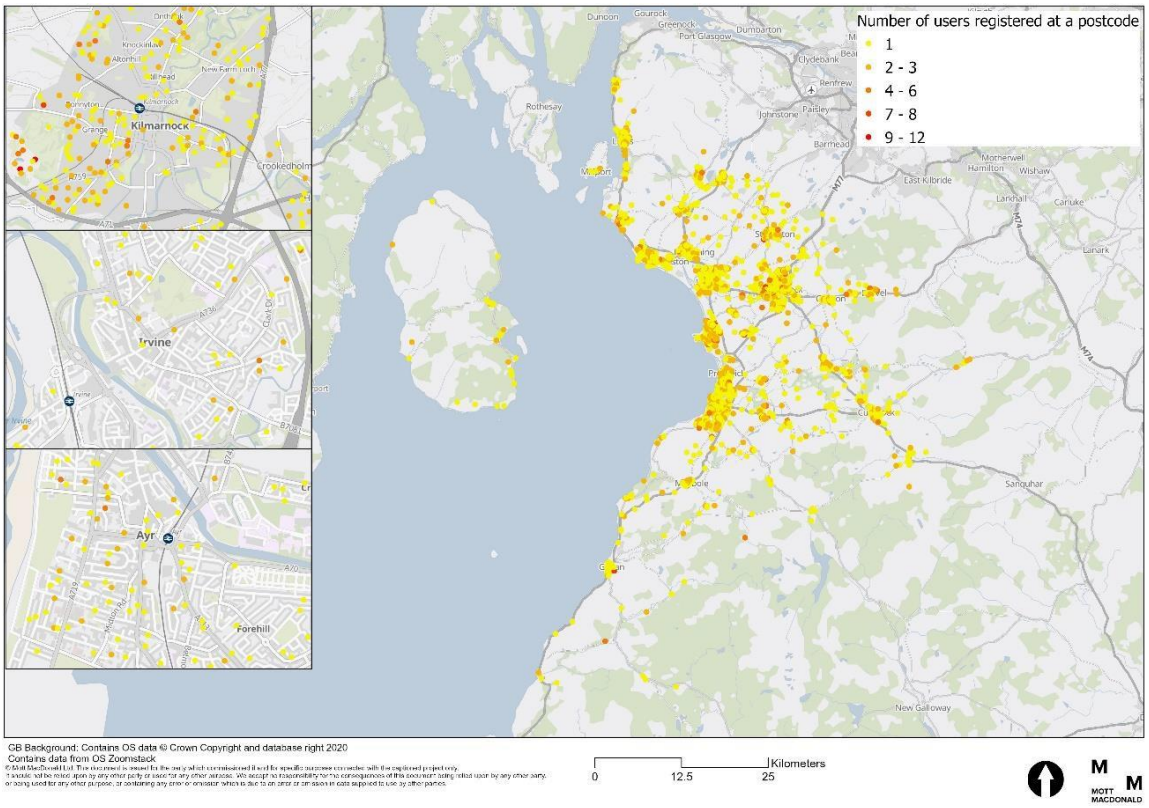


Source: DfT VEH01 Statistical Data

The Df T data indicates that there are more BEVs registered than PHEVs. Figure 3.3 and Figure 3.4, it can be seen that East Ayrshire and South Ayrshire have the fastest BEV growth, and that all three local authorities have comparable PHEV growth, with the exception of South Ayrshire in 2020. Df T statistical data includes vehicle fleets, therefore if a national company or local authority has a large vehicle fleet registered within a region then this could explain the greater number of PHEV registrations in South Ayrshire.

In addition to examining vehicle registration data, user data for the ChargePlace Scotland network was also assessed. Figure 3.5 shows the number of people signed up to the ChargePlace Scotland network by postcode.

Figure 3.5: Charge Place Scotland network by postcode



Source: Data from: CPS Map produced by: Mott MacDonald

The map indicates that there is a high number of registered users South Ayrshire in Troon, Prestwick and Ayr, with further concentrations in Kilmarnock. The concentrations of registrations are broadly consistent with the DfT ULEV data.

3.2 Current Approach to Service Delivery

A workshop was held on 7 March 2022 with key stakeholders from North, South and East Ayrshire to gain information about the current approach to service delivery in their areas.

In North Ayrshire, the sustainability team within North Ayrshire Council (NAC) are responsible for operating, managing, maintaining, procuring, and replacing the local authority's public EVI network as well as managing the income and costing.

NAC currently have a contract with Swarco for both installation and maintenance of EV charge points until 31 March 2024, however this has a £1 million budget cap and therefore a new procurement process will be required for new projects – most likely using Scotland Excel or CCS frameworks.

NAC provide EVI for its fleet. Departmental workplace chargers began to be installed around two years ago. These belong the corporate transport hub who look after the fleet of council vehicles. The most recently installed workplace chargers are currently under a 5-year warranty agreement with the installers. However, there is uncertainty over whether the chargers will be managed in the future by Property Management and Investment (PMI) who own the buildings, or by the buildings themselves which provide the electricity.

The Ayrshire Roads Alliance (ARA) are responsible for the EVI network in both South and East Ayrshire. ARA are an innovative public sector partnership delivering roads and transportation services on behalf of both Councils, and for their communities.

Private installations are managed separately to the council-owned chargers as ARA only look after the chargers that they have installed themselves.

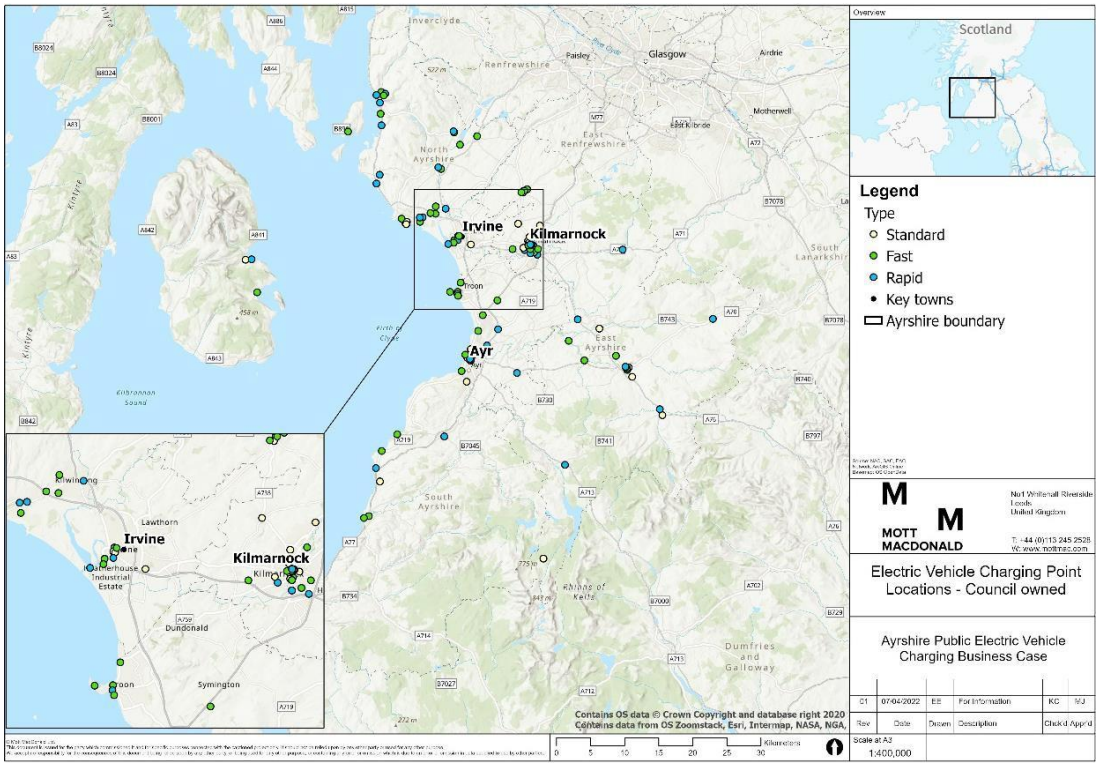
3.3 Electric Vehicle Infrastructure (EVI)

There are approximately 173 EVI locations in Ayrshire as a whole, 46 of which are rapid, 71 fast and 56 slow chargers. Figure 3.6 shows the council owned EVI by charger type.

Following this, Figure 3.7 shows all EVI locations throughout Ayrshire, both council and privately owned. There are 112 council owned and 61 privately owned Electric Vehicle Charge Points (EVCP). EVI is mostly found in the principal towns of Ayr, Kilmarnock and Irvine with some located in smaller towns and villages. EVI is irregular and sometimes sparse throughout rural Ayrshire, particularly in the south.

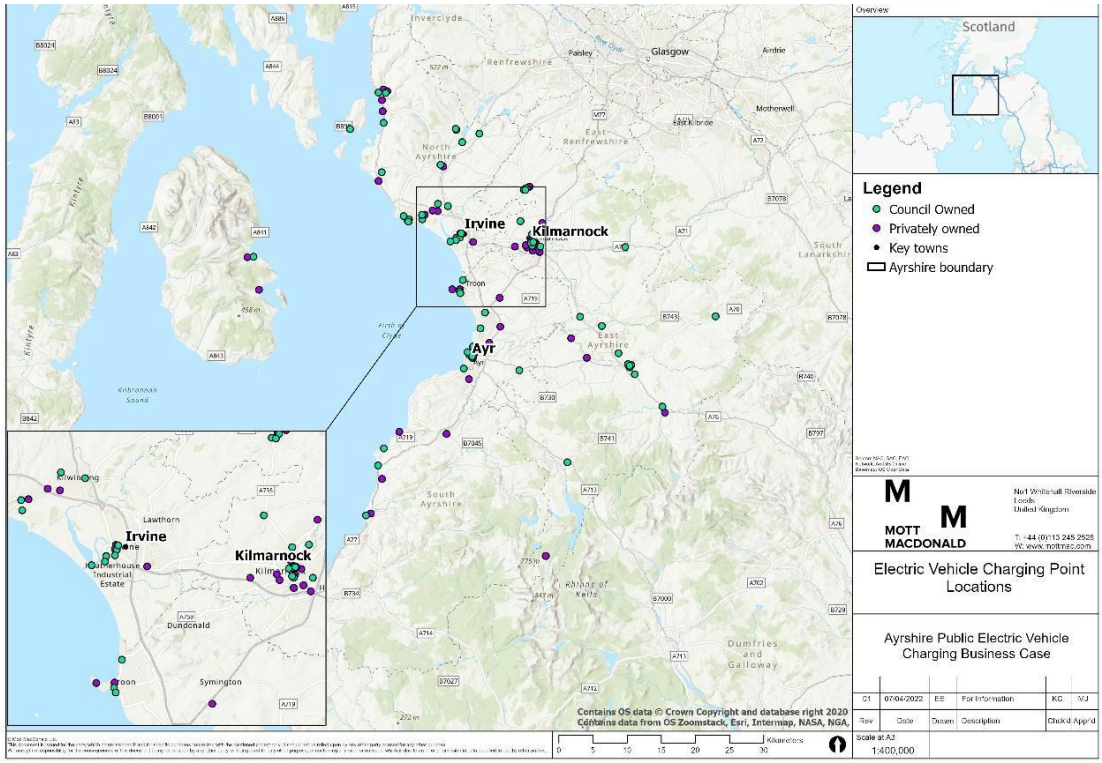
Full size maps of existing EVCI within the Ayrshire region is included in Appendix A.

Figure 3.6: Ayrshire EVCI – Council owned by charger type



Source: Mott MacDonald, data from North Ayrshire Council, Ayrshire Roads Alliance, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

Figure 3.7: Ayrshire EVI Council and privately owned

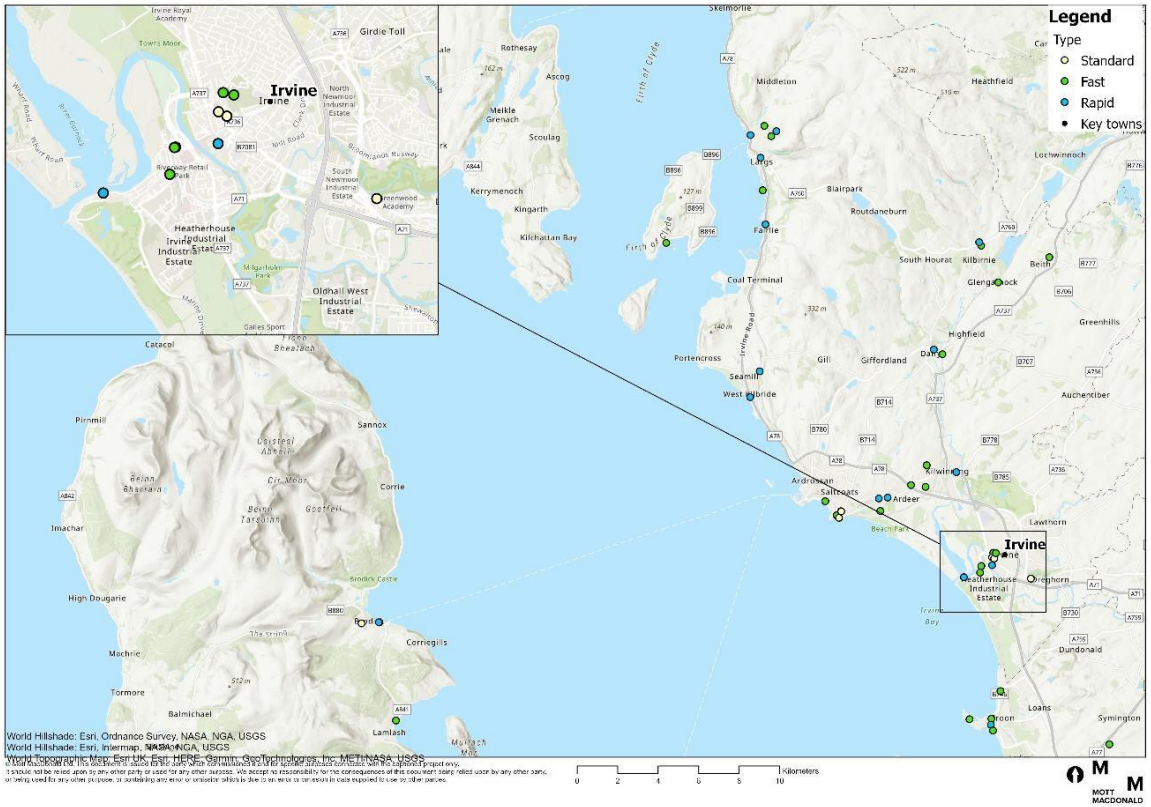


Source: Mott MacDonald, data from North Ayrshire Council, Ayrshire Roads Alliance, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

3.3.1 North Ayrshire

Figure 3.8 shows the 45 publicly accessible Electric Vehicle Charge Point (EVCP) locations within North Ayrshire. This includes 29 council owned and 16 privately owned chargers. The majority of these are located along the coast, in the principal town of Irvine as well as smaller towns including Saltcoats, Stevenston and Kilwinning. There are f ive located on the Isle of Arran, two rapid and three slow.

Figure 3.8: North Ayrshire EVI Locations



Source: Mott MacDonald, data from North Ayrshire Council, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

A list of the 29 existing council-owned chargers is shown in Table 3.2, indicating that 11 rapid chargers and 18 destination EVCI are currently available.

Table 3.2: North Ayrshire Council Owned Existing Public EVCI

Location	Post Code	Sector	EVCP	Max kW Output	CPS ID
Bay Street Car Park, Fairlie	KA29 0AL	Journey	1	50	53447
Bridge Street Car Park, Kilbirnie	KA25 7BL	Journey	1	50	53446
Caledonia Car Park, Irvine	KA12 0AA	Destination	1	7	51150
Caley Court Resource Centre, Stevenston	KA20 3HU	Destination	1	22	52437
Cunninghame House, Irvine	KA12 8EE	Destination	2	22	50632 & 52246
Dalrymple Court, Irvine	KA12 0PQ	Destination	1	7	60164
Dickson Court Car Park, Beith	KA15 2DR	Destination	1	22	52212
Garnock Community Campus, Garnock	KA14 3BJ	Destination	1	22	51120
Garnock Street Car Park, Kilbirnie	KA25 7BX	Destination	1	22	51149
Harbour Road Car Park, Irvine	KA12 8PS	Destination	1	22	52213
Kirkgate Car Park, Irvine	KA12 0DF	Journey	1	50	52215
Largs Campus, Largs	KA30 9EU	Destination	1	22	51419
Main Street Car Park, West Kilbride	KA23 9AN	Journey	1	50	52214
Montgomerie House Car Park, Kilwinning	KA13 6HN	Destination	1	22	51147

Location	Post Code	Sector	EVCP	Max kW Output	CPS ID
Quarry Road Sports Hub, Irvine	KA12 0TH	Destination	1	22	52435
Quayhead, Millport, Isle of Great Cumbrae	KA28 0AP	Destination	1	22	51151
Schoolwell Street Car Park, Stevenston	KA20 3DL	Journey	1	50	53110
Shore Road, Brodick, Isle of Arran	KA27 8BA	Journey	1	50	50525
Smith Street Car Park, Dalry	KA24 5BZ	Journey	1	50	53244
South Beach Car Park, Ardrossan	KA21 5BS	Destination	1	22	52176
The Braes Charging Hub, Saltcoats	KA21 5EP	Journey	2	50	53238 & 53239
The Braes Charging Hub, Saltcoats	KA21 5EP	Destination	1	7	53240
Union Street Car Park, Saltcoats	KA21 5LL	Destination	2	7	53448 & 53449
Viking Centre, Largs	KA30 8QL	Journey	1	50	51148
Windmill Street Car Park, Saltcoats	KA21 5DF	Destination	1	22	51146
Woodwynd Car Park, Kilwinning	KA13 6AE	Journey	1	50	51152

Source: North Ayrshire Council

A further 17 publicly accessible EVCI are in the process of being installed across the council area between 2022 - 2023 which will be owned and operated by the council. These proposed locations are shown in Table 3.3.

Table 3.3: North Ayrshire Council Proposed 2022/2023 Public EVCI

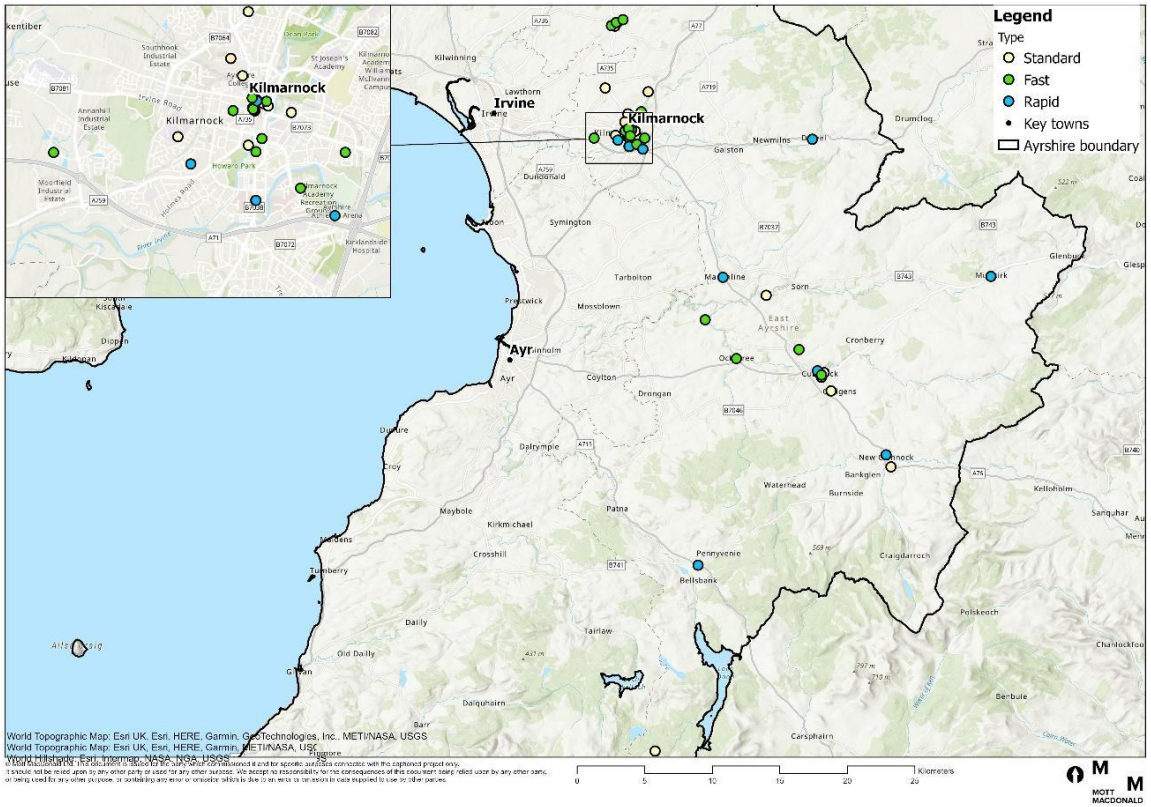
Location	Post Code	Sector	EVCP	Max kW Output
Ardrossan Ferry Terminal	KA22 8DH	Journey	2	50
Ardrossan Ferry Terminal	KA22 8DH	Destination	2	22
Arran Outdoor Education Centre, Lamlash	KA27 8PL	Destination	2	7
Caley Court Support Living Complex, Stevenston	KA20 3HU	Destination	1	7
Guildford Street, Millport	KA28 0AB	Journey	1	50
Harbour Street, Irvine	KA12 8PZ	Journey	1	50
Harbourside Development, Irvine	KA12 8PT	Destination	2	7
Lockhart ASN Campus, Stevenston	KA20 3JL	Destination	2	7
Ship House Car Park, Lamlash	KA27 8LT	Destination	2	7
Skelmorlie Community Centre	PA17 5AH	Journey	1	50
St Michaels Wynd Support Living Complex, Kilwinning	KA13 6FD	Destination	1	7

Source: North Ayrshire Council

3.3.2 EastAyrshire

Figure 3.9 shows the 83 accessible electric vehicle charge point locations within East Ayrshire. This includes 54 council owned and 29 privately owned. EVI is mainly located in Kilmarnock which is the principal town within East Ayrshire however there are also some located along the A76 and in towns such as Mauchline and Cumnock.

Figure 3.9: East Ayrshire EVI Locations



Source: Mott MacDonald, data from Ayrshire Roads Alliance, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

The council-owned publicly accessible EVCI are listed within Table 3.4, detailing the site, sector, number of EVCI, output and the CPS ID number.

Table 3.4: East Ayrshire Council Owned Existing Public EVCI

Site	Post Code	Sector	EVCP	Max kW Output	CPS ID
Academy Street, Troon	KA10 6EF	Journey	1	50	53774
Barns Crescent Car Park, Ayr	KA7 2BW	Destination	1	7	51930
Belleisle Park, Ayr	KA7 4BN	Destination	1	22	52029
Bellevue Car Park, Prestwick	KA9 1NW	Destination	1	22	50818
Bellevue Car Park, Prestwick	KA9 1NW	Journey	1	50	53555
Bellevue Car Park, Prestwick	KA9 1NW	Destination	3	7	52959 52960 52961
Burns Statue Square, Ayr	KA7 2EA	Journey	1	50	51535
Burnside Road, Monkton	KA9 2RN	Destination	1	22	53777
Castlehill Road Car Park, Ayr	KA7 2HT	Destination	3	7	52030 52031 52032
Coylton Activity Centre, Coylton	KA6 6JL	Journey	1	50	52976
Cromwell Road Car Park, Ayr	KA7 1DY	Destination	1	22	51325
Girvan Harbour, Girvan	KA26 9AG	Destination	1	22	52033
Girvan Harbour, Girvan	KA26 9AG	Journey	1	50	50816
Harbour Road Car Park, Maidens	KA26 9NR	Destination	1	22	52038

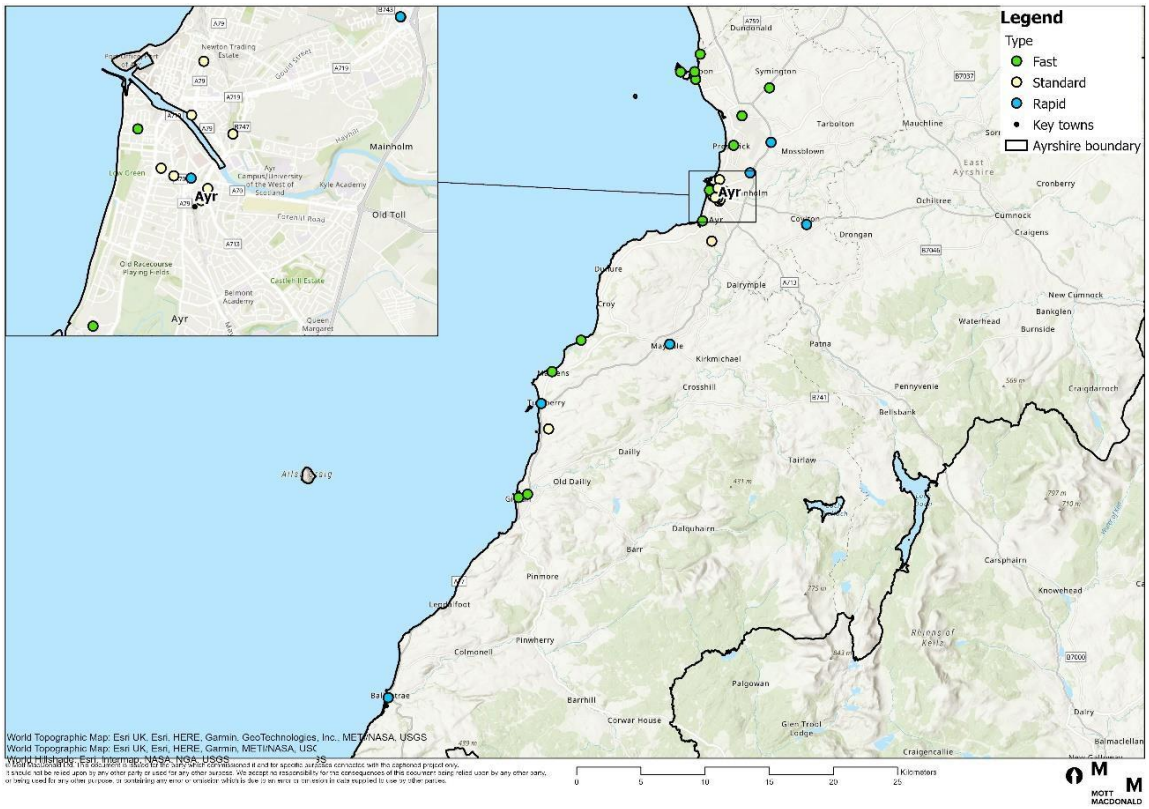
Site	Post Code	Sector	EVCP	Max kW Output	CPS ID
Lodge Road Car Park, Turnberry	KA26 9LX	Journey	1	50	53773
Mill Brae Car Park, Ayr	KA7 2HU	Destination	1	7	51793
Mill Brae Car Park, Ayr	KA7 2HU	Journey	1	50	52975
New Road Car Park, Ayr	KA8 8HE	Journey	1	50	52973
New Road Car Park, Ayr	KA8 8HE	Destination	1	7	52974
South Beach Road Car Park, Troon	KA10 6EF	Destination	1	22	50290
The Vennel, Ballantrae	KA26 0NH	Journey	1	50	52019
Troon Swimming Pool, Troon	KA10 6XQ	Destination	1	22	50817

Source: Ayrshire Roads Alliance

3.3.3 South Ayrshire

Figure 3.10 shows the 42 accessible EV charge point locations within South Ayrshire. This includes 26 council-owned and 16 privately owned. These are located mainly in the principal town of Ayr as well as along the west coast in towns including Girvan, Ballantrae and Troon.

Figure 3.10: South Ayrshire EVI Locations



Source: Mott MacDonald, data from Ayrshire Roads Alliance, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

The list of 26 publicly accessible EVCI owned by the council are summarised in Table 3.5.

Table 3.5: South Ayrshire Council Owned Existing Public EVCI

Site	Post Code	Sector	EVCI	Max kW Output	CPS ID
Academy Street, Troon	KA10 6EF	Journey	1	50	53774
Barns Crescent Car Park, Ayr	KA7 2BW	Destination	1	7	51930
Belleisle Park, Ayr	KA7 4BN	Destination	1	22	52029
Bellevue Car Park, Prestwick	KA9 1NW	Destination	1	22	50818
Bellevue Car Park, Prestwick	KA9 1NW	Journey	1	50	53555
Bellevue Car Park, Prestwick	KA9 1NW	Destination	3	7	52959 52960 52961
Burns Statue Square, Ayr	KA7 2EA	Journey	1	50	51535
Burnside Road, Monkton	KA9 2RN	Destination	1	22	53777
Castlehill Road Car Park, Ayr	KA7 2HT	Destination	3	7	52030 52031 52032
Coylton Activity Centre, Coylton	KA6 6JL	Journey	1	50	52976
Cromwell Road Car Park, Ayr	KA7 1DY	Destination	1	22	51325
Girvan Harbour, Girvan	KA26 9AG	Destination	1	22	52033
Girvan Harbour, Girvan	KA26 9AG	Journey	1	50	50816
Harbour Road Car Park, Maidens	KA26 9NR	Destination	1	22	52038
Lodge Road Car Park, Turnberry	KA26 9LX	Journey	1	50	53773
Mill Brae Car Park, Ayr	KA7 2HU	Destination	1	7	51793
Mill Brae Car Park, Ayr	KA7 2HU	Journey	1	50	52975
New Road Car Park, Ayr	KA8 8HE	Journey	1	50	52973
New Road Car Park, Ayr	KA8 8HE	Destination	1	7	52974
South Beach Road Car Park, Troon	KA10 6EF	Destination	1	22	50290
The Vennel, Ballantrae	KA26 0NH	Journey	1	50	52019
Troon Swimming Pool, Troon	KA10 6XQ	Destination	1	22	50817

Source: Ayrshire Roads Alliance

3.4 Revenue and Operations

North Ayrshire

EV tariffs in North Ayrshire went live on the 1 December 2021, at the following rates:

- £0.30/kWh (Journey - over 43kW)
- £0.19/kWh (Destination - 7kW and 22kW)
- An overstay fee of £10 is applied if charge time exceeds 70 minutes on a Journey charge point and 190 minutes on a Destination charge point[7]

Since tariffs were introduced in December 2021 NAC witnessed a small drop in usage; furthermore, there was significant uncollected revenue for December caused by data issues associated with the ChargePlace Scotland (CPS) migration and incorrect direct debit details. Although this issue is out of the Council's control and CPS is working to collect these payments, it has impacted revenues and has been considered in the Management and Commercial Cases.

A number of issues have been raised by NAC over their charge points:

[7] EVI Pathfinder NEC4 Scope – Scottish Futures Trust

- The chargers at the NAC offices at Cunninghame House are often used by Fleet vehicles. However, Council Fleet and Pool Cars are exempt from payment for these chargers meaning the public are unable to use them and revenue will therefore be reduced.
- Charge points are often blocked by cars which are not charging and this issue is poorly policed. NAC does not have Decriminalised Parking Enforcement (DPE) and there are no traffic wardens to issue penalty to vehicles which are blocking the chargers. This constrains charging (and therefore revenue earning) opportunities.
- Maintaining charge points is hard to manage when budgets and staffing are limited, especially due to the speed required to respond to EVI faults to maintain a reliable network.
- Usage of these chargers is expected to increase as more people return to work in the office and commuting.

For East and South Ayrshire

For ARA (working on behalf of EAC and SAC), a tariff is being developed for use on public chargers to support the ongoing cost of electricity and maintenance, which will be implemented in 2022.

"The existence of public funded, tariff free electric vehicle charging provision does not incentivise private investment in public charge points in Scotland however, particularly as the commercial case for many charge points will remain marginal in the short-term."[8].

Scotland is moving from a publicly owned and tariff-free model of EVI to a more commercial model which combines both public and private investment.

[8] SfT Electric Vehicle Infrastructure Report, 2021

4 Consultation and Stakeholder Engagement

Consultation and stakeholder engagement on the EVI plans within this business case has taken place through engagement with targeted stakeholders, public/business surveys, and a public webinar. These are described below. The surveys provided useful insights that enabled the demand modelling in the Economic Case to be tailored to Ayrshire.

4.1 Stakeholder Workshop

A stakeholder workshop took place on 7 March 2022 with 10 attendees from North Ayrshire Council, Scottish Futures Trust and Ayrshire Roads Alliance. A 'SWOT' (Strengths, Weaknesses, Opportunities and Threats) analysis was undertaken collaboratively, and the stakeholders reported the following:

4.1.1 Strengths

EVI plays a key role in helping to shape communities for the better, by building more resilient communities, and promoting sustainable economic growth. The presence of EVI helps to encourage local tourism, staycations and footfall to local towns in turn helping to boost the local economy.

Tourism is a significant economic driver for Ayrshire, and particularly for its islands – visitors need to know the EVI will be available to enable them to visit the area. Sufficient EVI will help to achieve its ambition of becoming carbon neutral islands as part of the Scottish Government's Plan. It will also help to provide car clubs if the infrastructure already exists.

4.1.2 Weaknesses

EVI can be a challenge to deliver and operate in more rural locations, and particularly on islands. Although EVI installation can be more costly on the islands, it is important they do not get left behind particularly due to the lack of digital connectivity such as poor p hone signal restricting the ease of access to EVI.

EV uptake likely to be slower in more deprived areas than in areas of affluence. Most of Ayrshire's housing was reported to have been built in the 1970's, and therefore many of the housing estates are not designed for EVI. They are built in very rural areas and have limited access to off-street parking. Sharing charging points is unlikely to work in these estates.

The reliability of EVI is important: infrastructure that becomes broken must be guaranteed to be fixed in a short time period.

4.1.3 Opportunities

There is an opportunity to learn from other areas on EVI and decarbonisation, especially for rural areas and islands in Ayrshire.

Integration between transport modes by introducing EVI at station 'park and ride' sites will enable all-day charging while commuting to Glasgow and other destinations via rail. This could encourage modal shift from car-only journeys to drive-and-ride. However, there may be land ownership issues and therefore a requirement for collaboration.

EVs help in reducing carbon and vehicle emissions but also provide indirect benefits such as health benefits, supply chain opportunities, and local job creation. They provide an opportunity

to shape and influence travel behaviours by locating EVI close to commercial and retail services.

EVI should be linked to sustainable generation from renewable energy sources such as wind and solar farms where possible.

4.1.4 Threats

Several potential threats were identified which could have an impact on the success of EVI. These include:

- Vandalism
- Uptake of electric vehicles
- Affordability
- Impact of ongoing maintenance of EVI
- Lack of understanding of EV
- The remoteness of locations throughout Ayrshire and the ability to travel the distance between remote areas
- Lack of digital connectivity throughout Ayrshire
- Reliability of EVI
- Accessibility of EVI to different user groups e.g., disability
- Safety at remote charge point sites
- Utilisation – EVI must be commercially viable, and the demand must be balanced
- Other factors must be considered such as lighting, road surface, markings and signage.

4.2 Residents and Businesses Survey

Two surveys were undertaken, to better understand the needs of residents and businesses so that future public EVI can be planned to meet their needs. One survey was aimed at businesses and one at individuals (primarily residents). In total, there were 70 responses to the businesses survey and 450 responses to the residents' survey. The surveys were hosted online.

The key results that emerged from the residents' survey are summarised below:

- 52% of 401 individuals responding currently own an electric vehicle.
- 64% of 445 individuals responding are planning to buy an electric vehicle or change their current electric vehicle.
- When asked which type of EV they are planning to buy in the future, 66% out of 286 answered Battery Electric Vehicle (BEV) (electric only, no other fuel) and 27% answered Plug-in hybrid (plug in electric, also petrol/diesel powered).
- 90% of 442 individuals stated they would like access to more EV charge points in their area.

Some key results that came from the businesses survey are outlined below:

- 50% of the 70 businesses who responded own fleet vehicles.
- 82% of businesses who already own fleet vehicles plan to buy EVs for the fleet in the next five years.
- Only 18% of the 70 businesses provide EV charging points, of those only one business provides EV charge sockets for their customers/public, and the majority provide them for Visitors / Staff / Fleet.
- 52% of businesses plan to install EV chargers in the next 5 years.

- 91% stated that they would like more EV charge points in their area, with the majority selecting Charging Hubs and Public Car Parks are the preferred location.

The full results from both surveys are available in Appendix C.

4.3 Non-domestic Tenants and Community Groups Webinar

This webinar consulted with non-domestic tenants and community groups to specifically discuss delivery model options, provided an overview of the project and plans so far, discussed how EV charge points can best be delivered across Ayrshire. It was an opportunity to hear comments about the expansion of EV charge points. Advertised online and via letter to groups and tenants, the webinar comments reinforced what was learnt through the surveys and earlier stakeholder engagement.

5 The Strategic Case

This section outlines the wider strategic and policy context, then uses the information to inform the vision, outcomes and objectives.

5.1 Policy Context

The following section outlines key national, regional and local policy with which the vision and objectives align to and support. It is important to note that some of the policy documents under review may not be directly applicable in Scotland but provide useful political context for this project.

There are now a large number of EV strategies, policies and objectives within the UK policy context, which provide impetus and guidance to develop an EVI business case, and in turn for the business case to help deliver.

5.1.1 Local EV Strategies

The North Ayrshire Council Electric Vehicle Strategy (2021-2025) was developed to support the uptake of electric vehicles and improve the network of charging infrastructure and outlines the approach to EV adoption and vision for North Ayrshire which is to 'increase the number of EVs being used throughout North Ayrshire by creating a robust network of EV charge points.' In order to achieve this vision and aim, the strategy sets out five core priorities:

1. Development of a network of strategically located EV charge points
2. Taking a co-ordinated approach across the Council services
3. Deploy EV within the Council's fleet and pool car scheme
4. Raise awareness of the benefits of EVs to individuals and businesses
5. Active Travel: Encourage wider E-bike and E-cargo bike opportunities

The European Commission has recommended that to ensure EVs are commercially viable, one charge point for every ten Plug-in-Vehicles (PiVs) are required on the road. North Ayrshire Council (NAC) have set a baseline as of December 2020 for one charge point for every five PiVs registered in North Ayrshire, exceeding the target set by the European Commission and the following targets by 2025:

- One publicly accessible charge point for every nine PiVs (including both public and privately owned)
- 2% of total number of vehicles registered in North Ayrshire to be PiVs
- 80 workplace charge sockets (44 workplace chargers with varying number of outlets)

Objectives:

- To create a deliverable action plan to facilitate an increase the number of EVs being used through North Ayrshire
- To take a proactive approach in creating a strong network of publicly accessible EV charge points which will meet the demand in the future
- To address air quality issues that have, or will arise due to transport-related issues
- To inform and complement the Council's wider policies on environmental sustainability and transport
- To raise awareness of the benefits of EVs and the charging infrastructure that is available
- To contribute to the Council's commitment to become net-zero carbon by 2030

The South Ayrshire EV Strategy (2021) was produced as a response to the Net Zero emission targets set by the Scottish Government and to support communities making the transition to alternative zero emission vehicles through policies and strategies that will provide the necessary EV charging infrastructure. The strategy supports a collaborative approach, highlighting the importance of working with community groups and local residents to provide the best solutions and deliver a 'charging network that meets the needs of all' which will include:

- Providing charge infrastructure as part of any new Council build
- Requiring developers to provide charge infrastructure at properties where there is little or no off-street parking, e.g., flats and apartments.

The vision is 'to enable to the electrification of a smart, integrated and sustainable transport system across South Ayrshire region to support the transport needs of our communities, businesses, and visitors'. In order to realise this vision, the strategy outlines several objectives which include developing EV charge hubs; introducing on-street charge points in town centres and piloting them in residential areas; expanding the current network within car parks; providing a network ready grid; and introduce charging facilities as part of new projects and developments.

The objectives of the Electric Vehicle Infrastructure Strategy have been prepared to support the transition to EVs and local and national climate change and air quality commitments. The objectives are:

- To develop EV charging hubs across South Ayrshire supported by traditional individual units where this is not possible due to space or power limitations
- To introduce on-street EV charging in our town centres
- To pilot on-street EV charging in residential areas
- To further expand EV charging within our car parks
- To work with energy suppliers to provide a "network ready" grid
- To work with developers to introduce EV charging facilities within new housing developments
- To include EV charging facilities as part of new Council construction projects
- To engage with and support local transport and taxi operators in moving to using EVs
- To increase the number of fleet EV chargers to meet the 2025 target of all new fleet cars and vans being electric
- Introducing low carbon means of powering electric vehicle infrastructure where appropriate
- To introduce a tariff for use of public charge points and look to emerging business opportunities.

The **East Ayrshire EV Strategy** is currently under development. It is expected that the strategy will broadly align with North and South Ayrshire's, and the Scottish Government's Vision for Scotland's Public Electric Vehicle Charging Network.

5.1.2 European and UK-Wide Strategies and Policies:

The European Parliament Alternative Fuels Infrastructure Directive (2020) encourages the development of alternative fuel and charge points across Europe and is now being reviewed to ensure there is sufficient charging infrastructure to meet increasing demands and reduce emission produced by the transport sector.

The UK Government's **Climate Change Act** (2008, amended in 2019) includes the commitment to deliver net zero in the UK by 2050. This target is inclusive of the devolved administrations. The government is required to set legally-binding carbon budgets, and the Climate Change Committee was also set up (in the 2008 version of the Act).

Both the **Net Zero Strategy (Build Back Greener)** and the **Zero Emission Vehicles Transition Council: 2022 Action Plan** highlight the need to make EVs accessible, affordable and sustainable in all regions by 2030, stressing how the transition to EVs is central to decarbonising road transport, but the roll-out of charging infrastructure will need to meet increasing demand and remain affordable and achievable for all**.** The **Net Zero Strategy** indicates that to support and accelerate the shift to zero emission vehicles (ZEVs), the UK government have committed to £1.3 billion to support the roll-out of charging infrastructure, stressing the commitment to providing a reliable, accessible charging network which meets the needs of all users. Similarly, the **Transitioning to Zero Emission Cars and Vans: 2035 Delivery Plan** outlines the need to create an EV charge network which is visible and reliable to reduce the barriers to purchasing an EV with a clear focus on accessibility for all to ensure a just transition.

Taking charge: the electric vehicle infrastructure strategy (March 2022) details the strategic approach to delivering 'world class charging infrastructure' which is 'fundamental to delivering net zero road transport' by 20309. It is anticipated that demand for public charge points by 2030 will be around 300,000 minimum in the UK but up to more than double this figure is possible. In order to meet demand, the rollout of a sufficient amount of charge points is required to ensure the UK is a place where:

- *'Everyone can find and access reliable public charge points wherever they live*
- *Effortless on and off-street charging for private and commercial drivers*
- *Fairly priced and inclusively designed public charging*
- *Market-led rollout for the majority of charge points*
- *Infrastructure is seamlessly integrated into a smart energy system*
- *Continued innovation to meet drivers' needs*[10].

Decarbonising Transport: A Better, Greener Britain (2020) highlights how the uptake of EVs is increasingly rapidly due to associated lower running and maintenance costs but there are still barriers to a full transition such as, the price of EVs and lack of confidence in infrastructure provision. Providing affordable options is therefore essential for ensuring growth in EV ownership and supporting the transition to low carbon transport.

The UK Government's **Ten Point Plan for Green Industrial Revolution** sets out the UK's commitment to tackling greenhouse gas emissions. Of relevance to this study are:

- Point 4 Accelerating the Shift to Zero Emission Vehicles which sets out the target milestones f rom 2021-2035, most notably the end of sales of new petrol and diesel cars and vans by 2030 (10 years earlier than planned) and an extensive network of charge points on motorways and major A Roads also by 2030.
- Point 5 Green Public Transport, Cycling and Walking: seen as equally important as decarbonising private vehicles is the increased share of sustainable journeys including public transport, walking and cycling.

Decarbonising Transport: Setting the Challenge (DfT 2020) sets out the government's ambitious plans to accelerate the decarbonisation of transport, representing the first step to shaping policy proposals and delivering the emissions reduction required for net zero. The document recognises that the adoption of EVs is increasing, and more infrastructure will be required, yet 20% of motorists do not have off-street parking, particularly in urban areas where air quality is usually worse. The UK government sets out a holistic approach to the transition to EVs highlighting the need to provide an 'adequate vehicle supply, a strong consumer base, the

[9] Taking charge: the electric vehicle infrastructure strategy (publishing.service.gov.uk)

[10] Taking charge: the electric vehicle infrastructure strategy (publishing.service.gov.uk)

right market conditions and a 'fit for purpose infrastructure network' to ensure net zero ambitions are met.

In their Consultation Response on **EV Charge Points in Residential and Non-residential Buildings (2021)** the DfT consulted on a set of new building regulations which would mandate charge point infrastructure in new homes and new non-residential buildings. The following new measures have been decided which require new homes, residential buildings undergoing renovation and new (and those under renovation) non-residential buildings to have an EV charge point based on the number of parking spaces and associated parking they have access to.

5.1.3 Scottish Strategies and Policies:

The Scottish Government's **Climate Change (Emissions Reductions) (Scotland) Act** (updated in 2019) includes a more ambitious target for the climate thank the UK-wide Climate Change Act, setting the target date for net zero emissions of all greenhouse gases in Scotland by 2045. A path of annual targets covering the whole economy is set in the plan, to enable Scotland to reach 2045. The actions required to reach Scotland's net zero targets are set out in the **Climate Change Action Plan** 2018-2032 update of 2021[11], which includes the commitment for Scotland's roads to contain no new petrol and diesel cars and vans from 2032 and for less people to be using private single-occupancy vehicles, compared to sustainable transport.

The **National Planning Framework (NPF4)** (draft) provides the planning framework for Scotland up to 2045. It recognises the value of EVs in delivering decarbonisation, and sees them as part of a system-wide response to net zero. It recognises the need for continued expansion of the charging network, and the need to plan this strategically.

The **Scottish National Transport Strategy 2 (2020)** provides a strategy for all of Scotland providing a vision for Scotland's transport system over the next two decades which will provide 'a sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland for communities, businesses and visitors. An integral part of this vision is the need to tackle climate change and deliver net zero targets through promoting greener, cleaner choices. Scotland have therefore committed to phase out new petrol and diesel cars by 2032 and is now taking a leading role in promoting low-emission and electric vehicles to decarbonise road transport.

The Sustainable Transport Hierarchy will be used in decision making to promote walking, wheeling, cycling, public transport and shared transport options in preference to single occupancy private car use for the movement of people. This doesn't currently include Electric Vehicles within this hierarchy.

[11] https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/

Figure 5.1: Sustainable Transport Hierarchy

Source: Scottish National Transport Strategy 2 (2020)

The document, **Decarbonising the Scottish Transport Sector (2021)** highlights the introduction of new emission targets in 2019 which reflect the updated advice of the UK Committee on Climate Change. The new targets require Scotland to reduce emissions to net zero by 2045 and the 'interim target to reduce emissions by 75% between 1990 and 2030 and 90% by 2040'. **Switched on Scotland Phase 2: An Action Plan for Growth** sets out a 10-point plan for advancing the widespread adoption of EVs building on the progress made since the Switched-On Scotland Roadmap was first produced in 2013. The actions that will be undertaken in this second phase are separated into ten outcome-focused actions which will deliver three positive impacts including, decreased costs, enhanced convenience and a change in user culture.

'A Network Fit For The Future,' the Draft Vision for Scotland's Public Electric Vehicle Charging Network (2022) represents a draft vision statement for public EV charging in Scotland which prioritises people and businesses and emphasises the need for an accessible, affordable, and reliable public network. This vision's four key principles are: a people-focused network; accelerating commercial investment; coordinating with the electricity network; and integration with Scotland's sustainable transport system.

At the heart of the approach is a 'just transition' where the benefits of a net zero transport system are felt by all. The approach will build on the existing provision and seek to deliver more chargers in the right places and reduce car miles travelled by 20% by 2030.

5.1.4 Research and Advice:

The Energy Saving Trust released a document on **the Incorporation EV ChargePoint's into Local Planning Policies for New Developments (2020)** which highlights the need to and benefits of incorporating charge points into planning policy. The benefits include increasing the confidence and convenience of driving an EV, reducing air pollution and carbon emissions. Inclusion in policy would help charging infrastructure become standard practice amongst developers and facilitate the transition to EVs

Energy Savings Trust – Positioning Charge points and adapting parking policies for EV (2019) focuses on the accessibility and positioning of public charging infrastructure and how this can inf luence usage and consumer behaviour, presenting a guide for local authorities installing charge points which covers the following:

1. Off-street EV Parking Bay Layouts: should maximise the ease of use and placed in a manner which serves as many users as possible.
2. Street furniture pressures for on-street chargepoints: strategic positioning of on-street infrastructure to take up minimal space and increase convenience, particularly making them accessible for all users.
3. Implementing changes to parking and enforcing EV bays: correct signage, traffic orders, length of stay limits etc.
4. Parking incentives for electric vehicles: making parking cheaper and easier for EVs drivers to encourage the uptake of EVs.

The **EV charging infrastructure report** (DfT, Feb 22) outlines the UK commitments to reducing greenhouse gas emissions by 28% by 2035 and Net Zero by 2050 whilst recognising that the transport sector is the largest source of emissions and that the transition to EVs is therefore key to reducing emissions and meeting these targets. The report highlights that in order to achieve this, a comprehensive and competitive EV charge network which is reliable and accessible is crucial. Public perceptions of and confidence in the network are key as a network which is perceived to be inadequate will act as a major barrier to the take up of EVs. The report found that current issues include the roll-out of charge points along motorways, remote locations and on-street charge infrastructure and have targeted interventions specifically in order to address these challenges, providing 8 recommendations to promote competition, unlock investment and build public trust.

Commissioned by the DfT, the BritainThinks Research Report (Feb 2022), ***Public Electric Vehicle Charging Infrastructure: Deliberative and quantitative research with drivers without access to off-street parking***, highlights several key themes among drivers without off-street parking in relation to driving and parking behaviours, and perception of charging and its compatibility with existing habits. The report notes that the main barrier to EV uptake is the perceived difficulty and subsequent inconvenience of charging which reduces the door-to-door nature, f lexibility, and autonomy of internal combustion engine vehicles (ICEV). The report also highlights how these perceptions are exacerbated by low awareness, poor knowledge, and charging misconceptions including, costs and driving range[12]. Some common misconceptions include:

- EV charging would be more expensive that refuelling an ICEV;
- confusion over charging such as time taken and method (access to and how to use);
- range anxiety and concept of 'topping-up' (almost half of respondents believed that EVs need to be charged every day).

Although the report suggests attitudes towards EVs and driving behaviour is changing, and drivers are adapting their behaviours to accommodate charging into their journey planning, there is still hesitancy over transitioning due to 'range anxiety' and concerns over unfamiliar routes and finding a charge point. Therefore, a significant shift in behaviour and driving habits is still required to increase the demand for EVs, and EV charging infrastructure provision will be affected by evolving consumer habits, charging preferences and innovative technologies.

5.1.5 Local Policies and Strategies:

The **East Ayrshire Council – Climate Change Strategy Report (2021)** sets out ambitious net zero targets and a vision for 'East Ayrshire [to] be a low carbon place with a thriving and diverse environment'. The strategy emphasises the council's support for a green recovery and just transition to net zero, recognising the behavioural changes brought about by COVID-19

[12] Public Electric VehicleCharging Infrastructure. Deliberative and quantitative research with drivers wi thout access to off-street parking. Research report. (publishing.service.gov.uk)

including significantly reduced vehicle miles travelled and a drastic increase in active travel (47% increase in people cycling in Scotland last year) and the need to retain this behaviour change, giving priority to cyclists and pedestrians.

The **East Ayrshire Climate Change Strategy** sets out the actions identified for achieving net zero. Having already achieved a 55% reduction since 1990, the East Ayrshire Council are making progress for meeting the Scottish Government's target of net zero by 2045. However, the council are aiming to meet the UK100 target of achieving net zero by 2030 which would require the annual reduction rate to double from 1.5K tonnes to 3K tonnes a year. Integral to these targets is the decarbonisation of the transport sector in and around Cumnock through the promotion of active travel and exploring opportunities for EVs. The strategy also highlights the importance of promoting alternative, sustainable travel and changing travel behaviours.

The **South Ayrshire Council Sustainable Development and Climate Change Strategy (2019-2024)** represents a 5-year strategy which sets out a framework for the promotion of sustainable development, mitigation against climate change emissions and climate adaptation through policies, projects, and initiatives. The overall goal outlined in the strategy is for 'people in South Ayrshire enjoy a good quality of life now and in the future – with a thriving economy, just society and healthy environment – while working to reduce greenhouse gas emissions to avoid the worst effects of climate change and build resilience to adapt to its impacts'.

The **North Ayrshire Environmental Sustainability and Climate Change Strategy (2017-2020)** has been developed to aid the delivery of the North Ayrshire's priorities for a sustainable environment. North Ayrshire is one of the councils that has declared a climate emergency.

Within its Workstream 3 – Transport and Travel, the strategy sets out a vision for transport over the next 20 years for a 'sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland'. The document also highlights the promotion of walking, cycling, public transport and bike, and encouragement of car and ride sharing instead of single occupancy car use. The transport priority actions of relevance to this study include:

- Development of solar charging hubs
- Apply for funding for 36 charge points in Irvine
- Workplace charging for fleet use
- Implement actions outlined in the EV strategy
- Increase number of publicly available charge points

Underpinned by fairness and equity, the **North Ayrshire Plan (2019-2024)** sets out the ambitions, vision and mission for North Ayrshire over the next five years. The vision is to provide a North Ayrshire which is 'Fair for All', recognising the strength in collaboration, engagement with communities and tackling inequality. The mission statement emphasises working collaboratively to improve well-being, prosperity, and equity across the district. Furthermore, outlined in the plan are a number of priority outcomes; of relevance to this study are the following:

1. North Ayrshire is well-connected with effective infrastructure
   - The council will provide well-maintained transport networks whilst supporting alternative and sustainable transport.
2. North Ayrshire is a sustainable environment
   - Develop low carbon renewable energy schemes

After a feasibility study was produced focusing on the predicted uptake in usage of Plug in Vehicles (PiVs), the **South Ayrshire Council Parking Strategy (2020-2024)** acknowledges that the redevelopment of town centres and development of local policies and strategies would

need to reflect the increase in demand for charging infrastructure to facilitate the use of low-emission vehicles by residents and visitors. The strategy outlines the continued investment needed in PiV charging infrastructure in line with growing demand. Similarly, the **North Ayrshire Town Centre Parking Strategy** recognises the importance of the development of alternative modes, reducing carbon emissions and improving air quality. Of relevance to the scheme, the following actions are proposed:

- Promotion of public transport
- Improved provision of cycle infrastructure and pedestrian connections
- Expansion of EV charging network

5.1.6 Implications of the Policies and Strategies for the Business Case

There are strong drivers and directives from Local Authorities, Scottish Government and the UK Government to transition to EV's as a key component of the decarbonisation of the transport sector – and a recognition that a step-change in the provision of EVI is needed to meet this challenge and incentivise the shift. Support and finance is increasingly available to enable this step-change, and there is a recognition that public and private sectors have a role to play. There is an imperative to provide a network of EVI that enables and encourages the shift to EVs, and equally that there is a risk to EV targets if this does not happen. This business case sets out how the three Ayrshire authorities will play their part in enabling the EV shift through the provision of EVI scaled to predicted demand (but flexible to respond to real-life changes in uptake), blending commercial and public-sector delivery.

5.2 Vision, Outcomes and Objectives

The vision and objectives developed for the future EV charging network in Ayrshire is outlined in the following sections. It is intended that these objectives supersede the previous EV policy in place for the Ayrshire councils.

5.2.1 Vision

In consultation with key stakeholders, a vision for the future EVI strategy for Ayrshire (North, East and South) has been developed, to provide a focus for the development of this business case and the EVI the three authorities are seeking to deliver:

The further expansion of EVI in Ayrshire will provide a public electric vehicle charging network that works for everyone. It will provide a just transition to Net Zero in 2045, supportingthe Scottish Government objective to provide a fairer, greener future for all where accessibility, availability and reliability is key and where no one is left behind from the positive shift to zero emission transport system – including rural and island communities.

The expansion of the EVI network will also consider the principles of Community Wealth Building, acting as a catalyst for local economic development (particularly tourism), whilst also ensuring that the more remote rural communities and island communities benefit equally. The EVI expansion will establish the region as an exemplar in the provision of EVI, contribute to inclusive green growth and position Ayrshire as a Scottish leader in EVI provision supporting the Draft Vision for Scotland's Public Electric Vehicle Charging Network 'A Network fit for the Future' (Transport Scotland, 2022). This vision includes four key principles: a people-focused network; accelerating commercial investment; coordinating with the electricity network; and integration with Scotland's sustainable transport system.

Public EVI has been provided and managed by the three Councils until now, who are transitioning from free charging facilities to a tariff-based network. This business case transitions the Council areas further to a commercially-viable model where possible and as a principle,

subsidised by public funding where necessary to ensure the 'just transition' and 'no one is left behind' elements of the vision are achieved.

5.2.2 Objectives

The objectives for the Ayrshire EV business case were also developed with stakeholders, as key outcomes required to achieve the vision. They are:

1. **USABLE** – The public EVI network will give people access to a technologically advanced, well maintained, reliable network.
   - It will provide a good customer experience (well lit, safe, accessible for people with disabilities, affordable, socially equitable and will have good interoperability – meaning end users can access EVI charging points easily).
   - It will keep up with shifts in technology, upgrading EVI when possible to provide various connector types and contactless payment features, as well as enabling overstay fees and management options.
2. **EQUITABLE** – The EVI network will work for everyone. It will adopt the 'Place Principle' and Community wealth building to achieve better outcomes for people and communities. It will ensure that the islands and rural areas are not left behind, acting as a catalyst for local economic development.
   - The 'Place Principle' is about delivering electric vehicle charge points based on the needs of communities, ensuring they are located in the right places to provide benefits
   - Over 95% of residents without access to off-street parking will be no more than a ten-minute drive to a destination or rapid charger. Less than 1% of residents without off-street parking will be beyond a 30 minute drive to destination or rapid chargers.
   - It will act as a catalyst for local economic development and job creation (particularly in the tourism sector as it is expected that the EVI will bring more footfall to the islands and towns).The islands and rural areas will not be left behind and the EVI network expansion will be a catalyst to improve provision in less well served areas such as remote rural areas and the islands where there is limited power supply infrastructure and digital connectivity (as mobile phone signal is necessary to be able to access EV charge points).
3. **VIABLE** – It will be commercially viable and will attract private sector investment.
   - It will be a future-proofed network and in order to maintain customer numbers, it will provide a good customer experience.
4. **ENVIRONMENTAL** – It will be powered by renewable energy sources where this is not available, the installation of small renewable energy facilities will be considered where feasible.
5. **CONNECTED** – It will promote the use of public transport and active travel as people's first choice in line with the National Transport Strategy, especially as part of trip chaining.
   - It will also be linked into the existing public transport network to enable informed choices to be made about journeys (eg: a driver could leave their EV charging at a P&R site and commute by bus or train).
   - Where possible, the positioning of EVI will support public transport and active travel as the primary purpose to help reduce the reliance on private car trips and contribute to meeting the Scottish Government target of a 20% reduction in car kilometres by 2030.

Assumptions have been adopted (and in some cases nuanced) in the modelling behind the Economic Case that will help ensure these objectives are delivered. For example, fi ve-minute

walking catchments have been assumed to residential chargers where off-street parking is limited to help deliver the ‘equitable’ and ‘usable’ objectives. But for example, in rural locations local provision will be dependent given the need to meet the ‘viable’ objective.

In addition, within key settlements (over 4,000 population) across the Ayrshire region, residents without access to off-street parking will be no more than a ten-minute drive from a destination or rapid charger. Most sites have been strategically positioned to help meet the ‘connected’, ‘equitable’ and ‘usable’ objectives. In dense areas with limited off-street parking, on-street charging infrastructure will be targeted in addition to destination or rapid chargers.

However, for more rural sites, this driving distance criteria is relaxed to 30 minutes to meet the ‘viable’ objective due to the cost prohibitive nature of rapid chargers within rural communities. The outcomes of the driving distance to destination and rapid chargers’ analysis is assessed later in this document.

6 The Economic Case

6.1 Demand Forecast Methodology

Demand forecasting was undertaken to develop an understanding on the potential uptake of EVs within the Ayrshire region, which would then help derive the EVCI required to support the potential future outcomes. The forecast was calculated by analysing several existing EV forecasts and then incorporating localised data to calculate Ayrshire specific low, central and high EVCI forecasts. An overview of the process is shown in Figure 6.1.

Figure 6.1: EVCI Forecast High-Level Methodology

A summary of the methodology for the electric vehicle forecast is detailed in the following sections, with a detailed methodology provided in Appendix E. Assumptions made during the calculations are recorded in Appendix D.

6.1.1 Electric Vehicle Forecast

6.1.1.1 Existing Electric Vehicle Forecasts

A review of several existing national data forecasts was undertaken, to outline insights on the future of EV charging by the energy industry, vehicle manufacturing industry, and public bodies. The following existing forecasts were collated and analysed:

- National Grid – Future Energy Scenarios 2021[13]
- Society of Motor Manufacturers and Traders' New Car Market Outlook to 2035[14]
- Transitioning to Zero Emission Cars and Vans: 2035 Delivery Plan[15]
- Element Energy – Decarbonising the Scottish Transport Sector[16]

The Element Energy forecast was produced as part of the 'Decarbonising the Scottish Transport Sector' Report, on behalf of Transport Scotland. This data was provided to Mott MacDonald, with permission to use, by Scottish Future Trust. None of the scenario pathways outlined in the report are official Scottish Government Policy and are provided for information only.

Aside from the above publicly available EV forecasts, SFT commissioned Field Dynamics to undertake EV demand forecasting for Scottish local authorities to be used as a cross check. The dataset closely resembles the National Grid Future Energy Scenarios Consumer Transformation.

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[13] Future Energy Scenarios (FES) 2021, National Grid ESO. July 2021.

[14] Society for Motor Manufacturers and Traders (SMMT) New Car Market and Parc Outlook to 2035 by Powertrain Type. 11th June 2021.

[15] Transitioning to Zero Emission Cars and Vans: 2035 Delivery Plan, HM Government. July 2021.

[16] Decarbonising the Scottish Transport Sector – Summary Report. September 2021. Element Energy on behalf of Transport Scotland.

6.1.1.2 Electric Vehicle Trend-based Forecast

The Department for Transport's (DfT) vehicle licensing data[17] and Scottish Transport Statistics (STS)[18], published by Transport Scotland, were used to establish a baseline of the total registered BEVs and PHEVs in Ayrshire. This place-specific data provided insight on the existing vehicle fleet size, uptake of EVs and annual new vehicle registrations.

Statistical data for cars and Light Goods Vehicles (LGVs) were obtained from the DfT datasets, whilst statistical data for taxis and private hires were derived from the STS data as this information is collected separately by the Scottish Government.

6.1.1.3 Methodology

Using the established place-specific baseline, five forecasts were produced for cars, LGVs, taxis and PHVs:

- One extrapolated the observed EV registration trends from the baseline using DfT/STS data
- Four were calculated by applying national trends from the existing forecasts listed in Section 6.1.1.1 to the place-specific baseline.

An overview of each approach is as follows:

- **Forecast based on DfT and STS data:** a line of best fit was applied to the extrapolated baseline data to forecast the total number BEVs and PHEVs in 2025 and 2030.
- **Forecast based on National Grid's Future Energy Scenarios 2021:** the growth rate, per annum, was calculated from the dataset and applied to the baseline. As this dataset was for the whole of Scotland, it was assumed that the growth rate in Ayrshire is the same as Scotland's average growth rate.
- **Forecast based on Society of Motor Manufacturers and Traders' New Car Market Outlook to 2035:** same methodology as the forecast based on National Grid's Future Energy Scenarios 2021.
- **Forecast based on Transitioning to Zero Emission Cars and Vans: 2035 Delivery Plan:** This forecast predicts the proportion of new vehicles that will be zero emission and ULEV. A different baseline was derived using the first-time registered vehicles per annum, from DfT and STS data. This baseline was extrapolated and the percentages from the Road to 2035 Data applied.
- **Forecast based on Element Energy – Decarbonising the Scottish Transport Sector:** same methodology as the forecast based on National Grid's Future Energy Scenarios 2021.

There are many other factors which may impact the uptake of EV within Ayrshire, including:

- Average vehicle age, which may be higher or lower depending on household income.
- Daily vehicle mileage within the region.
- Date of price parity of EV to ICE.
- The addition or removal of government incentives.
- Availability of existing charging infrastructure.

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[17] Vehicle Statistics Collection, Department for Transport and Driver Vehicle Licensing Agency. January 2022. https://www.gov.uk/government/collections/vehicles-statistics

[18] Scottish Transport Statistics No. 39 2020 Edition, Transport Scotland. February 2021. Available at: Scottish Transport Statistics No. 39 2020 Edition | Transport Scotland

6.1.1.4 Outputs

Based on the EV forecast methodology outlined, low, central and high scenarios for the forecast number of BEV and PHEV by 2025 and 2030 within Ayrshire are shown in Table 6.1 and Table 6.2 respectively.

Table 6.1: Forecast Number of BEVs in Ayrshire

BEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	3,147	6,160	8,039	13,062	20,562	27,139
LGV	402	591	987	1,936	4,072	5,607
Taxi	20	45	63	69	157	235
Private Hire	20	45	59	69	157	235
Total	**3,589**	**6,841**	**9,148**	**15,136**	**24,948**	**33,216**

Table 6.2: Forecast Number of PHEVs in Ayrshire

PHEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	735	1,444	3,543	1,612	2,613	12,066
LGV	189	487	1,171	348	1,957	4,395
Taxi	9	18	48	19	39	107
Private Hire	9	18	47	19	39	101
Total	**942**	**1,966**	**4,809**	**1,998**	**4,648**	**16,669**

The high growth forecast is based on the 75th percentile out of the range of forecast scenarios analysed, and therefore represents some of the more optimistic EV growth scenarios assessed. These are primarily the Element Energy forecasts, which demonstrate the potential policy pathways to meet the Scottish Government's net zero transport targets, but do not represent official government or Transport Scotland policy. Therefore, these could be viewed as optimistic at this time.

The low growth forecast represents the 25th percentile, and some of the lower EV growth estimates. These represent some of the older EV forecasts where demand was expected to be lower, or where supply/demand is low. These forecasts could be viewed as more pessimistic.

Therefore, the central growth forecast was progressed for the purposes of this business case to represent the median forecast as more balanced approach. It is noted that the Field Dynamics forecast is higher than the central forecast used in this analysis. However, given the uncertainties they are broadly similar.

A further breakdown of BEV and PHEV by local authority is outlined in the following sections.

North Ayrshire

A summary of the EV forecasts undertaken for North Ayrshire are shown in Table 6.3 and Table 6.4 respectively.

Table 6.3: North Ayrshire BEV Forecast by 2025 and 2030

BEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	787	1,646	2,020	3,265	6,391	6,798

BEV	2025			2030		
	Low	Central	High	Low	Central	High
LGV	155	226	382	763	1,557	2,145
Taxi	7	15	21	23	56	88
Private Hire	7	15	20	23	48	58
Total	**955**	**1,902**	**2,444**	**4,074**	**8,052**	**9,090**

Table 6.4: North Ayrshire PHEV Forecast by 2025 and 2030

PHEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	222	435	883	444	691	2,557
LGV	40	173	366	85	538	1,542
Taxi	3	7	14	6	13	34
Private Hire	6	10	15	15	35	58
Total	**270**	**625**	**1,278**	**550**	**1,277**	**4,191**

It is estimated that by 2025 there could be 1,902 BEV and 625 PHEV on the road in North Ayrshire, assuming the central case reflects the growth in the next few years.

East Ayrshire

The BEV forecast for East Ayrshire is summarised in Table 6.5, while the PHEV forecast is shown in Table 6.6.

Table 6.5: East Ayrshire BEV Forecast by 2025 and 2030

BEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	787	1,567	2,010	3,265	5,919	6,785
LGV	103	149	254	524	1,018	1,403
Taxi	7	15	21	23	56	78
Private Hire	7	15	20	23	48	72
Total	**903**	**1,746**	**2,305**	**3,835**	**7,041**	**8,338**

Table 6.6: East Ayrshire PHEV Forecast by 2025 and 2030

PHEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	222	435	1,342	444	691	4,936
LGV	56	161	545	96	587	2,221
Taxi	3	5	16	6	13	39
Private Hire	5	10	17	13	36	58
Total	**286**	**611**	**1,920**	**560**	**1,327**	**7,254**

The 2025 central forecast indicates that there could be 1,746 BEV and 611 PHEV on the road in East Ayrshire, based on the 2025 central forecast.

South Ayrshire

The EV forecasts for South Ayrshire are summarised in Table 6.7 and Table 6.8 for BEV and PHEV respectively.

Table 6.7: South Ayrshire BEV Forecast by 2025 and 2030

BEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	1,159	2,268	2,960	4,746	7,414	9,992
LGV	144	217	327	536	1,148	1,694
Taxi	7	12	21	23	47	67
Private Hire	7	12	21	23	47	78
Total	**1,316**	**2,510**	**3,329**	**5,328**	**8,656**	**11,832**

Table 6.8: South Ayrshire PHEV Forecast by 2025 and 2030

PHEV	2025			2030		
	Low	Central	High	Low	Central	High
Cars	295	670	1,579	635	1,571	5,539
LGV	91	153	365	148	628	1,111
Taxi	3	3	16	5	6	34
Private Hire	3	10	21	6	36	78
Total	**391**	**836**	**1,981**	**794**	**2,241**	**6,761**

The South Ayrshire forecast is slightly higher than North and East Ayrshire with 2,510 BEV and 836 PHEV forecast by 2025 assuming the central growth forecast.

6.1.2 Electric Vehicle Charging Infrastructure Forecast

Once the EV forecast was completed, the analysis was used to calculate the EVCI required to support the forecasted number of EVs. The supporting data, assumptions and detailed methodology used to calculate these EVCI requirements are detailed within Appendix E.2.

The EVCI forecast approach was based on the methodology outlined within the London 2030 Electric Vehicle Infrastructure Strategy. This follows a two-step approach:

1. **Total Energy Demand by Charger Type:** the overall energy demand by charger type is calculated. To calculate this, it was necessary to understand the total electricity requirement per vehicle type, based on the forecast number of EVs, average annual km driven and average vehicle energy efficiency. This electricity demand is then distributed by estimates on the utilisation of each charger type per vehicle type.
2. **Charger Utilisation:** an estimation on the amount of electricity that each type of charger can typically deliver annually. This annual utilisation influences how many chargers by type are required, as a higher utilisation means each asset can process more vehicles.

Aside from the number of forecast PiV, the average annual km driven is another key input to the EVCI forecast. The Scottish Government have set a target to reduce car km by 20% by 2030. However, we have assumed this variable to remain at 2019 levels for a number of reasons:

- Uncertainties still remain following the Covid-19 pandemic on the proportion of car trips compared to public transport and active travel.
- The forward outlook of this study is the next four years, and the current infrastructure pipeline in Ayrshire does not reveal any projects that may result in significant modal shift.
- It has however been assumed that the proportion of trips undertaken by active travel and public transport will proportionally increase over the coming years, offsetting any rise in private car mileage.

It is therefore recommended that the forecast is revisited in four years' time to account for any changes made in travel patterns and investment in other transport modes to rebase the

analysis. This will ensure the supply of EVCI remain aligned with this important national policy and does not work against it, to ensure that public transport and active travel still remain as the primary modes of travel as per the sustainable transport hierarchy.

The types of EV charging that has been considered as part of the analysis are as follows:

- **Residential:** these are typically located on-street outside residential properties using lampposts or bollards. Alternatively, there could be clusters of chargers within private residential car parks as local overnight charging hubs. These should be located where residents do not have access to off-street parking, such as flats, and are assumed to be slow charging, with a typical power output of up to 7KW. As most lampposts in Ayrshire are installed at the rear of the footpath away from the kerb, slimline bollards with integrated EVCI have been assumed to be installed instead.
- **Destination:** these are located in trip attractor locations, such as supermarkets, retail parks, leisure centre and country parks, where the typical length of stay is between one to four hours. These are considered to provide opportunity charging for drivers, and provide fast charging with typical power output of between 7kW to 22kW.
- **Rapid:** these are typically located where the stay is less than an hour, such as enroute on a journey, or where the sole purpose of the journey is to charge a vehicle. Therefore, the time taken to charge should be minimised, and it would be expected to be installed as hubs with multiple chargers available. Typical power output has conservatively been assumed to be 50kW due to the higher cost of ultra-rapid EVCI.

Charging undertaken on private property with off-street parking such as on driveways or garages, or at a workplace, have been assumed to have a lower demand on the public network. As a result, it has been calculated separately to the above categories.

To represent user preferences on locations to charge, the percentage distributions from the public consultation survey results were applied to each of the charger types. These preferences vary by vehicle type, type of EV (PHEV/BEV) and proportion of households with access to off-street parking[19].

Within the calculated requirements for EVCI calculations, several factors have a significant impact on the results. The estimated utilisation per EVCI influences the overall number of EVCI required to support the forecast number of EV on the road. A higher utilisation reduces the EVCI requirement as each charger can support more vehicles, while a lower utilisation means that more chargers are required to support the forecast number of EVs.

Additionally, the preferences towards different EVCI types by user is also a significant variable that impacts the infrastructure requirement. For example, a greater emphasis towards rapid charging would result in fewer overall chargers as rapid chargers can charge vehicles quicker, however at the trade-off of higher overall costs for grid reinforcement. A preference towards residential or destination slow/fast charger would result in more chargers overall, but with lower pressure on the grid.

The variables input to derive the preferred charge point mix is outlined in Section 6.2.

6.1.3 EV Model

The outputs from the EVCI forecast were then input to the Mott MacDonald EV Optimisation Model. This in-house tool uses existing EVCI location data, in addition to data provided from SPEN and Ordnance Survey to create a proposed charging network using machine learning

[19] Scottish HouseCondition Survey: Additional Analysis, Scottish Government. September 2020.

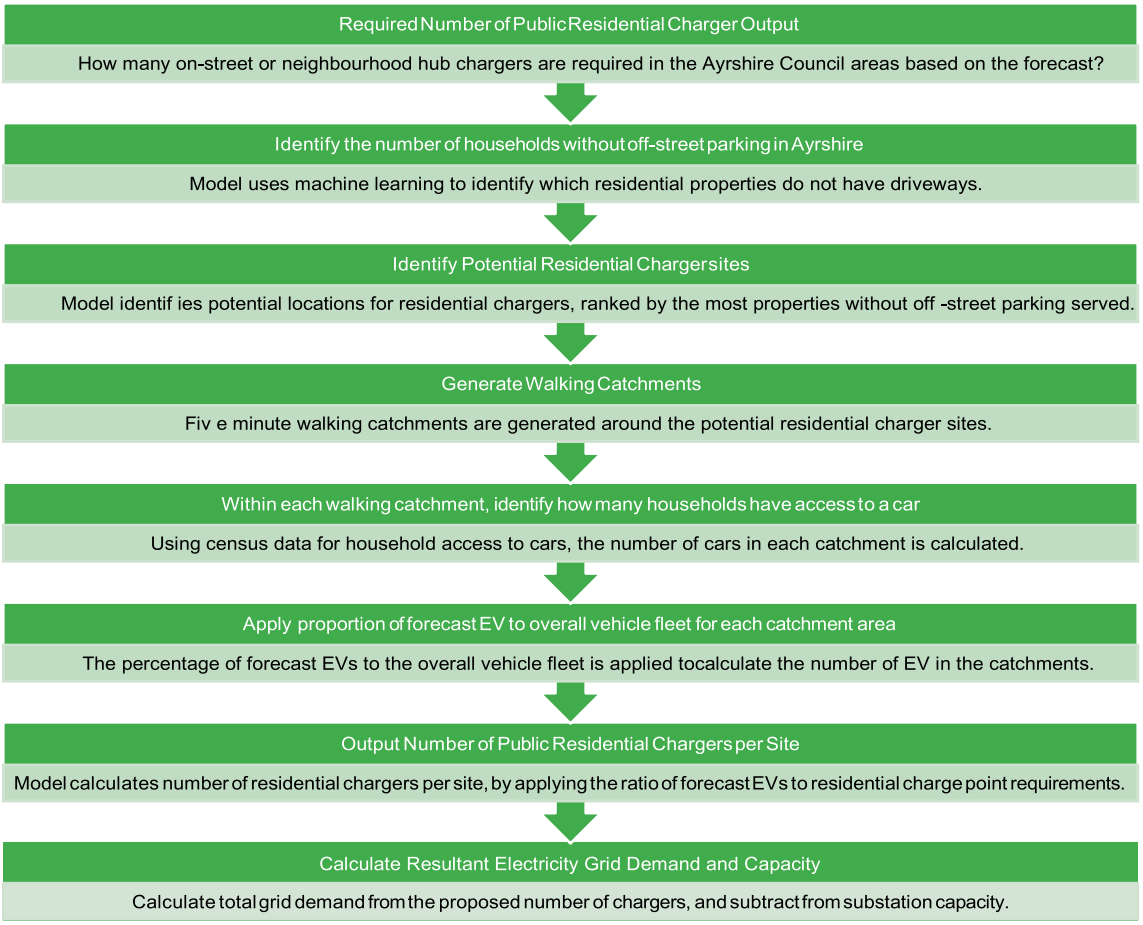
technology. The model adopts a two-stage approach to derive the EVCI network, to derive on-street charging in residential locations and destination (trip-attractor) charging.

An overview of the model operation is outlined in this section.

6.1.3.1 Residential Charging Analysis

The residential charging analysis identifies and prioritises households without access to off-street parking, as it is assumed that properties with access to off-street parking (such as driveways and garages) can meet their charging needs mostly at home. The residential charging model process is illustrated in Figure 6.2.

Figure 6.2: EV Optimisation Model Residential Charging Analysis Methodology



The residential charging sites are assumed to have 7kW chargers only given that typical usage will be overnight or ad-hoc throughout the day. In addition, the survey findings indicated that most respondents would be prepared to walk up to five minutes to access a charge point. Therefore, as part of the modelling process it was assumed that residents would walk five minutes at most to a public charge point.

6.1.3.2 Destination Charging Analysis

Similar to the residential charging analysis, existing EVCI locations were identified, before identifying public sector locations and commercial properties suitable for EV charging, using Ordnance Survey data. These could be for destination or journey chargers, with examples including public car parks, service stations, restaurants and fast-food takeaways. The model process is illustrated in Figure 6.3.

Figure 6.3: EV Optimisation Model Destination Charging Analysis Methodology

Each of the destination charging sites identified is assumed to use a combination of 7kW to 22kW fast chargers and 50kW rapid chargers depending on the estimated dwell time at the site.

6.2 Preferred Charge Point Mix

Out of the three potential EV scenario outcomes (low, central, and high), the central forecast was used as it represented a good balance between an aspiration target whilst also being a possible middle trajectory based on the analysed scenarios. This avoids planning for a potential over or undersupply of EVCI given the outlook for this study is the next four years.

To derive the subsequent charge point mix and number of EVCI required, several variables form part of the EVCI calculation which can significantly impact the type of infrastructure recommended to support the forecast demand. Section 6.2.2 provides more information on how the suggested charge point mix was arrived at.

6.2.1 Distributions

Table 6.9 lists some of these variables set for each of the three council areas, which are split into two distinct categories. Firstly, the distribution of residential on and off-street parking accessibility is defined, based on the values from the Scottish House Condition Survey[19]. In addition, the split between EV types is also defined based on the demand forecasting.

Table 6.9: Ayrshire Council Area EVCI Variables

	Household Parking Availability		Car and Van ULEV Composition	
Local Authority	**Off-Street Parking**	**On-Street Parking**	**PHEV**	**BEV**
North Ayrshire	53%	47%	41%	59%
East Ayrshire	56%	44%	30%	70%
South Ayrshire	64%	36%	39%	61%

Source: Department for Transport Vehicle Statistics (Fuel Type Composition) and Scottish Household Survey (Household Parking Availability)

The composition of ULEV is based on the demand forecasting outcomes to separate the types of EV between PHEV and BEV, due to:

- Lower electrical energy requirement from PHEVs compared to BEV, as PHEVs primarily rely on the ICE to function.
- BEV and PHEV users have different preferences towards recharging types, as PHEVs can rely on the ICE in case of low battery.
- The majority of PHEVs cannot use rapid chargers, and so they have been excluded from the energy demands for rapid chargers.

The availability of household parking is based on the Scottish Household Survey outputs, with different household parking arrangements resulting in different charging preferences. This is due to the assumption that those with off-street parking can undertake most of their vehicle charging needs privately without being wholly reliant on the public charging network.

6.2.2 Charging Preferences

To derive the preferred EVCI mix, the survey data was analysed, and appropriate factors were calculated based on user preference responses. The survey asked respondents to indicate locations which they would prefer to recharge their vehicle, whether they had a BEV, PHEV or ICE vehicle. The responses were collated and analysed, with responses organised based on whether the respondent had on/off-street parking or their vehicle type. This meant that preferences could be derived based on the broad circumstances of user groups.

A summary of these preferences is shown in Table 6.10 below. Note the preferences were set as the same for each of the Ayrshire local authorities due to the lower sample size per local authority.

Table 6.10: Ayrshire Surveyed Charging Preferences

		Charging Assumptions			
Primary Parking Location	**Vehicle Category**	**Privately Charged**	**Residential Slow (7kW)**	**Destination Fast (22kW)**	**Rapid Charging (50kW)**
Off-Street Parking	PHEV	70%	0%	30%	0%
	BEV	52%	0%	22%	26%
On-Street Parking	PHEV	22%	22%	55%	0%
	BEV	10%	9%	51%	30%

Source: Mott MacDonald

The 'privately charged' category includes recharging at home or work, and this energy requirement is not counted towards the overall public EVCI calculations. The remaining distribution between residential, destination and rapid charging inform the charger mix.

The requirements for each of the three Ayrshire local authorities based on the forecasting methodology are outlined in the subsequent sections. These requirements are based on the total required, either public sector or private sector, to meet the forecast demand.

6.2.3 Charger Utilisation

The amount of time that EVCI are utilised impacts the overall number required to meet the forecast number of EVs. A longer utilisation value results in more electricity delivered per EVCI, compared to a lower utilisation value would result in more EVCI required to meet the demand as the usage is lower.

The values of utilisation from the EVCI calculation are summarised in Table 6.11 below.

Table 6.11: Utilisation Values for EV Charging Infrastructure by Type

Local Authority	Residential Charging (<7kW)	Destination Charging (7 – 22kW)	Rapid Charging (50kW)	Notes (2021 Utilisation Data)
North Ayrshire Council	3,223	4,473	24,724	Average slow utilisation for residential. Average fast utilisation for destination. Average rapid utilisation.
Ayrshire Roads Alliance	3,262	5,251	9,582	Average slow utilisation for residential. Average fast utilisation for destination. Average rapid utilisation.

Source: North Ayrshire Council, Ayrshire Roads Alliance and ChargePlace Scotland

The utilisation values are based on the 2021 data provided by the councils. The maximum utilisation value was typically utilised due to the small existing sample sizes, in addition to some sites having a low utilisation due to being out of service or newly installed.

It must be noted that the utilisation values are based on the first six months of tariff implementation in North Ayrshire. For East and South Ayrshire, no tariff is currently in place meaning no utilisation data with tariffs in place is available.

These utilisation values have been agreed with the councils as a starting basis for calculating the EVCI requirements.

6.2.4 Assumptions

The key assumptions behind the EV and associated EVCI forecast, which subsequently impact the associated commercial and financial modelling, are detailed within this section.

- **Vehicle efficiency:** the distance each electrified vehicle can travel per unit of electricity, which is known as the miles per kWh in the UK. The higher the value, the more efficient the vehicle is in converting the electrical energy into kinetic energy. Future technological improvements may change the vehicle efficiency, along with the aerodynamics of the vehicle. However, to be conservative, the vehicle efficiency value has been assumed to remain the same as current vehicle models.
- **Annual vehicle kilometres travelled:** the distance travelled is proportionate to the amount of electricity required for each vehicle to travel that distance. Therefore, the amount of electricity required for the electrified vehicle fleet allows the number of EVCI to be calculated (based on the assumed utilisation per charger type).
- **Charger utilisation:** the amount of electricity each charger type can deliver during a certain timeframe. The utilisation values are based on an annual basis. The higher the utilisation value, the more electricity delivered by the asset resulting in higher revenues.

- **Private charging preference:** the proportion of the calculated overall electricity demand by the forecast number of EVs which are recharged at home, workplace or private communal parking areas. Essentially, these are any chargers that are not on the public network. Therefore, this energy requirement does not contribute towards the calculated EVCI requirements. Typical charging speeds are 7kW or below.
- **Destination charging preference:** the proportion of the calculated overall electricity demand by the forecast number of EVs which are recharged at trip attractor destinations. Examples of such include supermarkets, leisure centres or retail parks where dwell times are typically greater than an hour. The amount of destination charging compared to rapid charging has a significant impact on the demands placed on the electricity grid. Drivers who utilise 'opportunity charging' by topping up their vehicle where possible have a reduced pressure on the electricity grid due to the comparatively lower power demand compared to rapid charging. Typical recharge speeds are between 7kW and 22kW.
- **Rapid charging preference:** the proportion of the calculated overall electricity demand by the forecast number of EVs which are recharged at rapid charging hubs such as petrol stations and motorway services. Rapid chargers typically provide between 50kW to 350kW and require significant grid reinforcement to support the sudden spikes in demand within the locality. A higher preference towards rapid charging would subsequently reduce the destination charging preference and also require more rapid charging hubs. This could lead to increased costs when considering the amount of electricity delivered especially compared to a higher destination charging preference.
- **Residential charging preference:** the proportion of the calculated overall electricity demand by the forecast number of EVs which are recharged on-street or in residential parking areas. These locations are designed for where vehicles are parked for long periods of time such as overnight in residential areas and can be equipped to lamp posts or bollards. It is noted that there are currently issues with mounting chargers on street lamps in Ayrshire due to the switching power supplies and streetlamp installation at the rear of the kerb. Therefore on-street charging bollards have been assumed instead, with a typical output of below 7kW.
- **Residential charger catchment:** the walking distance residents are prepared to walk to access a public charger. For the purposes of this assessment, this distance has been set to 400m which equates to a 5-minute walk. This corresponds with the survey findings.
- **Existing petrol stations:** it has been assumed that most petrol stations will eventually provide some form of rapid charging facilities as the number of EVs on the road increases. Some petrol stations within Ayrshire already provide rapid chargers on their forecourts.

A full list of the outlined assumptions is provided in the Assumption Log in Appendix D.

6.2.5 Forecast EV Charging Infrastructure Requirements

6.2.5.1 North Ayrshire EVCI Requirements

Table 6.12 summarises the estimated number of charge points required within North Ayrshire by 2025 and 2030, based on the outlined demand forecast for BEV and PHEVs for 2025 and 2030. The values represent the overall number of charge points required (including existing), and do not distinguish between public or private ownership.

Table 6.12: North Ayrshire Forecast EV Infrastructure Requirements

	2025 Forecast Requirement			2030 Forecast Requirement		
	Low	Central	High	Low	Central	High
Residential (Slow)	40	78	125	163	313	502
Destination (Fast)	122	244	340	474	769	1,132

	2025 Forecast Requirement			2030 Forecast Requirement		
	Low	Central	High	Low	Central	High
Rapid	34	62	87	147	259	351
Total Devices	**196**	**384**	**552**	**784**	**1,340**	**1,984**

Based on the charger mix identified for North Ayrshire, it is evident that a total of 384 EVCI would be required by 2025. The majority of these should be destination charging across the council area, followed by on-street infrastructure in main towns/villages and rapid chargers at key locations. By 2030, this forecast requirement increases substantially to a total of 1,340 sockets, however it is acknowledged that due to the rapid change underway within the industry results in a greater uncertainty around the forecast.

The 2025 central forecast results in an overall ratio of charge points per 100,000 population of 286.

6.2.5.2 East Ayrshire EVCI Requirements

The estimated number of charge points required within the East Ayrshire local authority area up to 2030 are summarised in Table 6.13. These values are based upon the forecast BEV and PHEV demand for 2025 and 2030 and include existing charge points within the area.

Table 6.13: East Ayrshire Forecast EV Infrastructure Requirements

	2025 Forecast Requirement			2030 Forecast Requirement		
	Low	Central	High	Low	Central	High
Residential (Slow)	60	116	225	227	468	884
Destination (Fast)	48	97	150	180	335	510
Rapid	23	43	59	99	185	231
Total Devices	**132**	**256**	**435**	**506**	**988**	**1,625**

For East Ayrshire, the greatest proportion of charging devices should be residential-based due to the population being largely concentrated in towns and the higher proportion of forecast BEV compared to PHEV, resulting in a larger energy demand for on-street locations. The remaining infrastructure should target destination and rapid charging devices in hubs spread across the local authority.

The 2025 central forecast results in an overall ratio of charge points per 100,000 population of 211.

6.2.5.3 South Ayrshire EVCI Requirements

The outlined EVCI requirements forecast for South Ayrshire are shown in Table 6.14. These are based on the outlined vehicle forecasts for 2025 and 2030 and represent the total requirement across the area.

Table 6.14: South Ayrshire Forecast EV Infrastructure Requirements

	2025 Forecast Requirement			2030 Forecast Requirement		
	Low	Central	High	Low	Central	High
Residential (Slow)	79	142	234	267	541	879
Destination (Fast)	64	126	185	240	399	617
Rapid	33	60	83	130	227	318
Total Devices	**176**	**329**	**502**	**637**	**1,167**	**1,813**

In South Ayrshire, the forecast indicates that on-street residential chargers form the greatest number within the forecast within the 329 total devices required by 2025. By 2030, the forecast range increases due to the greater uncertainty between the forecasts as a result of the significant change underway within the transport sector.

The 2025 central forecast results in an overall ratio of charge points per 100,000 population of 293.

6.3 Site Identification and Grid Connection

The EV Model was run based on the forecast charger estimates for residential and destination locations, as outlined in the previous section for 2025 assuming the central case scenario. This scenario was chosen as it offers a balanced approach between the aspirational and pessimistic forecasts.

The EV Optimisation tool analysed the local authority areas based on the outlined methodology and output suggested sites for EVCI. These suggested sites were then reviewed and modified based on a range of criteria such as the location of council-owned facilities for the public-sector charging network to target. It was broadly assumed that the majority of petrol stations within the council areas will eventually provide rapid chargers alongside petrol/diesel, as evidenced with BP, Shell and MFG installing EVCI at existing forecourts. Additional private sector EVCI may also be implemented at retail parks, typically featuring rapid or destination charging.

Therefore, recommendations for EVCI within each local authority mostly focus on providing destination charging at car parks owned by the council at schools, leisure centres or near High Streets. Rapid charging has only been recommended where market failure could exist in more rural locations.

6.3.1 Assessment Criteria

The assessment criteria analysed as part of the EV Model are outlined in the following section.

6.3.1.1 Grid Capacity Assessment

From the calculated required EVCI, the EV model identified potential sites based on the input criteria outlined. The nearest primary substation capacity was then analysed, based on data provided by Scottish Power Energy Networks (SPEN)[20], with the total number of identified potential EVCI locations. If the total power demand from the proposed sites within the

[20] Scottish Power Energy Networks, 2022. Distributed Generation Heat Map data. Available at: https://www.spenergynetworks.co.uk/pages/sp_distribution_heat_maps.aspx

catchment of the primary substation resulted in a remaining capacity of less than 2MVA, then the model flagged an issue. This allowed a high-level overview of whether the proposed infrastructure could be accommodated on the local power grid and enables capacity constraints to be identified.

Primary substations with potentially limited capacity to support the potential energy demand from the proposed infrastructure within the catchment areas is highlighted in Table 6.15.

Table 6.15: Primary Substations Identified with Potentially Limited Capacity

Primary Substation	Firm Capacity (MVA)	Maximum Recorded Load (MVA)	Total Ayrshire Public Sector Charger Load (MVA)	Potential Private Sector Load (MVA)	Remaining Capacity (MVA)
Irvine	21.00	19.04	0.25	0.01	1.95
Mill Street	21.00	17.85	0.69	3.22	-0.07

The primary substation within central Irvine and on Mill Street, Ayr were both identified as having potential capacity constraints in relation to the proposed EVCI required to support the forecast number of EV within the area. These two primary substations were identified as having less than 2MVA capacity after the additional load was accounted for.

Further detail on the grid analysis undertaken by local authority is provided in Appendix F.

Grid Assessment Disclaimer:

It must be noted the potential number of EVCI that the primary substation could support is only an approximation, and no forecasting assessment was carried out on the potential future maximum load. In addition, while a primary substation could accommodate additional load, the local grid infrastructure in the vicinity may require upgrades to support the proposed locations to provide sufficient power to a charging site.

Any future developments such as housing schemes have also not been considered for the potential impact on the grid capacity. Appropriate engagement is highly recommended with SPEN at an early stage of planning to ensure aspirations are aligned.

6.3.1.2 Other Considerations

Further assessment criteria have also been considered within the analysis, which are listed as follows:

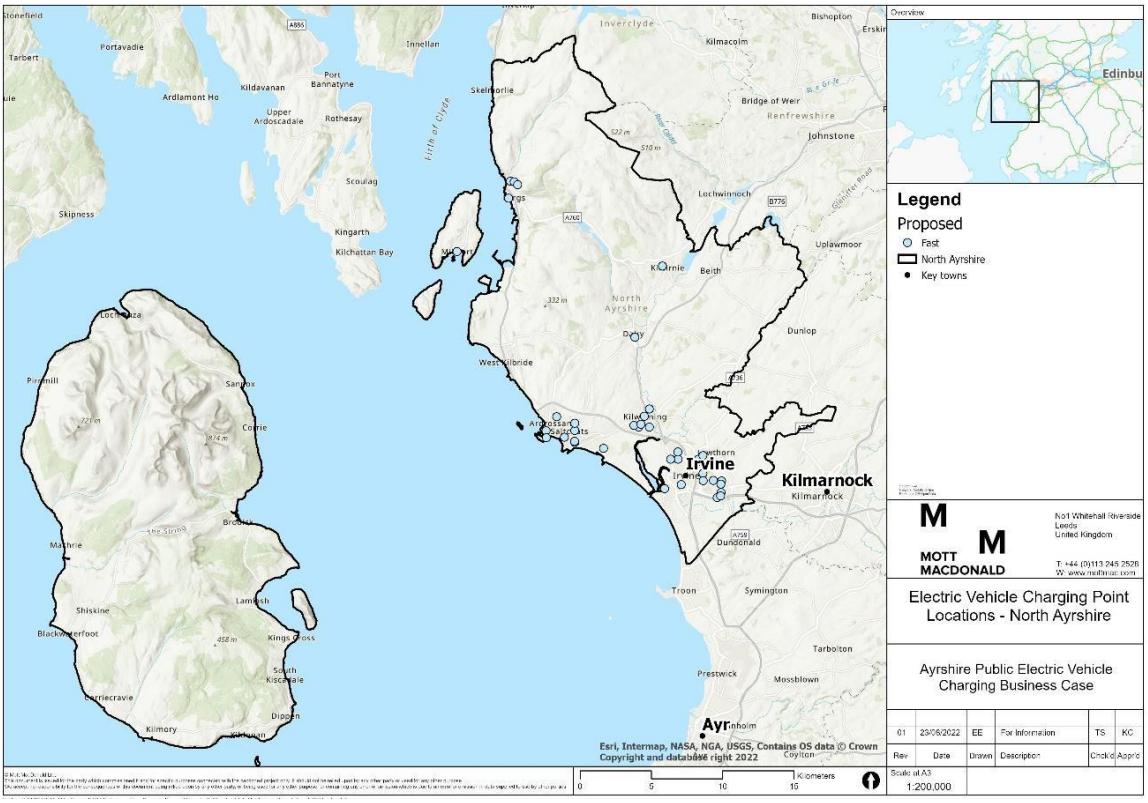
- **Scottish Index of Multiple Deprivation (SIMD)** – ensure Transport Scotland's EVCI vision is met through the Just Transition and ensure EVCI are available in a range of demographic areas.
- **Existing petrol stations** – where the private sector may develop existing petrol stations into future rapid charging sites.
- **Existing supermarkets and retail parks** – where destination and rapid charging could be provided by the private sector.
- **Trunk roads** – proximity to well-trafficked routes through the region, where the private sector is likely to develop rapid charging hubs.
- **Placemaking criteria** – use the placement of EVCI to promote high streets and town centres, such as within public car parks.
- **Public Transport and Active Travel** – proximity to public transport and active travel infrastructure.

6.3.2 North Ayrshire Identified Sites

Residential EV Chargers

The identified potential residential EV charger locations from the model output are shown in Figure 6.4.

Figure 6.4: North Ayrshire Potential Residential EV Charger Locations



Source: Data from: North Ayrshire Council Map produced by: Mott MacDonald

A total of 39 locations for on-street residential EV charging were identified from the analysis, to meet a forecast requirement of 78 AC sockets. These locations are spread across the council area, primarily based in locations where off-street parking is limited and residents would rely on the public network. Each site is assumed to feature at least a dual socket 7kW charger. The proposed sites are listed in Table 6.16.

Table 6.16: North Ayrshire Council Proposed Public Sector Residential EVCI Sites

Site	Post Code	Placement
Anderson Drive, Saltcoats	KA21 6AS	On-street
Argyle Road, Saltcoats	KA21 5AF	On-street
Baird Avenue, Kilwinning	KA13 7AP	On-Street
Bensley Avenue, Irvine	KA11 1AH	Car Park
Blacklands Avenue, Kilwinning	KA13 6HU	Car Park
Braehead, Girdle Toll, , Irvine	KA11 1BE	Car park
Brisbane Rd, Largs	KA30 8NW	On-Street
Broomfield Place, Largs	KA30 8LA	On-street
Broomlands Drive, Irvine	KA12 0DT	On-street
Burns Avenue, Saltcoats	KA21 6HD	On-Street

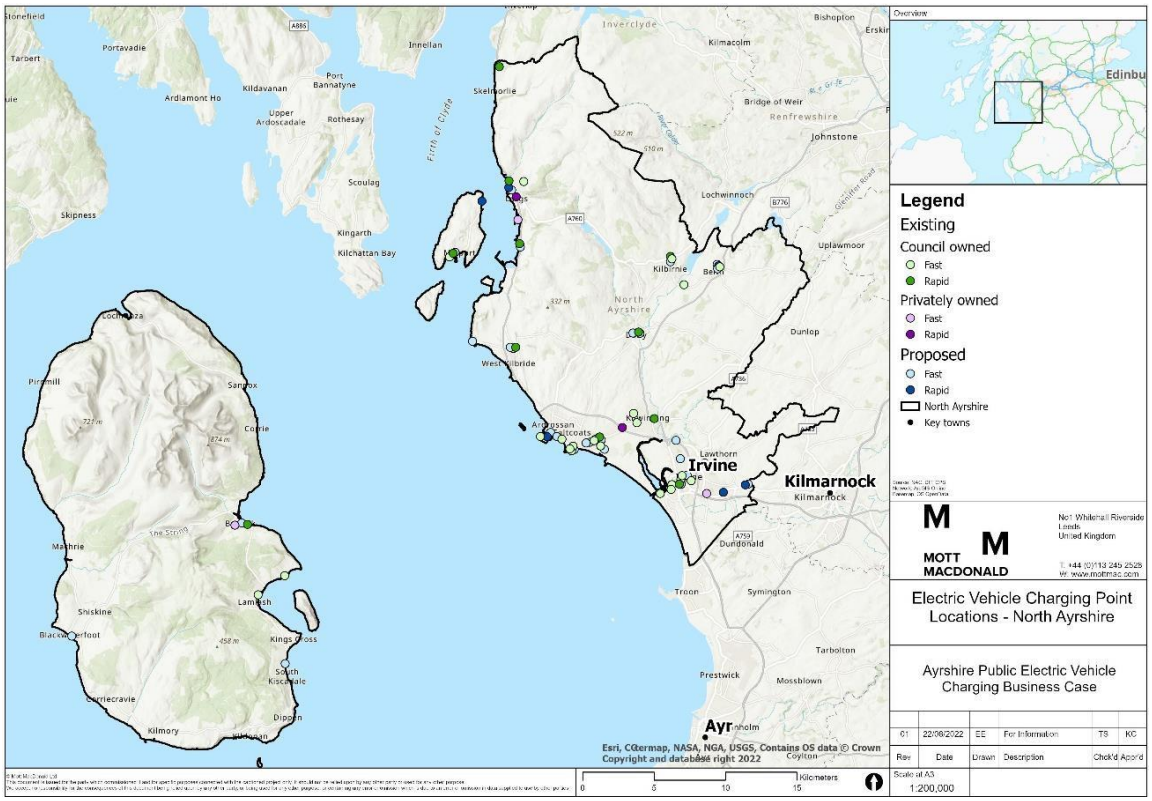
Site	Post Code	Placement
Carment Drive, Stevenston	KA20 3LD	On-street
Claremont Crescent, Kilwinning	KA13 7HF	On-Street
Corserine Bank, Irvine	KA11 1LH	Car Park
Dickson Drive, Irvine	KA12 9AH	On-Street
Dundonald Road, Irvine	KA11 4DB	Car park
Garelet Place, Irvine	KA11 1EX	Car Park
Garnock St, Dalry	KA24 4AW	On-Street
Gladstone Road, Saltcoats	KA21 5LF	On-Street
Glasgow Street, Isle of Cumbrae	KA28 0DP	On-street
Glenapp Place, Kilwinning	KA13 6TQ	On-Street
Haco Street, Largs	KA30 9BG	On-Street
Harbour Street, Irvine	KA12 8PZ	Car Park
Heatherstane Way, Irvine	KA11 1DU	Car Park
Holehouse Road, Largs	KA30 9JH	On-Street
Ladeside Court, Kilbirnie	KA25 6BG	On-Street
Lanfine Way, Irvine	KA11 1BT	Car Park
Lewis Wynd, Irvine	KA11 1HL	Car park
Lismore Drive, Irvine	KA11 4JF	Car Park
Manuel Terrace, Irvine	KA11 4BY	On-Street
Milldown Place, Irvine	KA11 1EF	Car park
Montgomerie Street, Ardrossan	KA22 8HP	On-street
Morar Place, Irvine	KA12 9PU	Car Park
Muirside Road, Saltcoats	KA13 6NA	On-Street
Newfield Place, Irvine	KA11 1NS	Car Park
Princes Street, Ardrossan	KA22 8DQ	On-street
Redburn Place, Irvine	KA12 9BQ	Car Park
Stanley Road, Adrossan	KA22 7DL	On-Street
Sundrum Place, Kilwinning	KA13 6SP	Car Park
Victoria Road, Saltcoats	KA21 5LG	On-street

The on-street residential charging locations identified from the EV Model are detailed in Appendix G.

Destination and Journey EV Chargers

Potential locations for destination or rapid chargers were also identified based on trip attractor data and a 4km driving distance around these attractors. These potential sites are shown in Figure 6.5.

Figure 6.5: North Ayrshire Potential Destination or Rapid EV Charger Locations



Source: Data from: NAC, DfT and CPS Map produced by: Mott MacDonald

The list of sites identified by the EV model and further analysis that could be provided by the public sector are listed in Table 6.17. The total new destination and journey charging units are 65, with 12 DC chargers and 53 dual socket AC chargers.

Table 6.17: North Ayrshire Identified Public Sector Destination EVCI Sites

Site	Post Code	Location	Sector	EVCP	Primary Current	Max kW Output
Afton Road Car Park, Stevenston	KA20 3EY	Car Park	Destination	1	AC	22.0
Ardeer Youth and Community Centre, Stevenston	KA20 3NB	Off-Street	Destination	2	AC	7.0
Auchenharvie Academy, Stevenston	KA20 3JW	Off-Street	Destination	2	AC	7.0
Auchenharvie Leisure Centre, Stevenston	KA20 3JR	Off-Street	Destination	2	AC	7.0
Beith Community Centre	KA15 2BQ	Off-Street	Destination	1	AC	22.0
Bellman's Close Car Park, Beith	KA15 2AX	Car Park	Journey	2	DC	50.0
Blackwaterfoot Car Park	KA27 8ET	Car Park	Journey	1	DC	50.0
Blackwaterfoot Car Park	KA27 8ET	Car Park	Destination	1	AC	22.0
Bradshaw Street Car Park, Saltcoats	KA21 5HR	Car Park	Destination	1	AC	7.0
Caledonia Car Park, Irvine	KA12 0AA	Car Park	Destination	3	AC	7.0
Castlepark Community Centre, Irvine	KA12 9LQ	Off-Street	Destination	2	AC	7.0
Civic Centre, Ardrossan	KA22 8HJ	Car Park	Destination	1	AC	7.0
Cumbrae Ferry Terminal	KA28 0HQ	Off-Street	Journey	1	DC	50.0

Site	Post Code	Location	Sector	EVCP	Primary Current	Max kW Output
Dalry Primary School/Community Sports Hub	KA24 5DR	Off-Street	Destination	2	AC	22.0
Eglinton Park, Irvine	KA12 8TA	Off-Street	Destination	2	AC	7.0
Garnock Community Campus	KA14 3BJ	Off-Street	Destination	1	AC	22.0
Garnock Community Campus	KA14 3BJ	Off-Street	Journey	1	DC	50.0
Garrison House, Millport	KA28 0DJ	Off-Street	Destination	1	AC	22.0
Gateside Street Car Park, Largs	KA30 9LG	Car Park	Destination	1	AC	7.0
Girdle Toll, Irvine	KA11 1AQ	Off-Street	Destination	1	AC	22.0
Glen Road, West Kilbride	KA23 9BL	On-Street	Destination	1	AC	22.0
Invercloy Car Park, Brodick	KA27 8BD	Car Park	Destination	1	AC	22.0
Kilmeny Terrace Car Park, Saltcoats	KA22 8DX	Car Park	Destination	1	AC	7.0
Largs Campus, Largs	KA30 9EU	Off-Street	Destination	1	AC	22.0
Main Road Fairlie Car Park, Fairlie	KA29 0AB	Car Park	Destination	1	AC	7.0
Main Street Car Park, Dreghorn	KA11 4AH	Car Park	Destination	1	AC	22.0
Main Street Car Park, Dreghorn	KA11 4AH	Car Park	Journey	1	DC	50.0
New St Car Park, Dalry	KA24 5AF	Car Park	Destination	1	AC	7.0
Newton Street Car Park, Kilbirnie	KA25 6HN	Car Park	Destination	1	AC	7.0
Portencross Car Park	KA23 9QA	Car Park	Destination	1	AC	22.0
Princes Street, Ardrossan	KA22 8GA	On-Street	Journey	2	DC	50.0
Roslin House, Stevenston	KA20 3JL	Off-Street	Destination	1	AC	22.0
Seafront Car Park, Largs	KA30 8LZ	Car Park	Destination	2	AC	7.0
Seafront Car Park, Largs	KA30 8LZ	Car Park	Journey	2	DC	50.0
Ship House Car Park, Lamlash	KA27 8LT	Car Park	Journey	1	DC	50.0
Silverburn Road Car Park, Whitling Bay	KA28 8PS	Car Park	Destination	1	AC	22.0
Skelmorlie Community Centre	PA17 5AH	Off-Street	Destination	2	AC	7.0
Smith Street Car Park, Dalry	KA24 5BZ	Car Park	Destination	2	AC	22.0
Springside Community Centre	KA11 3BG	Off-Street	Destination	1	AC	22.0
Springside Primary School	KA11 3AZ	Off-Street	Journey	1	DC	50.0
Strand, Beith	KA15 1DT	On-Street	Destination	1	AC	22.0
The Portal, Irvine	KA12 0BT	Car Park	Destination	2	AC	7.0
Viking Centre, Largs	KA30 8QL	Car Park	Destination	2	AC	7.0
Volunteer Hall Car Park, Irvine	KA12 0DA	Car Park	Destination	2	AC	7.0
West Kilbride Community Centre	KA23 9EH	Off-Street	Destination	1	AC	22.0
Woodlands Primary, Irvine	KA12 0PU	On-Street	Destination	2	AC	7.0
Woodwynd Car Park, Kilwinning	KA13 6AE	Car Park	Destination	1	AC	22.0

The total forecast requirement for the 2025 central forecast was 244 AC destination sockets and 62 DC rapid chargers. A comparison between the forecast EVCI and identified sites are outlined in the following section.

Summary

A summary of the forecast public and private EVCI is shown in Table 6.18.

Table 6.18: North Ayrshire Public and Private Sector EVCI Summary

	Residential AC (7kW)		Destination AC (7 - 22kW)		Rapid DC (50kW)	
	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025
LA Procured	0	39	30	83	16	28
Private CPO	0	0	6	39	4	34
Total	**0**	**39**	**36**	**122**	**20**	**62**

The destination and rapid charging locations identified from the EV Model are detailed in Appendix G.

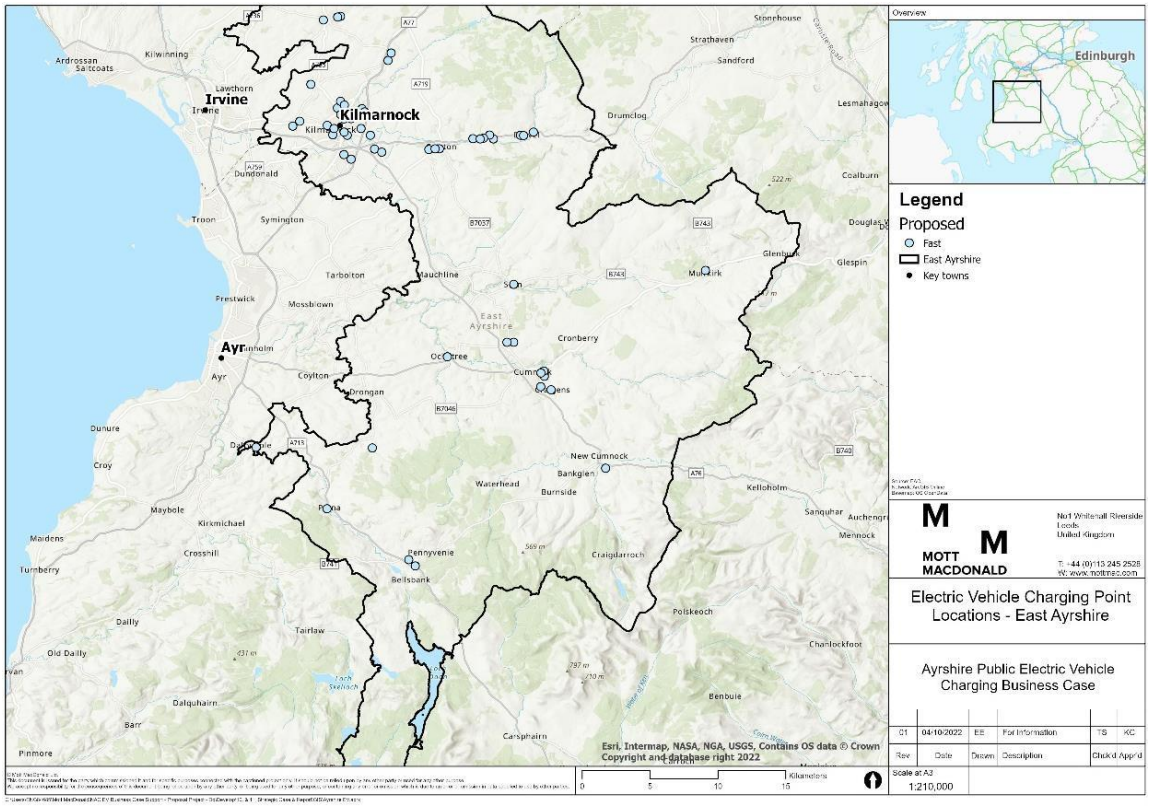
At the time of writing, a proposal for 14 rapid chargers by MFG at a BP Petrol Station on Littlestane Road, Irvine was submitted to planning. It is assumed that similar sites will appear across the region based on private sector engagement, however these could range from two rapid chargers to a large charging hub like the proposed MFG site across a range of trip attractors. Therefore, the need of the sites listed in Table 6.17 should be continually reviewed until 2025.

6.3.3 East Ayrshire Identified Sites

Residential EV Chargers

The potential residential EV charger locations from the model output are shown in Figure 6.6.

Figure 6.6: East Ayrshire Potential Residential EV Charger Locations



Source: Data from: East Ayrshire Council Map produced by: Mott MacDonald

A total of 57 residential charger sites were identified in the EV model, assuming two 7kW sockets per location for a total of 114 sockets. These locations are spread across the council

area, primarily based in locations where off-street parking is limited and residents would rely on the public network.

The list of proposed residential EV charger sites within East Ayrshire are shown in Table 6.19.

Table 6.19: East Ayrshire Council Proposed Public Sector Residential EVCI Sites

Site	Post Code	Placement
Anderson Place Car park, Kilmarnock	KA3 7JU	On-street
Ardgour Road	KA3 2AE	On-street
Avisyard Avenue, Cumnock	KA18 3BL	On-street
Barbieston Road, Auchinleck	KA18 2EJ	On-Street
Barclay Drive, Kilmarnock	KA3 7PD	On-street
Barshare Road, Cumnock	KA18 1NH	On-street
Bath Street, Kilmarnock	KA3 1HX	On-street
Birch Ave, Dalrymple	KA6 6EB	On-Street
Blair Avenue, Hurlford	KA1 5BD	On-street
Burnton Place, New Cumnock	KA18 4EU	On-street
Cairnduff Place, Stewarton	KA3 5QN	On-street
Castle Croft, Dalmellington	KA6 7RD	On-Street
Catherine Drive, Galston	KA4 8BU	On-street
Cessnock Avenue,Hurlford	KA1 5EE	On-street
Dalgleish Avenue, Cumnock	KA18 1QY	Car Park
Dallowie Road, Patna	KA6 7ND	On-street
Dalry Road, Stewarton	KA3 3AN	On-street
Dean Street, Kilmarnock	KA3 1EA	On-street
Edgar Avenue, Cumnock	KA18 1TQ	On-street
Fleming Street, Darvel	KA17 0HQ	On-street
Forbes Place, Kilmarnock	KA3 7RQ	Car Park
Gibson Street, Kilmarnock	KA1 2PL	On-street
Gilfoot, Newmilns	KA16 9HT	Car Park
Glebe Road, Galson	KA4 8DT	Car Park
Glebe Road, Kilmarnock	KA1 3BA	Car Park
Greenhead, Newmilns	KA16 9AX	On-street
Grougar Road, Kilmarnock	KA3 6LD	On-street
High Street, Newmilns	KA16 9EA	On-street
Hillmoss, Kilmaurs	KA3 2RS	On-Street
John Morton Crescent, Darvel	KA17 0JJ	On-street
Jubilee Drive, Stewarton	KA3 5PR	On-street
Kennedy Drive, Kilmarnock	KA3 7TQ	On-Street
Kirkton Road, Fenwick	KA3 6DP	On-street
Lindsay Gardens, Kilmarnock	KA3 7PU	On-street
Littlemill Place, Rankinston	KA6 7HE	On-street
MacIntosh Place, Kilmarnock	KA3 7NG	On-street

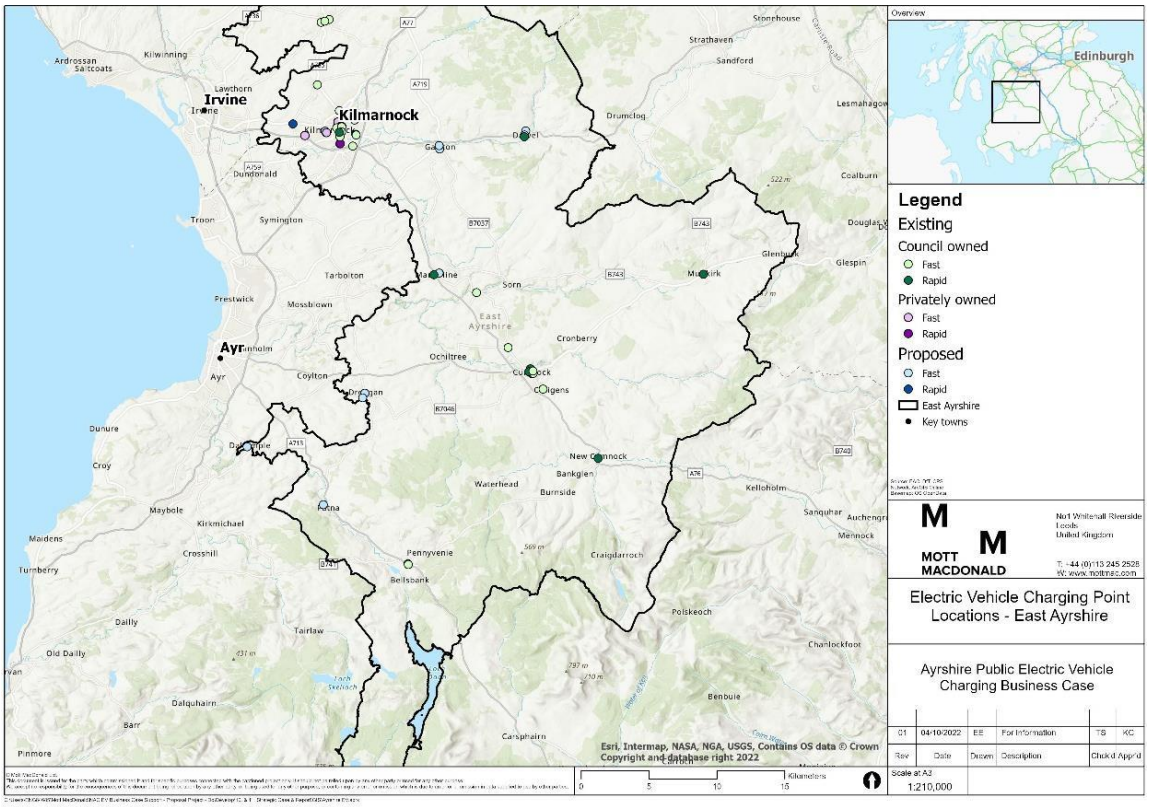
Site	Post Code	Placement
Macphail Drive, Kilmarnock	KA3 7EU	On-street
Main Road, B7061, Fenwick	KA3 6AL	On-street
Main Street, Dunlop	KA3 4AN	On-street
Main Street, Ochiltree	KA18 2PD	On-street
Main Street, Sorn	KA5 6HU	On-street
Meiklewood Road, Kilmarnock	KA3 2EL	On-street
Menzie Avenue, Cumnock	KA18 3DE	On-street
Merrick Road, Kilmarnock	KA1 3TA	On-street
Nelson Street, Newmilns	KA16 9AP	On-street
Orchard Street, Galston	KA4 8EB	Car Park
Paterson Street, Dalmellington	KA6 7RS	On-street
Rennie Street, Kilmarnock	KA1 3AB	On-street
Rugby Road, Kilmarnock	KA1 2DW	On-street
School Road, Auchinleck	KA18 2HZ	On-street
Shields Road, Newmilns	KA16 9HG	On-Street
South Dean Road, Kilmarnock	KA3 7RF	On-street
Temple Street, Darvel	KA17 0DR	On-street
Wardneuk Drive, Kilmarnock	KA3 2EF	On-street
Wellwood Street, Muirkirk	KA18 3RR	On-Street
West Woodstock Street, Kilmarnock	KA1 2JH	On-street
Witchknowe Road, Kilmarnock	KA1 4LQ	On-street
Woodbank Road, Kilmarnock	KA2 0ET	On-street

The on-street residential charging locations identified from the EV Model are detailed in Appendix G.

Destination and Journey EV Chargers

Potential locations for destination or rapid chargers were also identified based on trip attractor data and a 4km driving distance around these attractors. These potential sites are shown in Figure 6.7.

Figure 6.7: East Ayrshire Potential Destination or Rapid EV Charger Locations



Source: Data from: EAC, DfT and CPS Map produced by: Mott MacDonald

The list of sites identified by the EV model and further analysis that could be provided by the public sector are listed in Table 6.20. The total destination and journey EVCI are 34, with 3 DC chargers and 31 dual socket AC chargers.

Table 6.20: East Ayrshire Identified Public Sector Destination Sites

Site	Post Code	Location	Sector	EVCP	Primary Current	Max kW Output
Avenue Square Car Park, Stewarton	KA3 5AP	Off-Street	Destination	1	AC	7
Barr Street Car Park, Galston	KA4 8HU	Off-Street	Destination	1	AC	22
Church Lane Car Park, Galston	KA4 8HE	Off-Street	Destination	1	AC	22
Darvel Primary School/Sports Centre	KA17 0BT	Off-Street	Destination	1	AC	22
Drongan Centre	KA7 7AY	Off-Street	Journey	1	DC	50
Drongan Centre	KA7 7AY	Off-Street	Destination	1	AC	7
Drongan Community Centre	KA6 7BZ	Off-Street	Destination	1	AC	7
East George Street Car Park, Kilmarnock	KA1 1GB	Off-Street	Destination	1	AC	7
East Main St, Darvel	KA17 0AB	On-Street	Destination	2	AC	7
Foregate Car Park, Kilmarnock	KA1 1LU	Off-Street	Destination	3	AC	7
Gatehead Road Car Park, Crosshouse	KA2 0AH	Off-Street	Destination	1	AC	7

Site	Post Code	Location	Sector	EVCP	Primary Current	Max kW Output
Gatehead Road Car Park, Crosshouse	KA2 0AH	Off-Street	Journey	1	DC	50
Glaisnock Street Car Park, Cumnock	KA18 1JS	Off-Street	Destination	1	AC	7
Grange Academy/Leisure Centre, Kilmarnock	KA1 2EN	Off-Street	Destination	3	AC	7
Loudoun Street Car Park, Mauchline	KA5 5BE	Off-Street	Destination	1	AC	7
Main Street, Dalrymple	KA6 6DF	On-Street	Destination	1	AC	22
Mauchline Primary School	KA5 6AW	Off-Street	Destination	2	AC	7
Multi-storey Car Park, Kilmarnock	KA1 1LU	Off-Street	Destination	3	AC	7
Patna Resource Centre	KA6 7LX	Off-Street	Destination	1	AC	22
Ranouldcoup Road, Darvel	KA17 0JU	Off-Street	Destination	1	AC	7
Rose Reilly Sports Centre, Stewarton	KA3 3DN	Off-Street	Destination	1	AC	7
Saint Germain Street Car Park, Catrine	KA5 6RQ	Off-Street	Journey	1	DC	50
St Joseph's Leisure Centre, Kilmarnock	KA3 7SL	Off-Street	Destination	3	AC	7
Tanyard Car Park, Cumnock	KA18 1BG	Off-Street	Destination	1	AC	7

These destination and rapid charging sites identified from the EV Model are detailed further in Appendix G.

Summary

The required number of destination charge points will change depending on the level of EV uptake within East Ayrshire and the associated demand on charging infrastructure. Furthermore, a change in the charging preferences would impact the number of charger types required.

A summary of the forecast public and private EVCI is shown in Table 6.21.

Table 6.21: East Ayrshire Public and Private Sector EVCI Summary

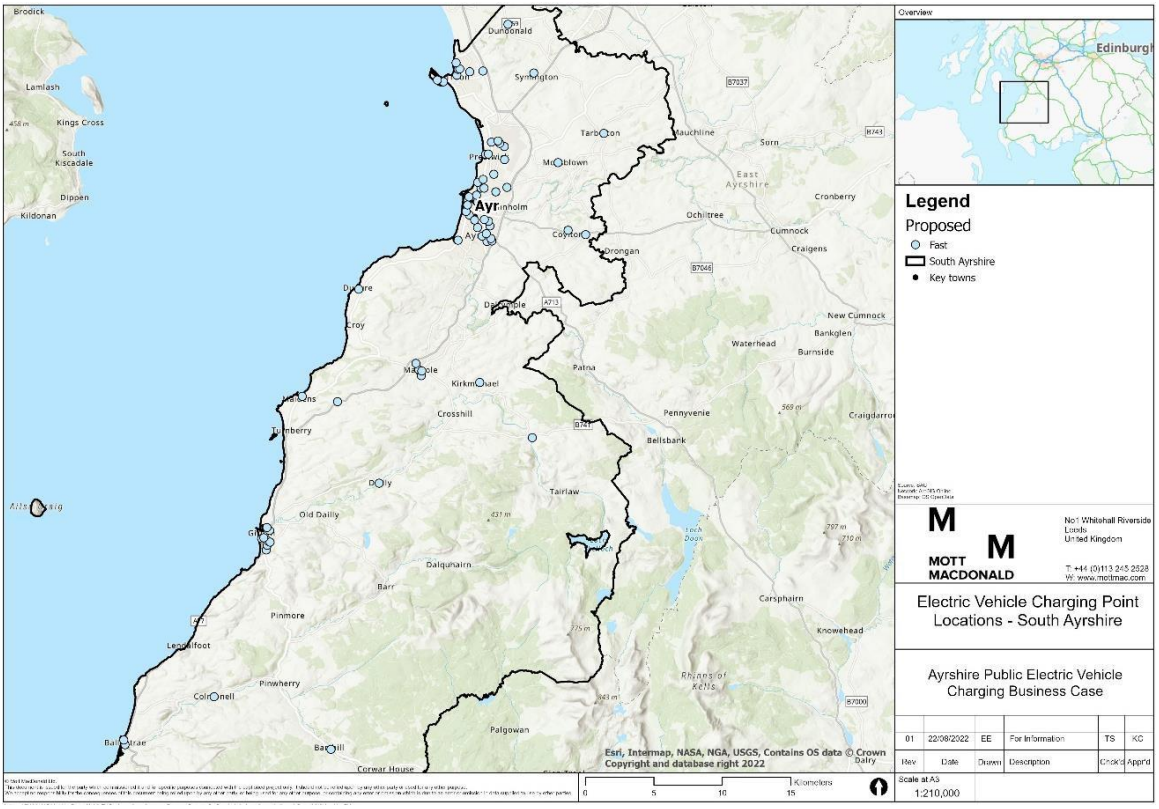
	Residential AC (7kW)		Destination AC (7 - 22kW)		Rapid DC (50kW)	
	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025
LA Procured	0	58	40	71	14	17
Private CPO	0	0	13	13	3	26
Total	**0**	**58**	**53**	**84**	**17**	**43**

6.3.4 South Ayrshire Identified Sites

Residential EV Chargers

The identified potential residential EV charger locations from the model output are shown in Figure 6.8.

Figure 6.8: South Ayrshire Potential Residential EV Charger Locations



Source: Data from: South Ayrshire Council Map produced by: Mott MacDonald

The EV Model identified a total of 69 sites across South Ayrshire, with each site assumed to feature two AC sockets for the purposes of residential charging. A summary of the analysed sites is shown in Table 6.22.

Table 6.22: South Ayrshire Council Proposed Public Sector Residential EVCI Sites

Site	Post Code	Location
Ailsa Road, Troon	KA10 6DB	On-street
Annpit Road, Ayr	KA8 9BZ	On-street
Arcon Court, Mossblown	KA6 5BT	Car park
Arran Avenue, Ballantrae	KA26 0NT	Car park
Arran Court, Girvan	KA26 0EG	On-street
Ballantine Drive, Ayr	KA7 2RG	On-street
Bank Street, Prestwick	KA9 1PT	On-street
Bank Street, Troon	KA10 6AL	On-street
Beechwood Road, Tarbolton	KA5 5RF	On-street
Bellevue Crescent, Ayr	KA7 2DP	On-street
Blackford Crescent, Prestwick	KA9 2LW	Car park
Buchan Road, Troon	KA10 7BT	On-street
Burnfoot Avenue, Troon	KA10 6RE	Car park
Campbell Court, Ayr	KA8 0SE	On-street
Campbell Street, Ayr	KA8 9AR	On-street
Carrick Street, Maybole	KA19 7DN	On-street
Castleview, Dundonald	KA2 9JB	Car park
Charlotte Street, Ayr	KA7 1DZ	On-street
Dalrymple Street, Girvan	KA26 9BG	On-street
Elba Street, Ayr	KA8 0DQ	On-street
Fairfield Road, Ayr	KA7 2AU	On-street
Fenwickland Avenue, Ayr	KA7 3QD	On-street
Gilles Street, Troon	KA10 6QH	On-street
Glencairn Road, Ayr	KA7 3HJ	On-street
Goukscroft Park, Ayr	KA7 4DS	Car park
Hawthorn Place, Troon	KA10 6QA	On-street
Heather Park, Ayr	KA7 3XJ	Car park
Henrietta Street, Girvan	KA26 9AN	On-street
Hillfoot Road, Ayr	KA7 3LF	On-street
Hyslop Crescent, Colmonell	KA26 0SE	On-street
Kennedy Drive, Dunure	KA7 4LT	On-street
Kerr Court, Girvan	KA26 0BP	On-street
Kincaidston Drive, Ayr	KA7 3YL	Car park
Kirk Street, Prestwick	KA9 1AU	On-street
Kirkoswald Road, Maidens	KA26 9NS	Car park
Kyle Crescent, Coylton	KA6 6NP	Car park
Ladywell Road, Maybole	KA19 7BE	Car park
Logan Drive, Troon	KA10 6QF	On-street
Lorne Terrace, Hillhead	KA6 6JX	On-street

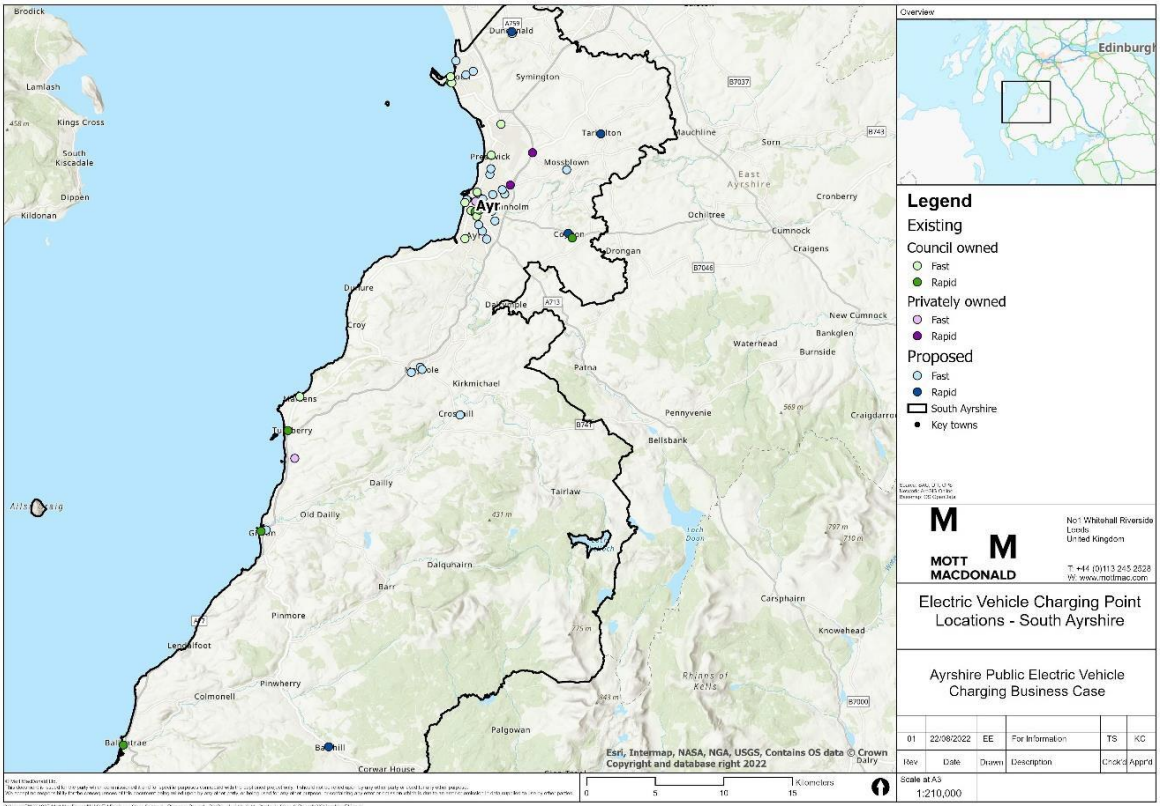
Site	Post Code	Location
Low Road, Ayr	KA8 9SB	Car park
Main Road, Kirkoswald	KA19 8HY	Car park
Main Street, Ballantrae	KA26 0NA	On-street
Main Street, Barrhill	KA26 0QP	On-street
Main Street, Dailly	KA26 9SB	On-street
Main Street, Loans	KA10 7EX	On-street
Main Street, Straiton	KA19 7NF	On-street
Main Street, Symington	KA1 5QG	On-street
Marina Road, Prestwick	KA9 1QZ	On-street
Minnoch Crescent, Maybole	KA19 8DW	Car park
Montgomerie Street, Girvan	KA26 9HS	On-street
Moor Park Crescent, Prestwick	KA9 2NL	Car park
Murray Gardens, Maybole	KA19 7AZ	Car park
Orchard Avenue, Ayr	KA7 3EJ	On-street
Oswald Road, Ayr	KA8 8LT	On-street
Patna Road, Kirkmichael	KA19 7PJ	On-street
Piedmont Road, Girvan	KA26 0DS	On-street
Princes Court, Ayr	KA8 8HX	Car park
Rowanbank Road, Prestwick	KA9 1DS	On-street
Shawfarm Gardens, Prestwick	KA9 2GZ	Car park
Shawfarm Place, Prestwick	KA9 1JQ	Car park
Sorrel Drive, Ayr	KA7 3XP	Car park
Southfield Park, Ayr	KA7 2NU	Car park
St George's Road, Ayr	KA8 9HN	On-street
Thomson Street, Ayr	KA8 9QB	On-street
Trefoil Place, Ayr	KA7 3XG	Car park
Troweir Road, Girvan	KA26 9EB	On-street
Willow Drive, Girvan	KA26 0DE	On-street
Wood Park, Ayr	KA7 3SL	On-street
York Street, Ayr	KA8 8AN	On-street

The on-street residential charging locations identified from the EV Model are detailed in Appendix G.

Destination and Journey EV Chargers

Potential locations for destination or rapid chargers were also identified based on trip attractor data and a 4km driving distance around these attractors. These potential sites are shown in Figure 6.9.

Figure 6.9: South Ayrshire Potential Destination or Rapid EV Charger Locations



Source: Data from: SAC, DfT and CPS Map produced by: Mott MacDonald

The list of sites identified by the EV model and further analysis that could be provided by the public sector are listed in Table 6.23. The total destination and journey EVCI are 75, with 7 DC sockets and 68 AC sockets.

Table 6.23: South Ayrshire Identified Public Sector Destination Sites

Site	Post Code	Location	Sector	EVCP	Max kWh Output
Annbank Primary School, Mossblown	KA6 5DZ	Off-Street	Destination	1	22
Ayr Academy, Ayr	KA8 0SZ	Off-Street	Destination	1	22
Barns Crescent Car Park, Ayr	KA7 2BW	Off-Street	Destination	2	7
Barrhill Memorial Hall	KA26 0PP	Car park	Journey	1	50
Beach Road Car Park, Troon	KA10 6SG	Off-Street	Destination	2	7
Belmont Academy, Ayr	KA7 3SN	Off-Street	Destination	1	22
Braehead Primary School, Ayr	KA8 9PJ	Off-Street	Destination	1	22
Citadel Leisure Centre, Ayr	KA7 1JB	Off-Street	Destination	2	7
Coylton Shops, Coylton	KA6 6PH	Off-Street	Journey	1	50
Crosshill Community Centre, Crosshill	KA19 7RJ	Off-Street	Journey	1	50
Crosshill Community Centre, Crosshill	KA19 7RJ	Off-Street	Destination	1	22
Dalmilling Primary School, Ayr	KA8 0PD	Off-Street	Destination	1	22
Forehill Primary School, Ayr	KA7 3JU	Off-Street	Destination	1	22
Heathfield Primary School, Ayr	KA8 9DR	Off-Street	Destination	1	22
Kincaidston Primary School, Ayr	KA7 3YN	Off-Street	Destination	1	22

Site	Post Code	Location	Sector	EVCP	Max kWh Output
Kingcase Primary School, Ayr	KA9 2DG	Off-Street	Destination	1	22
Main Street, Dundonald	KA2 9HL	On-Street	Destination	1	22
Main Street, Dundonald	KA2 9HE	On-Street	Journey	1	50
Marr College, Troon	KA10 7AB	Off-Street	Destination	1	22
Maybole Community Campus, Maybole	KA19 8BP	Off-Street	Destination	2	7
Maybole Town Hall, Maybole	KA19 7BZ	Off-Street	Destination	1	22
Muirhead Activity Centre, Troon	KA10 7AZ	Car park	Destination	2	7
New Road Car Park, Ayr	KA8 8HE	Off-Street	Destination	1	7
Newton Primary School, Ayr	KA8 8JL	Off-Street	Destination	1	22
Old Street Car Park, Girvan	KA26 9EY	Off-Street	Destination	2	7
South Beach Road Car Park, Troon	KA10 6EF	Off-Street	Destination	2	7
Southcraig School, Ayr	KA7 2ND	Off-Street	Destination	1	22
St John's Primary School, Ayr	KA8 0JB	Off-Street	Destination	1	22
Tarbolton Primary School, Tarbolton	KA5 5QD	Off-Street	Destination	1	22
Tarbolton Primary School, Tarbolton	KA5 5QD	Off-Street	Journey	1	50
The Carrick Centre, Maybole	KA19 7DE	Off-Street	Destination	1	22
Troon Swimming Pool, Troon	KA10 6XQ	Off-Street	Journey	2	50
Whitletts Activity Centre, Ayr	KA8 9RW	Car park	Destination	2	7

Further detail on the identified destination and rapid charging sites are provided in Appendix G.

Summary

The EV Optimisation Tool indicated that most EV growth would be concentrated around the main towns in South Ayrshire (e.g. Ayr, Troon, Prestwick and Girvan), where rapid charging infrastructure is likely to be more attractive to the private sector.

At the time of writing, a proposal for two rapid chargers at a BP Petrol Station on the A77 roundabout at Monkton was noted. It is assumed that similar sites will appear across the region based on private sector engagement, however these could range from two rapid chargers to a large charging hub across a range of trip attractors. Therefore, the requirement for the list in Table 6.23 should be continually reviewed until 2025.

From the analysis, the only location catchment area where grid capacity has been identified as an issue is the Mill Street primary substation within Ayr. The data provided by SPEN indicated this substation had limited capacity, and some of the EVCI sites identified from the modelling are potentially within the catchment of the primary substation. Therefore, while the utilisation of these charge points may be higher than other locations due to being located in the main town in South Ayrshire, upgrade works are likely required to accommodate the additional loading from the EVCI.

A summary of the forecast public and private EVCI is shown in Table 6.18.

Table 6.24: South Ayrshire Public and Private Sector EVCI Summary

	Residential AC (7kW)		Destination AC (7 - 22kW)		Rapid DC (50kW)	
	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025
LA Procured	0	69	17	52	9	16
Private CPO	0	0	4	12	3	44
Total	**0**	**69**	**21**	**64**	**12**	**60**

6.3.5 Summary

Based on the identified sites and the forecast CPO sites across the three Council areas, Table 6.25 summarises the existing public sector EVCI within each of the Council areas along with the proposed EVCI by 2025. Note that these are EVCI and may include single and dual socket units.

Table 6.25: Summary of Ayrshire Existing and Proposed Public Sector EVCI

Summary of Council Procured EVCI	Residential AC (7kW) EVCI		Destination AC (7 - 22kW) EVCI		Rapid DC (50kW) EVCI	
	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025	Existing 2022	Proposed by 2025
North Ayrshire	0	39	30	83	16	28
East Ayrshire	0	58	40	71	14	17
South Ayrshire	0	69	17	52	9	16
Total	**0**	**166**	**87**	**206**	**39**	**61**

This results in the following number of additional EVCI to be procured across the Council areas, as summarised in Table 6.26.

Table 6.26: Summary of Identified Additional Public Sector EVCI in Ayrshire

	Residential AC (7kW) EVCI	Destination AC (7 – 22kW) EVCI	Rapid DC (50kW) EVCI	Total
North Ayrshire	39	53	12	**104**
East Ayrshire	58	31	3	**92**
South Ayrshire	69	35	7	**111**
Total	**166**	**119**	**22**	**307**

The remaining difference between the forecast EVCI and the identified council procured sites are assumed to be catered by the private sector. Table 6.27 summarises the forecast private sector EVCI.

Table 6.27: Summary of Ayrshire Existing and Forecast CPO EVCI

Summary of Forecast CPO EVCI	Residential AC (7kW) EVCI		Destination AC (7 - 22kW) EVCI		Rapid DC (50kW) EVCI	
	Existing 2022	Forecast by 2025	Existing 2022	Forecast by 2025	Existing 2022	Forecast by 2025
North Ayrshire	0	0	6	39	16	28
East Ayrshire	0	0	13	13	3	26
South Ayrshire	0	0	4	12	3	44
Total	**0**	**0**	**33**	**64**	**22**	**98**

6.4 Capital Investment Pipeline and Estimated Costs

As there are a number of variables that can affect the cost of EVCI installation including civil works, DNO connection and wider grid upgrades, it is not possible to provide a comprehensive list of costs for each individual site. Each location would require detailed site surveys to ensure the proposed infrastructure can be accommodated.

To derive the potential costs, high-level cost estimates have been produced based on a limited dataset of EVCI installations and DNO grid upgrade quotes. The calculated costs are outlined within the following sections.

6.4.1 EVCI Installation Cost Estimates

EVCI Installation costs have been assumed as follows:

- **Residential/Destination 7kW (Slow):** £8,580 for a single-phase dual socket destination charging post.
- **Destination 22kW (Fast):** £8,910 for a three-phase dual socket destination charging post.
- **Journey 50kW (Rapid):** £46,760 for rapid charging at service stations or destinations.

These estimated costs are based on quotations provided to North Ayrshire Council and Mott MacDonald for each type of charger. The costs above include the following:

- Unit cost of the EV charger, dependent on the power output.
- General civils works between £2,120 (7kW AC) and £6,430 (50kW DC), including risk share.
- Preliminaries, overheads and profit of 15%
- Risk and contingency at 15% risk
- Inflation based on BCIS All-in TPI from Q3 2022 to Q2 2023 of 2.2%.

Figure 6.10: Example 7kW On-street Residential Charge Point

Source: Ubitricity

Costs will vary depending on the size of the installation and the proposed locations. It must be noted that the above costs do not include the grid connection, and assumes no works are required to the existing parking provision/road network. No utility diversions and associated works have been accounted for either.

Residential <7kW (Slow) Charger:
It has been assumed that the slow charger would be wall or bollard charger with up to a 7kW power output, such as the Ubitricity Satellite Bollard, or similar, as shown in Figure 6.10. The estimated total cost of £8,580 includes installation and the EVCI at £6,460, plus general civils works (line markings, signage, kerb surround and an area of hardstanding, plus two operatives and plant hire) at £2,120.

These are assumed to be installed in pairs for each identified residential charging site. Should the lamp post or bollard style charger be unsuitable, a destination 7kW dual socket charging post could also be used, however these are more expensive and have a larger footprint.

Figure 6.11: Example Fast Destination Charger Dual Post Installation

Source: Mott MacDonald

Destination 7kW to 22kW (Fast) Charger:

For destination charging where dwell times could be several hours, 7kW to 22kW dual-socket fast charging post has been assumed, such as the Swarco Evolve Dual Post. An example of such an installation is shown in Figure 6.11. The total cost estimate for a single dual socket 7kW post is assumed to be £8,580, while a similar dual socket 22kW post is assumed to be £8,910. The EVCI and installation costs are assumed to be £6,460 and £6,750 respectively, plus enabling civils works. These include an area of hardstanding, kerb surround, bollards, signage and line markings, plus two-days' time allowances for two operatives and plant hire at £2,120 and £2,161 for 7kW and 22kW respectively.

These are anticipated to be installed as a single 22kW post where a single unit has been recommended, or where more than two sockets are recommended these are anticipated to be installed as multiple 7kW posts. This is due to the greater cost effectiveness of working within a typical 100A single phase supply as up to six 7kW 32A sockets can be installed in comparison to only a dual 22kW within a three phase supply.

Destination 50kW (Rapid) Charger:

For destination sites where dwell times are under an hour, or for sites which are suitably located on the road network, 50kW rapid chargers have been assumed. The EVBox Troniq 50 has been assumed as an example for the purposes of these cost estimates. The EVCI and installation cost estimate are assumed to be £40,330. Additionally, enabling works are assumed to cost £6,430 with the quote including an area of hardstanding, kerb surround, bollards, signage and line markings, plus two-days' time allowances for two operatives and plant hire.

An example of a 50kW rapid charger installation is shown in Figure 6.12.

Figure 6.12: Example 50kW Rapid Charger Installation

Source: Mott MacDonald

6.4.2 DNO Cost Estimates

The DNO costs for connecting the EVCI to the grid can significantly vary by site, and therefore engagement with the DNO should be the initial step in planning new EVCI. Site investigations are recommended in order to obtain more detailed information on the works required to connect the proposed EVCI to the grid, and to understand any capacity limitations within the vicinity.

6.4.2.1 Proposed DNO Cost Reforms

Proposed changes to the DNO costing system may come into effect by April 2023, detailed in an Ofgem report [21]. The review details the proposed reforms to the system, aiming to improve the uptake of EV, heat-pumps and energy storage. Currently, the cost burden of the connection costs are shared between the connecting customer and the wider distribution network. There may currently be suggested locations for connecting customers to utilise spare capacity on the network. Any remaining cost of reinforcement, including any reinforcement two voltage levels above the voltage at the point of connection, is paid by the wider customer base.

From April 2023, it is proposed that there will be reduced overall connection charges with the wider distribution network reinforcement charge removed (with some exceptions). Connection charges however will remain as they are for any extension assets. This means that these connection charges will reduce in future as the wider DNO cost (such as new grid infrastructure to support increased demand in a location) is removed altogether.

6.4.2.2 DNO Cost Methodology

For the purposes of this assessment, the costs have been calculated based on the SPEN Connecting Electric Vehicles[22] report, which outlines that medium sized grid connections for up to 20 fast or rapid chargers would cost up to £100,000. Therefore, assuming that 20 fast chargers require a £100,000 grid connection, this has been adjusted to account for other charger types (slow/rapid) based on the proportional kW output. To derive uplifts for rural and island locations, sample DNO quotes were provided by North Ayrshire Council for urban, rural and island locations and the subsequent rural/island cost uplifts were calculated. This resulted in a 120% uplift for rural locations and 440% for island locations.

Table 6.28 below summarises the estimated DNO connection costs based on the outlined data inputs.

Table 6.28: Estimated DNO Costs based on Charger Output

	Estimated DNO Cost by Charging Speed (£)		
Location Typography	**Slow**	**Fast**	**Rapid**
Urban	682	5,000	9,773
Rural	1,500	11,000	21,500
Islands	3,682	27,000	52,773
*Excl. VAT			

Using the cost basis of 20 fast chargers requiring a £100,000 grid connection, and the uplift factors calculated for remote locations, the following conclusions were drawn:

- The quotes significantly varied by site despite the small geography of some proposed locations, illustrating the need for individual site investigations.
- The uplift for islands ranged from 25% to 1300%, with an average of 440%.

[21] Access and Forward-Looking Charges Significant Code Review: Final Decision, Ofgem. May 2022.

[22] Connecting Electric Vehicles: Driving the way to a more sustainable future, SP Energy Networks.

- There is a limited sample size for urban quotes, meaning this could impact the overall uplifts.

To derive the location typography per proposed EVCI site, the 3-fold Scottish Government Urban-Rural Classification index[23] was utilised to derive the potential DNO cost per site.

6.4.2.3 Capacity Charges

For any grid connection over 100kVa, SPEN issue capacity charges to manage these high powered grid connections. It is understood that currently there are four sites across the Ayrshire region that incur connection charges, with potentially further sites depending on the locations procured. These are as follows:

North Ayrshire:

- Ardrossan Low Carbon Hub (in planning) (estimated at £1,856)
- Largs Seafront Car Park (proposed) (estimated at £1,698)

East Ayrshire:

- Ayrshire Athletics Arena, Kilmarnock (1,000kW capacity): £9,052
- East George Street and Queen Street, Kilmarnock: £1,249

The assumed total capacity charges, including the new hubs proposed in North Ayrshire, is £15,105.

6.4.3 Estimated Capital Investment Costs

As a result of the outlined EVCI installation and DNO cost estimates, the total investment has been calculated for each local authority. The values have been rounded to the nearest 1,000.

North Ayrshire:

- Forecast EVI and associated installation costs: £1,357,000
- Forecast DNO costs: £533,000
- Combined cost (excluding ongoing transaction and maintenance costs): £1,890,000

East Ayrshire:

- Forecast EVI and associated installation costs: £906,000
- Forecast DNO costs: £171,000
- Combined cost (excluding ongoing transaction and maintenance costs): £1,076,000

South Ayrshire:

- Forecast EVI and associated installation costs: £1,226,000
- Forecast DNO costs: £356,000
- Combined cost (excluding ongoing transaction and maintenance costs): £1,581,000

6.4.4 Transaction and Maintenance Costs

In addition to the installation and DNO cost estimates outlined, other costs have also been included in the financial modelling and associated Financial Case described in Section 8. The maintenance and transaction costs discussed within this section have been discussed and agreed with SFT at a meeting on 29/09/2022.

[23] Scottish Government Urban Rural Classification 2020, Scottish Government. Published 31st May 2022.

Maintenance Costs

These have been calculated based on information provided by North Ayrshire Council and the Ayrshire Roads Alliance. The current maintenance arrangements are based on £432 per AC charger, and £837 for DC chargers.

These costs have been applied to the existing and proposed EVCI, per unit. In addition, other maintenance costs were received from the Councils. These are based on other ad-hoc maintenance fees accounting for vandalism and wear and tear replacements. These costs were set at £250 for North Ayrshire and £450 for Ayrshire Roads Alliance.

A further £49 annual automatic meter reading fee has additionally been applied for each charging site. These result in the following total costs for AC and DC chargers:

- Slow and Fast AC: £727
- Rapid DC: £1,132

Transaction Costs

These are operational costs based on the charge point network 'back office' and are levied based on each transaction incurred at an EVCI. CPS currently provide the back office for Council charge points across Ayrshire. This means transaction costs for North Ayrshire and Ayrshire Roads Alliance are lower than would be expected than compared to a private operator, as these costs are subsidised by Transport Scotland.

To calculate the transaction costs, the utilisation values detailed in Section 6.2.3 were analysed. These were based on CPS data provided and have been pro-rated to reflect the tariff operation in North Ayrshire while East and South is based on no tariff. The number of transactions from the utilisation data was used based on a £0.20 transaction cost for RFID or app-based payment, and £0.25 for each contactless or WebPay transaction.

Where data exists for current sites, the transaction costs were based on existing utilisation. For proposed sites, the maximum number of transactions were used for existing sites and were applied as follows:

- Slow and Fast AC - £81
- Rapid DC -£326

6.5 Analysis of Proposed Network

Following the site identification process, further analysis was undertaken on the EV Model outputs to ensure the proposed network met the network objectives from Section 5.2.2. In addition, comparisons were made to the Field Dynamics forecasts and zonal analysis.

6.5.1 Supporting Public Transport and Active Travel

A key objective of the public charging network, in line with the Transport Scotland vision, is to ensure active travel and public transport remain the primary modes of transport to maintain the sustainable transport hierarchy. These have been accounted for in development of the network.

Locations of transport hubs have also been considered, for example, p ublic EVCI have been sited on the mainland in North Ayrshire adjacent to ferry terminals, with slower charging options available. These are to encourage drivers to leave vehicles behind on the mainland to reduce private car trips to the islands, especially important during the tourist season. This strategy supports both Arran and Cumbrae as being cycling destinations, helping to reduce traffic on the islands.

A key strategy behind the choice of sites for charge points across the three Ayrshire council areas has been to reduce drive time to ensure good levels of coverage. This has been achieved through supporting on-street EVCI especially in dense urban areas. This means vehicle trips are effectively reduced to access charge points, as drivers can recharge their vehicles slower over longer periods of time rather than making specific trips to access a charging hub. Reducing vehicle trips can have positive impacts on public transport journey times and active travel safety. This also helps to reduce the number of kilometres driven by vehicles in Ayrshire.

In the next stage of development of this programme of EVCI, it is recommended that the more detailed development of sites includes consideration of walking and cycling infrastructure, and whether the provision of cycle stands, for example, could help to encourage cycling for part of the journey.

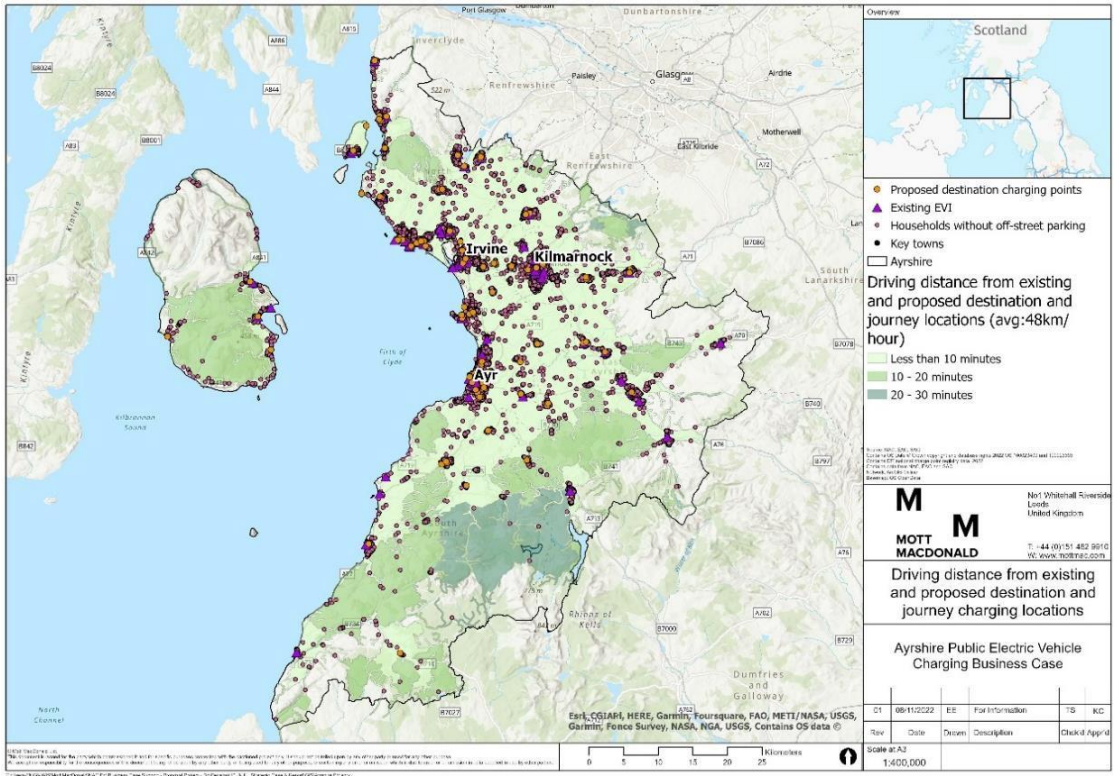
6.5.2 Driving Catchment Analysis

A key objective of the proposed EVCI network across Ayrshire is accessibility for households without access to off-street parking, specifically with 95% of households to be within a ten-minute drive to a destination or rapid charger. In addition, less than 1% of rural households without off-street parking should be beyond a 30-minute drive to a destination or rapid charger.

The driving catchment analysis was undertaken to assess the social value of the network by determining the coverage of the proposed EVCI network across Ayrshire. This analysis was performed to ensure that rural locations have adequate coverage. The assessment derived 10, 20 and 30 minute driving catchments (at 48 km/h) from destination and rapid chargers in the proposed network. Households identified from the analysis as lacking off-street parking were also plotted to assess accessibility to the public charging network from those households likely dependent on it.

The associated results from the analysis are shown in Figure 6.13. The proposed destination and rapid EVCI are shown in orange, with existing EVCI shown as purple triangles. Households without access to off-street parking are also shown across the region.

Figure 6.13: Destination and Rapid EVCI Driving Catchment Analysis



Source: Mott MacDonald

The analysis indicates the proposed EVCI network provides good coverage across the region, with the majority of the region covered within a ten-minute drive of a destination or rapid charger. A breakdown of the driving catchments and households identified without access to off - street parking is summarised in Table 6.29.

Table 6.29: Driving Catchment Analysis

Driving distance from existing and proposed destination and journey EVCI	Households without off-street parking within driving catchment	Proportion
10 minutes (8km)	79,961	99.51%
20 minutes (16km)	352	0.44%
30 minutes (24km)	30	0.04%
Outside driving catchments but within SBC	0	0.00%
Total Households	**80,356**	**100.00%**

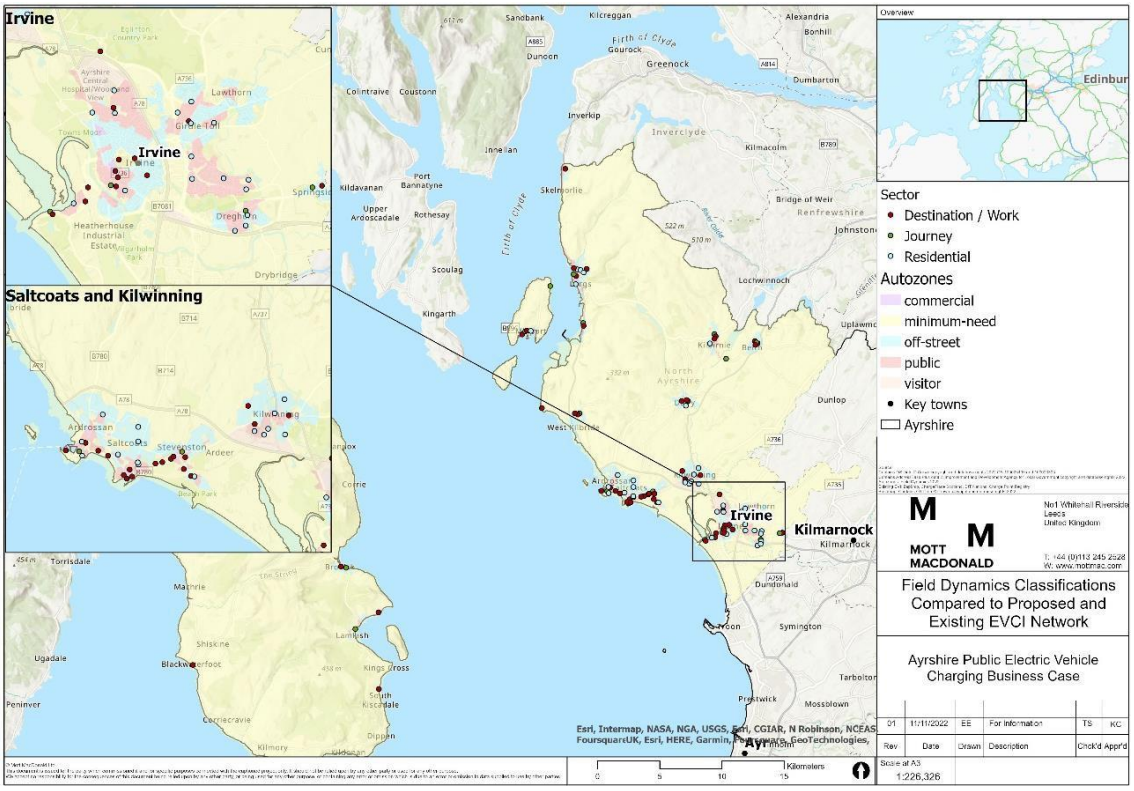
It is evident that 99.5% of the households without access to off-street parking are within a ten-minute drive of destination or rapid chargers from the proposed network. Only 0.5% of households are between a 20- and 30-minute drive to a destination or rapid EVCI, while no households have been identified as beyond a 30-minute drive to a destination or rapid charger.

Aside from the destination and rapid EVCI included within this analysis, additional on-street infrastructure is also proposed as part of the network which will provide local charging opportunities for residents. In addition, no private sector EVCI sites have been identified or shown in the analysis, which will also provide further opportunities for drivers to recharge their vehicles.

6.5.3 Field Dynamics Zonal Analysis – North Ayrshire

In addition to the supporting demand forecasting undertaken by Field Dynamics (commissioned by SFT), analysis was undertaken on the potential zonal areas within Ayrshire where certain types of EVCI could be targeted. The outputs from the analysis were compared with the proposed EVCI network for comparison purposes, as illustrated in Figure 6.14. It must be noted that due to data availability only the proposed network in North Ayrshire was analysed.

Figure 6.14: Field Dynamics Zonal Analysis and Proposed Network in North Ayrshire



Source: Mott MacDonald and Field Dynamics

A breakdown of the Field Dynamics zoning with the types of EVCI proposed are summarised in Table 6.30.

Table 6.30: Comparison between Field Dynamics Analysis and Proposed EVCI Network for North Ayrshire

Field Dynamics Zoning	Residential	Destination/Work	Journey
Commercial	0	6	1
Minimum need	7	44	15
Off-street	14	14	5
Public	17	19	7
Visitor	1	0	0

Source: Mott MacDonald and Field Dynamics

7 The Commercial Case

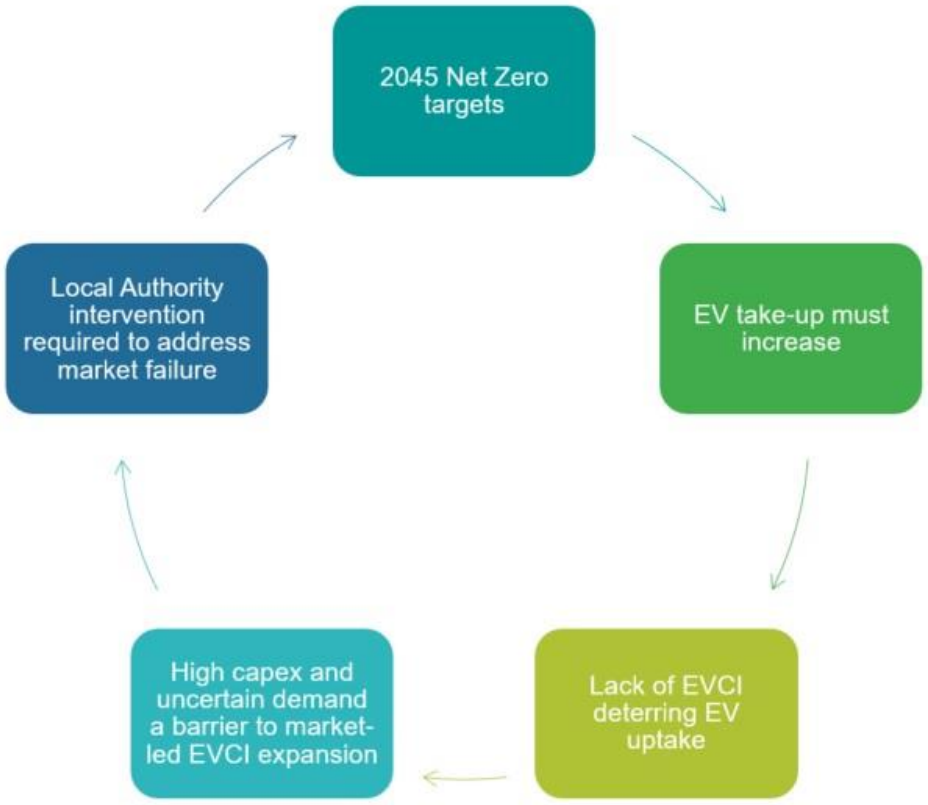
This section explores and assesses different commercial models for the delivery of a public charging network in Ayrshire, and identifies a model which potentially best aligns with the objectives and capabilities of the local authorities in this sector.

7.1 Commercial model objectives

7.1.1 Case for Local Authority Intervention

As set out in the Strategic Case section, there is a strong case for local authority intervention in the UK EVCI market. This is driven primarily by local authority targets to achieve Net Zero by 2045 (for Scotland), with the transition away from internal combustion engine vehicles to electric vehicles being a key component of the strategy to deliver this. However, surveys show that the current lack of charging infrastructure is the main barrier to consumer adoption of EVs, with 43% of respondents citing this as their primary deterrent in a recent Scottish study[24]. At the same time, the combination of potentially high initial investment costs and uncertain user demand present barriers to private sector led expansion of the EVCI network. In order to achieve net zero targets, therefore, local authority intervention is likely to be required to address market failure and stimulate the required expansion of EVCI. This situation is summarised in the following diagram and addressed in the Vision Statement from Section 5, reproduced here.

Figure 7.1: Case for local authority intervention



Source: Mott MacDonald

[24] 'Switched on Towns and Cities Feasibility Study', 2020

It is recognised that the three Ayrshire Councils are already performing a role in the EVCI market to stimulate EV adoption and use by being the provider of some existing public chargers which, historically, have provided free charging. However, as identified in Section 6 above, the current level of market intervention must now increase to help meet Net Zero targets.

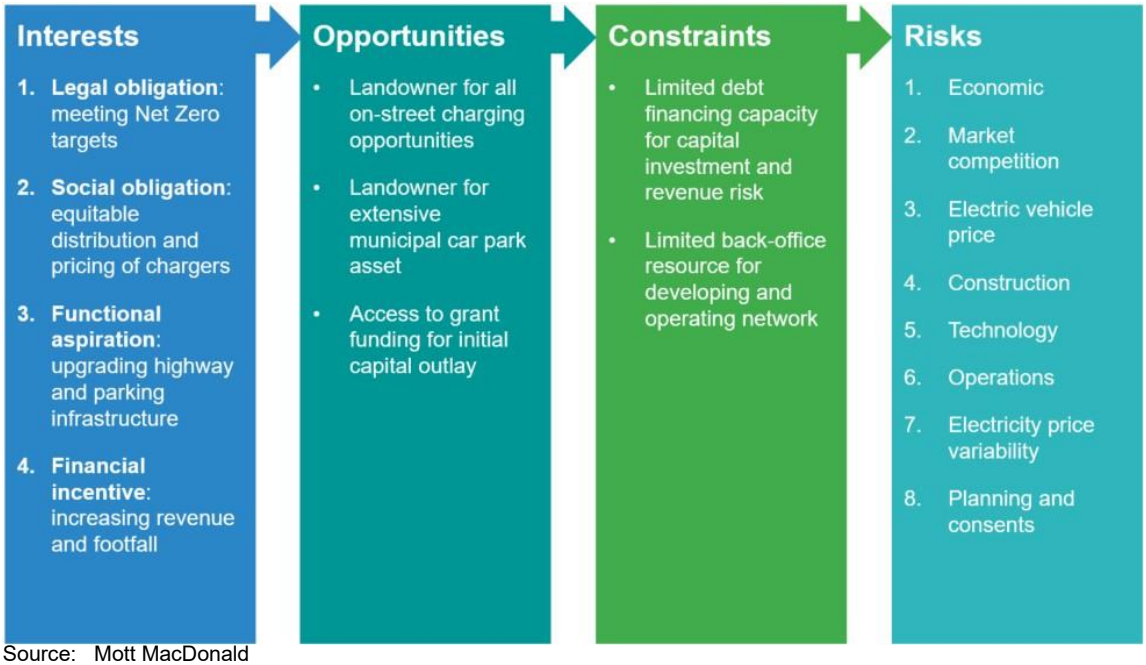
This reality is acknowledged and addressed by the Ayrshire councils EVCI vision statement presented in Section 5.1.1 above and reproduced here:

The further expansion of EVI in Ayrshire will provide a public electric vehicle charging network that works for everyone. It will provide a just transition to Net Zero in 2045, supportingthe Scottish Government objective to provide a fairer, greener future for all where accessibility, availability and reliability is key and where no one is left behind from the positive shift to zero emission transport system – including rural and island communities.

7.1.2 Local Authority Market Position

In considering the most appropriate commercial model for delivering the above vision, it is important to consider the local authorities' position with respect to the EVCI market. This is summarised in the following figure:

Figure 7.2: Local authority EVCI market position



Source: Mott MacDonald

This f igure highlights the following:

- Local authorities have a direct **interest** in supporting and potentially entering the EVCI market, ranging from their legal obligation to deliver net zero and their social obligation to deliver a fair and equitable network, to the best-practice aspiration of upgrading the highway network and the financial incentives of generating a new revenue stream and potentially increasing footfall in town centres etc.
- Local authorities also boast considerable **opportunities** in the EVCI market through being the landowner for all on-street charging options and for considerable off-street parking assets, as well as having access to grant funding sources.

- On the other hand, local authorities are also subject to greater borrowing **constraints** than the private sector, which can limit their potential to service capital and revenue risk and to operate, while resourcing constraints can limit their capacity for operating an EVCI network.
- Local authorities also face some significant **risks** in entering the developing EVCI market due to a range of uncertainties. Local authorities may be less well-placed to manage some of these risks compared with other organisations. The above risk categories are expanded in the following table:

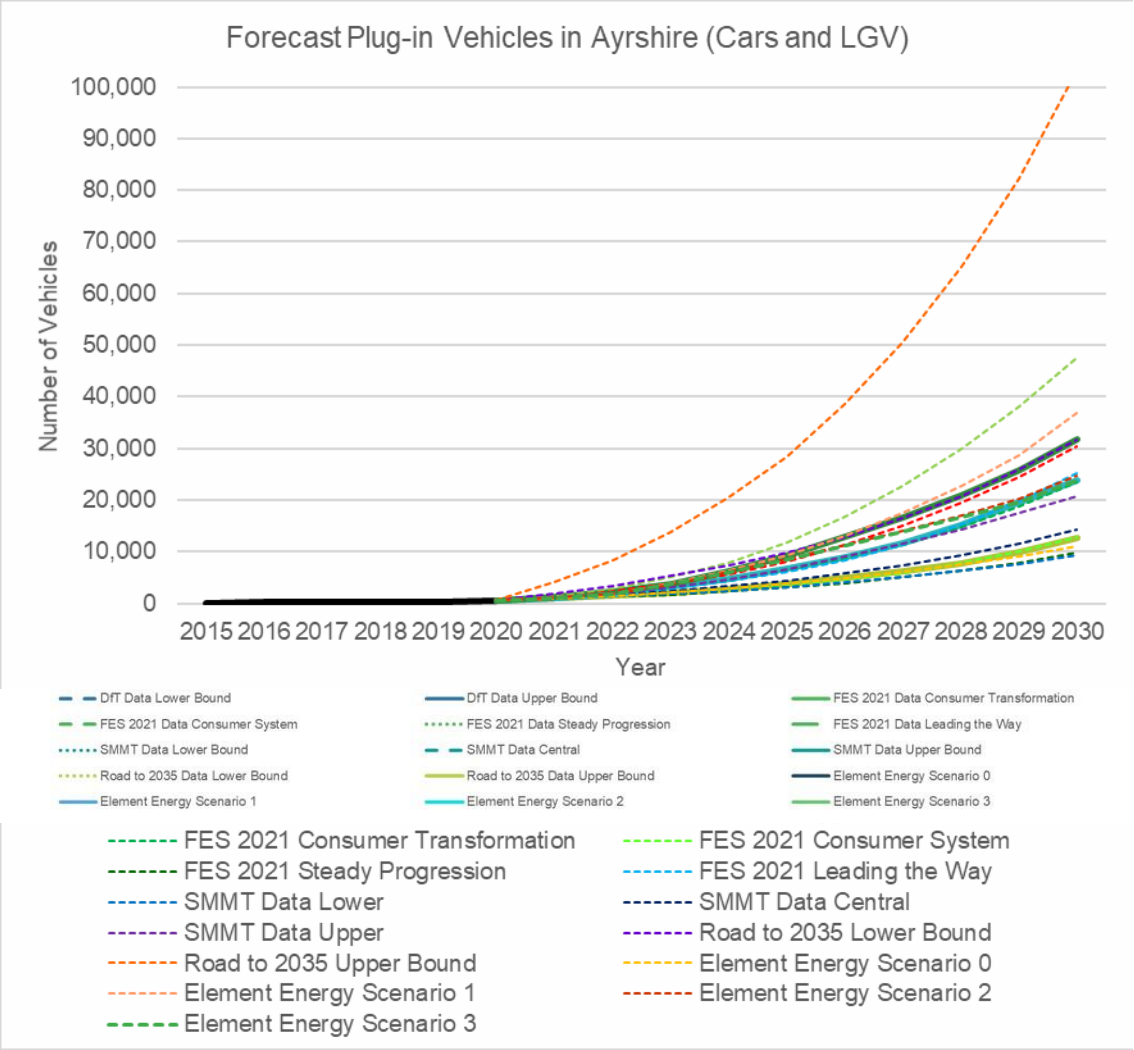
Table 7.1: Examples of delivery and operating risks in EVCI market

Risk	Examples	Impact
Economic	• Population impacts • GDP Forecast • Inflation • Hybrid working • Cost of living crisis	High
Market competition	• Private sector charge points • Home charging facilities • Behavioural change	High
Electric Vehicle price	• Pricing the vehicles out of the market	High
Construction	• Construction inflation • Material cost • Practical obstructions • Availability of equipment	High
Technology	• Obsolescence of assets	High
Operating	• Availability of Electricity supply • Equipment failure/damage • Maintenance availability/spare part availability	Medium
Electricity Price change	• Pricing the supply out of the market	Medium
Planning & Consent	• Additional requirement for planning • Development costs • Advisory costs	Low

Source: Mott MacDonald

This latter aspect of commercial risk is particularly relevant to the EVCI market as there is currently significant uncertainty around the uptake of EVs and the charging preferences of future users. The following chart highlights the demand risk by collating a number of different estimates on future EV levels in Ayrshire and showing the significant variation between them.

Figure 7.3: EV adoption projection estimates



Source: Mott MacDonald

Further detail on the EV forecasting undertaken is specified in Appendix E.

7.1.3 Commercial Model Objectives

Based on the above review of the local authorities' position with respect to the EVCI market, the following seven objectives are proposed for identifying a preferred ECVI expansion commercial model for Ayrshire councils.

Table 7.2: Commercial model objectives

Objective	Description
Affordability	Ensuring that a scheme's public sector capital investment demand falls within local authority capital access limits
Social outcomes	Allowing the local authority a level of control to ensure the equitable distribution and pricing of chargepoints
Risk allocation	Ensuring that scheme risks are allocated to parties best placed to manage them and able to offset against scheme reward
Contestability	Stimulating a competitive market that avoids private sector monopoly conditions or public sector over-regulation

Objective	Description
Procurement	Preference for models which can be procured through standard channels to reduce implementation time and resource
Resources	Preference for models which can be delivered within the constraints of local authority back office resourcing
Revenue	Preference for models which can increase net revenue stream to local authority

Source: Mott MacDonald

The potential commercial models outlined below are assessed against these stated objectives.

7.2 EVCI market landscape

7.2.1 Market Segmentation

The EV charging network is multi-dimensional in terms of charger types, locations and ownerships, so it is important to identify which areas of the market are most likely to suit local authority intervention.

In Section 6 above, demand for three charger types are considered:

- Slow chargers, most likely to be installed for domestic purposes where overnight charging most commonly takes place.
- Fast chargers, more likely to be installed at destination locations, like workplaces and retail car parks, where dwell times are likely to be shorter.
- Rapid chargers, installed either at destination locations or at service stations to allow for in-journey charging.

For the purpose of this segmentation assessment and building on the above types, the following charger typologies have been further defined:

- **Residential**
  - For overnight charging at home
  - Typically slow chargers
- **Destination**
  - For charging at trip destinations
  - Typically fast / rapid chargers
- **Transit**
  - For charging mid-trip
  - Typically rapid / ultra rapid chargers

Table 7.3 summarises how these typologies tend to be distributed by public and private sector land ownership.

Table 7.3: Chargepoint typology distribution by sector

Sector	Residential Chargepoints	Destination/Transit Chargepoints
Private sector	• Off-street parking – c.56% of EAC households – c.53% of NAC households – c.64% of SAC households	• Private off-street car parks – Public car parks – Work places – Supermarkets – Gyms / cinemas etc • Service stations
Public sector	• On-street parking – c.44% of EAC households – c.47% of NAC households – c.36% of SAC households	• On-street parking bays • Council-owned public car parks – Public car parks, libraries etc • Council-owned workplace parking – Council offices, schools etc • Taxi ranks

Source: Mott MacDonald

This table highlights that local authorities have ready access to the EVCI market in the following three sectors:

- **On-street residential chargepoints**, for houses without off-street parking. Across the three Ayrshire council areas, this ranges between about a third to half of all households that would rely on on-street chargepoints for residential charging. In practice, not all households without off-street parking would need frequent on-street charging with many users being able to rely on destination chargers only. Households without off-street parking are also more likely to be in lower socio-economic groups, so the expansion of the EVCI network into these areas fits with all three Councils' objectives to increase network equity.
- **Council-owned public and workplace car parks**. These can amount to considerable assets across a local authority's portfolio where EV users are likely to park for extended stays. The addition of chargepoints in public car parks can also increase usage of the facility, while workplace car parks host a captive market with long dwell times and assist in encouraging council staff to adopt EVs. The risk with these destination chargepoint locations is competition from nearby private-sector destination chargepoints, so location choice would need to take that into account.
- **On-street destination chargers**. Local authorities control a ready supply of on-street parking bays in urban centres which could be equipped with chargepoints. Typically, on-street bays cater for shorter stay parking than off-street bays, so these could potentially offer fast or even rapid charging. A benefit of this provision could be increased attraction to town centres and increased dwell times while vehicles charge.

Based on this market segmentation assessment, it is therefore recommended that local authorities focus their interventions in these three market areas.

7.2.2 EVCI Components

Just as the EVCI market is comprised of different segments, the installation and operation of an EVCI network is also comprised of different components, all of which need to be considered by the commercial model. The main components are summarised in the following figure.

Figure 7.4: EVCI components

Source: Mott MacDonald

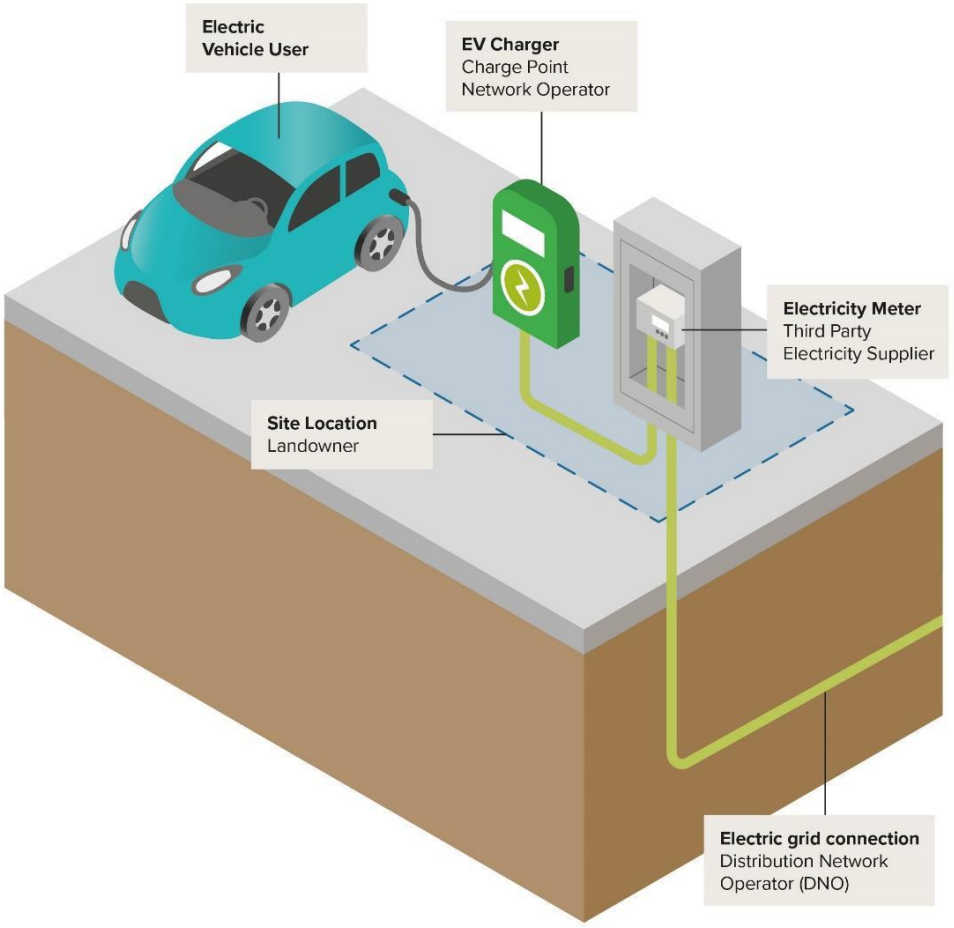
This shows that the infrastructure itself is comprised of two relatively independent components:

- **The underground connection** – this provides the power supply from the grid to the chargepoint. It is a one-off expense, but can be a relatively high cost and subject to variability depending on distance to the grid etc. However, from March 2023[25], that variability will be reduced by the Distribution Network Operator (DNO) bearing the cost of any network upgrades required to support new chargepoint demands, e.g. by upgrading substations etc. The cost of the connection to the network will still be the responsibility of the applicant.
- **The above-ground chargepoint** – this provides the interface between the power supply and the EV user. Chargepoints are consumable items, being much more subject to wear and tear than the underground connection and also to technical obsolescence as standards and technology changes over time. Conversely, the cost of a chargepoint is lower than the underground connection and much less subject to uncertainty.

The infrastructure components and their typical ownership are summarised in the figure below.

[25] Access and Forward-Looking Charges Significant Code Review: Decisionand Direction | Ofgem

Figure 7.5: Chargepoint infrastructure components and typical ownership



Source: Mott MacDonald

7.3 Commercial Model Options

As noted in Figure 7.4 above, the EVCI network the local authority chooses to implement will generate capital and operating costs as well as operating revenue. The commercial model determines how these costs and revenues are distributed across public and private sector parties.

On that basis, there are a minimum of three potential commercial models to consider, as follows:

- Fully private-sector-led model
- Fully public-sector-led model, and
- Some form of public-private partnership hybrid.

In the following table, we identify four main commercial models to consider, which include the first two of the above models plus two types of hybrid models.

Table 7.4: Commercial model options

	A – Privately owned and operated	B – Privately operated only	C – Privately operated with risk share	D – Public sector owned and operated
Approach	Private sector ownership and operation of network	Public sector ownership with private sector operation	Public sector ownership with private sector shared-risk/revenue operation	Public sector ownership and operation of network
Existing and new EVCI asset ownership	Private	Public (concession model)	Public (concession model)	Public
Loss making assets	Bundled with profit-making assets	Bundled with profit-making assets	Bundled with profit-making assets	Public
Operator	Private	Private	Private	Public
Risk to LA	No	No	Yes	Yes
Revenue stream to LA	No	No	Yes	Yes
Tariff setting	Private	Private / Public	Private / Public	Public

Source: Mott MacDonald

Some initial observations from this table are as follows:

- Model A assumes that the private sector would own and operate all existing and new assets, giving them greatest control over tariff setting and charger locations.
- Model D assumes that the public sector would own and operate all existing and new assets, giving them full control over tariff setting and charger locations.
- Model B assumes that the public sector would ultimately own all existing and new assets, but that the network would be leased via a concession model to a private sector operator who receives all revenue but assumes all asset and operating risk.
- Model C is the same as Model B, except that the public sector also enters into a risk and revenue sharing agreement with the operator (as part of the terms of the concession), receiving a level of income for assuming a level of operating risk.

Further details and examples of each model are provided in the following subsections, with a comparative assessment of the models undertaken in the next section.

7.3.1 A – Privately Owned and Operated Model

Description	Pros	Cons
Full market-led network, with private sector funding, owning, operating and maintaining all existing and new EVCI assets. Operator collects all revenue and assumes all commercial risk. Long concessions required to cover high initial capex, and local authority retains little control over either charger locations or tariff level. Private sector retains control of below-ground asset beyond commission lifespan, unless specified in contract.	• No capital or revenue risk to local authority • Minimal local authority resource commitment	• Little local authority control over charger location or tariff • No revenue to local authority • Potential contestability issues over longer term • Potentially unviable to private sector

Example:

- *Local Authority:* Mid-Devon
- *Type of contract:* Supplier fully funded and owned installation
- *Revenue:* Local authority received small rental income as landowner
- *Contract length:* 20-year lease agreement

7.3.2 B – Privately Operated Only Model

Description	Pros	Cons
Local authority ownership of all EVCI assets with private sector operation of network. Assets funded through combination of private sector concessionaire investment and grant subsidy. Operator collects all revenue and assumes all commercial risk. Long concessions required to recover high initial investment, Local authority retains full control over charger location and partial control over tariff level.	• Greater LA control over charger specification, location and tariff • No capital or revenue risk to local authority • Low local authority resource commitment • Likely viability to private sector	• No revenue share for local authority

Example:

- *Local Authority*: Hampshire County Council
- *Type of contract*: Based on combination of grant and private funding
- *Revenue*: Revenue to supplier, except for 1% standing charge to Council
- *Contract length*: Up to 15 years

7.3.3 C – Privately Operated with Risk Share

Description	Pros	Cons
As Model B, but local authority also take share of revenue in exchange for share of risk.	• Greater LA control over charger location and tariff • No capital risk to local authority • Potential revenue stream to local authority	• Local authority exposed to commercial risk, which could exceed revenue gain • Higher resource commitment than models A and B • Potentially unviable to private sector

Example:

- *Local Authority*: Oxford
- *Type of contract:* Concession agreement covering on-street charge points funded by Go Ultra Low Cities Scheme grant
- *Revenue:* Most to supplier with a revenue share to the council once chargepoints are profitable
- *Contract length:* Sites leased to operators for 4 + 4 years

7.3.4 D – Public Sector Owned and Operated Model

Description	Pros	Cons
Fully local authority funded, owned, operated and maintained network, with public sector funding all infrastructure installation, collecting all revenue and assuming all commercial risk. Local authority retains full control over charger location and over tariff level.	• Full local authority control over charger location and tariff • Full revenue stream income	• Upfront capex for full asset base • Full resource commitment on local authority • Full CAPEX and OPEX risk • Required grant subsidy or borrowing levels potentially unavailable to local authority

Example:

- *Local Authority:* West of England
- *Type of contract:* Own and operate model, funded by Go Ultra Low Cities funding with maintenance carried out by chargepoint supplier
- *Revenue:* All revenue goes to the local authorities
- *Contract length:* 5 years

7.4 Commercial Model Assessment

In this section, we assess the above four commercial models by scoring them against the objectives defined above (see Table 7.2).

7.4.1 Assessment Parameters

For all objectives, each model has been qualitatively scored on a scale of 0 to 3. The following table provides examples of what, in each case, constitutes a low score and a high score, and also suggests a weighting against each objective from 1 to 3.

Objective	Low score example	High score example	Suggested weighting
Affordability	Models which maximise capital investment burden to local authority, e.g. model D	Models which minimise capital investment burden to local authority, e.g. model A	3
Social outcomes	Models which release chargepoint location and pricing control to private sector, e.g. model A	Models which retain chargepoint location and pricing control with public sector, e.g. model D	3
Risk allocation	Models which assign high-resource / high-reward risks to public sector, e.g. model D	Models which assign high-resource / high-reward risks to private sector, e.g. model A	3
Contestability	Models which grant long-term full infrastructure ownership to either sector, e.g. models A or D	Models which limit competition enhancing assets to private sector, e.g. model B	2
Procurement	Models with greatest level of public-private partnership, e.g. model C	Models with least level of public-private partnership, e.g. models A or D	1
Resources	Models requiring greatest local authority back-office resource commitment, e.g. model D	Models requiring least local authority back-office resource commitment, e.g. model A	1
Revenue	Models least likely to return a long-term profit to the local authority, e.g. model A	Models most likely to return a long-term profit to the local authority, e.g. model D	1

Source: Mott MacDonald

The suggested weighting values reflect the following local authority priorities:

- Affordability, social outcomes and risk allocation are given the highest weightings because the model:
  - Must be affordable to the Council
  - Must meet the Councils' vision of providing a fair and equitable network, and
  - Should not expose the Council to unmitigated risk.
- Contestability, procurement, resources and revenue are given lower weightings as, though these are important objectives, they are of a lower priority.

7.4.2 Assessment Scoring

Based on the above scoring parameters, the following table presents a high-level scoring assessment of the four commercial models against the objectives.

Table 7.5: Commercial model scoring – weighted results

Objective	A – Privately owned and operated	B – Privately operated only	C – Privately operated with risk share	D – Public sector owned and operated
Affordability	3	2	2	1
Social outcomes	1	3	3	3
Risk allocation	3	3	2	1
Contestability	1	3	3	2
Procurement	2	2	1	3
Resources	3	3	2	1
Revenue	1	1	2	3
Weighted avg score	**2.07**	**2.57**	**2.29**	**1.86**
Normalised score	**0.81**	**1.00**	**0.89**	**0.72**

Source: Mott MacDonald

The following observations can be drawn from these assessment results:

- Model D scores lowest, for though it would give the local authority maximum control over the implementation and operation of EVCI network and would potentially maximise revenue, it would also fully expose the authority to the significant commercial uncertainties of this emerging market, while requiring a level of capital investment and back-office resource commitment that many authorities are not best placed to generate and sustain.
- Model A scores second lowest. The fully market led approach is better placed to effectively handle market uncertainties and while shielding the local authority from commercial risk, but the downside is that it is also less likely to deliver a socially equitable network (as loss making locations would be unlikely to proceed) and while the considerable up-front investment could also prove commercially unviable to the private sector. Private ownership of the underground connections would also potentially reduce the long-term contestability and adaptability of the network.
- The two hybrid models provide an opportunity to combine the respective strengths of models A and D, with the combination provided by model B – 'privately operated only' – resulting in the highest score. This model retains local authority ownership of all assets with no exposure to capital risks, which are covered by a combination of private sector concessionaire investment and grant subsidy. This gives the public sector control over chargepoint specifications, locations and, to some degree, tariffs, while allowing the private sector to handle all commercial risks in return for collecting all revenue. Model C is similar but with revenue share to the local authority, but this is in exchange for exposure to financial downside risks which could potentially outweigh revenue gains if realised (and which local authorities may be less well placed to manage than EV charging organisations who have greater capability to forecast future demand). This model therefore scores lower than Model B.

Overall, based on this assessment, Model B is recommended for further consideration as the preferred commercial model to support local authority intervention into the EVCI market for the three Ayrshire Councils, working together. However, it should be noted that all commercial models are likely to be viable and have been implemented by local authorities in other parts of the UK. The degree to which a local authority wishes to take on revenue risk is a key consideration; some authorities may feel better placed to adopt this than others. It is worth

noting, however, that while local authorities take on demand risks that have some similarity to EV charging (for example by owning and operating car parks), these revenue streams are often more proven and dependable than the EV charging market is at present.

For reference, the unweighted assessment results in the same ranking of models.

7.5 Procurement Considerations

Local authorities can procure EV charging infrastructure through one of two approaches:

- A bespoke contract award process under public procurement rules, or
- Through via a framework or dynamic purchasing system (DPS).

While the first option allows the local authority maximum flexibility in setting the terms of the contract, frameworks and DPSs provide a proven off-the-shelf procurement route which can reduce the work and risk involved in the process.

The contract value indicated by Section 8 below (<£5m) suggests that the procurement of a public EVCI network for Ayrshire would need to be carried out under the Procurement Reform (Scotland) Act 2014 (2014 Act).

Schedule 2 of the Burness Paull document, 'Expanding the EV Charging Network: Procurement Options for Local Authorities', includes a list of available frameworks which could be applicable for delivering the above recommended Commercial Model B. Of these options, the document states that:

> *'The CCS's DPS is the broadest, being designed toallow buyers to "purchase a full end-to-end solution or specific elements to support the transition to low emission vehicles.", giving Local Authorities flexibility in determining their specification. This includes both buyer funded and supplier funded options.'*

Model B would include both grant and supplier funding options.

The document also recommends that, in advance of the procurement process, local authorities should consider matters such as the following:

- How many chargepoints do they think they will need?
- Are current chargepoints to be included?
- To what, if any, extent, are new chargepoints expected to be sited on local authority owned or leased land?
- Will this include charging hubs in town or city centres or regular on-street parking bays with chargers?
- How many miles should drivers be from the nearest chargepoint?
- What should the user interface that drivers engage with look like?
- Should they pay at the chargepoint, online or via an app, or using an account or subscription service?
- Will networks vary from town to town or area to area, or be standardised across a Local Authority's area, or even in collaboration with other local authorities?
- Who will engage with (and pay) utility providers and Distribution Network Operators as between the local authority and the successful contractor?

Many of these matters are addressed by above sections of this document, while others would need further discussion with private operators.

Lastly, the use of Prior Information Notices (PINs) is recommended in advance of an EVCI procurement process. This can replace the need for a contract notice or shorten the period for

responses to a contract notice, but it also gives local authorities a means of testing market interest in the proposed contract. Given the uncertainties involved in the value of the preferred commercial model to the market, this initial period of market testing would allow the Council to refine or adjust the proposed contract before formal issue.

One f inal issue that Ayrshire Councils will wish to consider is how far they seek to coordinate procurement of EVCI. This could take place under a contractual structure or a special purpose vehicle where two or more of the authorities came together to jointly procure EVCI across the whole of their areas. There are precedents for joint procurement between Ayrshire authorities (e.g. Ayrshire Roads Alliance across East and South Ayrshire) as well as across multiple authorities elsewhere in the UK. Relevant considerations would include:

- If a contract structure, clarity over risk allocation between each local authority (e.g. in relation to share of payments out or revenue received)
- If an SPV, level of investment (equity participation) in the SPV by each authority
- If an SPV, rules over distributions from the SPV to its owners
- If an SPV access to finance in downside scenarios

The Management Case begins this process (see Section 9.2) through suggesting a Inter-Entity Agreement for the next stage of work (prior to procuring commercial suppliers to install and operate the EVCI).

7.6 Summary

This section explores and assesses different commercial models for the delivery of a public charging network for Ayrshire Councils and identifies a model which potentially best aligns with the objectives and capabilities of the local authorities in this sector, and with the project vision.

Local authorities have an interest in intervening in the EVCI market, both in order to promote EV uptake towards Net Zero targets and to ensure a socially equitable network. They also have a number of strengths to bring to the market, such as being highway authority and car parking provider, and with access to grant funding opportunities. However, it is also recognised that local authorities are not as well placed as the private sector for borrowing capital and responding to the significant delivery and operating uncertainties associated with this emerging market. Four commercial models have therefore been considered in response to these factors as follows:

- Model A – Private sector ownership and operation of the network
- Model B – Public sector ownership with private sector operation
- Model C – Public sector ownership with private sector operation and risk/revenue share
- Model D – Public sector ownership and operation of the network

Each model has been assessed against key criteria including affordability, risk allocation, social outcomes, contestability, procurement, resources and revenue. Based on this assessment, Model B is recommended for further consideration as the preferred commercial model to support local authority intervention into the EVCI market, for the three Ayrshire Councils. However, it is noted that other models are also potentially suitable, dependent on each local authority's access to capital and their risk appetite. A final consideration – which will need to be guided by each authority – is how far each Ayrshire authority wishes to procure EVCI on its own vs. working together with one or more of the other Ayrshire authorities. This is already under consideration (see Commercial and Management Cases) and it is likely that the three Councils will work together.

8 The Financial Case

8.1 Funding Sources

The objective of the Financial Case is to identify the financial requirement to bring about the wider benefits outlined in the Strategic and Economic Cases. Whilst benefits can be used in the Economic Case to offset costs to produce a Net Present Value, the actual cost of delivery must be accounted for. This section of the Financial Case sets out the sources of funding available to Ayrshire Councils.

As outlined in the Commercial Case, Model B (public sector ownership with private sector operation through a concession model) is recommended. Using this model, there are three sources of funding used to mobilise the construction phase of the EVCI; Grant Funding from the Scottish Government, Private Sector investment, and Operational Cashflow available for funding generated from charge point usage, which is available after year one.

Private sector funding is key to this business case as the Grant money from the Scottish Government is unlikely to provide the far-reaching implementation of charge points that the strategic and economic cases outline. With private investment the infrastructure requirements can be met, and thus meet the objectives of the Scottish Government, SFT and the three Ayrshire Councils. It is therefore important to present this investment opportunity in a way that is attractive to private investors, ensuring that there is a suitable return on the investment, that mitigates risks in an emerging market. Based on initial discussion with private sector suppliers, we expect the opportunity put forward by Ayrshire will be of interest, though further market engagement is recommended prior to procurement.

The quantities and profile of spending by funding source are all set out in the next chapter of this Financial Case.

8.2 Financial Viability of Service / Concession Type Contracts

All figures and charts have been calculated using the 'SFT EVI Feasibility Model v3.0 20220901', referenced henceforth as the 'SFT Feasibility Model', spreadsheet model provided[26]. All inputs have been discussed with colleagues at SFT and are deemed appropriate for this analysis, and consistent with the approach they expect to see in all model applications.

The Management Case suggests an approach whereby all three Ayrshire Councils collaborate in the management and delivery of the EVI programme set out in this business case document. Therefore, this Financial Case refers to 'Ayrshire' as a whole, covering all three Councils working together.

The results of the SFT Feasibility Model is largely driven by two kinds of key input; the technical inputs, which comprises of the Asset Register discussed in Section 5.3, and the financial inputs, which are made up of local, regional and national figures, optimised to provide the best reflection of the circumstances of each scenario. The SFT Feasibility Model assumes a commercial model where a private sector operator will assume control of all assets for the length of the operating period, this is Model B as described in the Commercial Case. All income and costs will be the responsibility of the operator, minus a nominal £50k per annum amount for the council to manage the concession. There is an assumed Internal Rate of Return (IRR) values of 17.5%. At the end of the concession, all assets will be transferred back to the council, which will include some assets with remaining residual value. SFT's Feasibility Model is a tool to

[26] SFT Feasibility Model provided by Scottish Futures Trust (SFT) foruse on all Pathfinderprojects.

identify the public funding applied for, and does not include wider costs such as procurement costs.

Taking into account all incomes, minus all operating costs, the private operator invests the maximum amount that would still enable them to achieve the IRR target of 17.5%. Any operational cashflow that can be invested will be used throughout the construction phase. The remaining balance is the Capital requirement that this application is seeking to secure. The breakdown of funding requirement is presented in the table below.

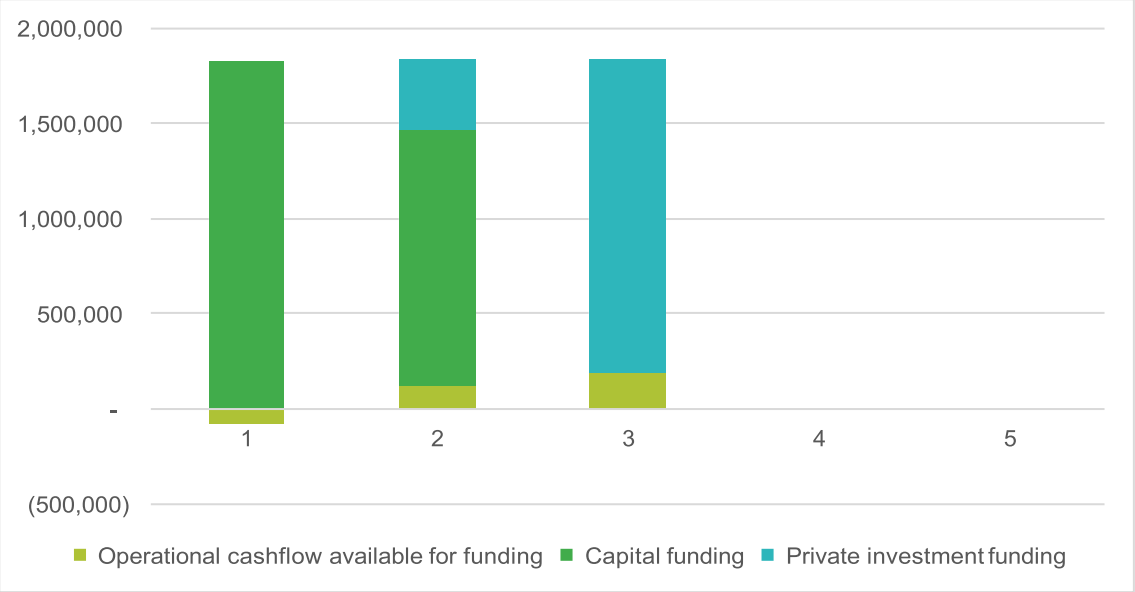
Table 8.1: Funding sources

Funding Source	Value £, 2022 prices
Capital funding	£ 3,200,000
Private investment	£ 2,000,000
Operational cashflow available for funding	£ 200,000
Total upfront Investment requirement	**£ 5,400,000**

Source: Mott MacDonald

The profile of capital spend in the construction period is shown in Figure 8.1.

Figure 8.1: Time profile of funding sources



Source: Mott MacDonald

Across the three Ayrshire Councils' portfolio, utilisation percentage is at 3.0% of total capacity which leads to a limited income. This means that the maximum amount an operator is likely to contribute only accounts for 37% of the overall cost. The capital funding requirement in this scenario is approximately 59% of the total upfront capital cost.

Management costs plus costs for transferring the existing assets to the new operator result in a small operating loss in year one which must be offset. After year one the new assets generate income above costs which can be used to pay the remaining capital.

8.2.1 Links to the Commercial Model

In Chapter 7 four commercial models have been outlined, along with the benefits and disbenefits that each would bring. The assumptions in the analysis above use commercial

Model B, however, using the SFT Feasibility Model, the other commercial models can be illustrated to demonstrate the effect of the other commercial models on the finances. Given the high-level nature of the SFT Feasibility model, the table below does not include absolute values. Instead, it uses a Red-Amber-Green (RAG) scale to indicate where costs or revenue are likely to be higher in each case.

Table 8.2: Commercial model comparison RAG analysis

		Model A	Model B	Model C	Model D
Costs	Asset Capital Cost				
	Electric, Maintenance and Connection Costs				
	Management and Operations				
	Revenue Share	None	None		None
	Total Costs				
Income	Capital funding	None			
	Tariff Revenue				
	Project Income				
Results	**Operator Net Margin**				
	Operator IRR				
	Council Net Margin	None	None		

Source: Mott MacDonald

8.2.1.1 Model A comparison

Model A is privately operated and owned and therefore is efficient in terms of costs, but there is no capital funding to pump-prime the market, which ultimately leads to lower income (indicated by the red cell). This would lead to a lower overall margin, and a lower rate on return (red cells). In model A, Ayrshire Councils would not receive any contribution, thus the Councils' net margin is none.

8.2.1.2 Model B comparison

Model B is the recommended approach from the Commercial Case, and is how the SFT Feasibility model is set up. Costs are taken on by the operator, without any revenue share to the council and therefore are efficient. The income received includes the grant from Transport Scotland to pump prime the market, and therefore the maximum income is generated. The operator margin and return are consequently maximised as all earnings, as well as responsibility for risk mitigation, are retained by the operator.

8.2.1.3 Model C comparison

Model C is much like Model B, however it includes an additional cost to the operator in the form of revenue share. This increased cost, (indicated by the yellow cell) leads to higher overall costs and therefore a reduction in the operator margin and return. The councils however make a small

margin from the revenue share, but would be liable to demand or supply risks should they occur.

8.2.1.4 Model D comparison

The councils own and operate the assets themselves. The construction cost of the assets, and the cost of operating the assets would be the same as for the private sector, but it is likely that management and other operating costs would be significantly higher for the councils as there is not the same level of expertise in the councils as an operator. This drives up the project costs significantly and results in a much lower return and margin. The councils would receive all profits, however, the investment is not likely to be very profitable, and should any of the supply or demand risks materialise, the councils would be fully liable, and the margin would need to be used to mitigate those risks.

The RAG analysis shows that model B gives the best outcome for the private operator, and does not expose the Ayrshire councils to any supply or demand risks.

8.3 SFT Recommended Values

In order to apply consistency across funding applications SFT have provided a list of recommended values to use in the SFT Feasibility Model. Whilst these values represent a benchmark, they are often high level, and non-geography specific. Given the rural nature of the Ayrshire councils, coupled with provision to Arran, the costs are usually higher than the given value. These figures have been discussed with SFT representatives.

The table below has each of the SFT recommended values alongside the Ayrshire specific value. A justification is provided where there is a difference in values.

Table 8.3: Model input values

Cost Heading	SFT Value	Modelled Value	Reason for Difference	Background Information
Tariffs (excluding VAT)	Project Specific	AC: £0.50/kWh DC: £0.60/kWh		Based on local assessment of a market rate for comparable services and forecast electric costs in 2023 and 2024.
Contract Length	Project Specific	20 years		Concession/service type contracts are expected to be in the range of 15 to 20 years.
Electricity Utilisation Yr 1	Project Specific	1,410, 428 kWh		Recent ChargePlace Scotland data
Electricity Utilisation Growth	5%	5%		This may vary based on local EV uptake, 3rd party supply of infrastructure nearby and their tariffs.
Electricity Rate Year 1	24p/kWh	24p/kWh		Current local authority estimate is around. Source: Contract Notice #52 Price Risk Guidance July 2022
Electricity Rate Real Price Inflation	Flat lined	Flat lined		Assumes changes in electric rate are passed on to the consumer in future contracts
EVCP Transaction Costs	**7kW** - £146/yr **22kW** - £146/yr **50kW** - £365/yr	**AC** - £81 **DC** - £326	Based on the maximum observed values in North Ayrshire. These have been applied to the whole region.	Transaction costs associated with charging sessions. Examples include back-office costs, merchant fees etc.

Cost Heading	SFT Value	Modelled Value	Reason for Difference	Background Information
EVCP Planned Maintenance Costs	**7kW** - £400/yr **22kW** - £400/yr **50kW -** £1,800/yr	**AC** - £727 **DC** - £1,132	Maintenance costs provided by councils, with an allowance added for unforeseen maintenance costs.	This includes service visits, bay cleaning, wear and tear.
EVCP Annual Capacity Charges	Project Specific	£13,000	Based on Ayrshire Athletics Arena, East George Street and Queen Street. Additional capacity charge estimated based on proposed hubs at Ardrossan Harbour and Largs Seafront Car Park.	To be include in row 76 of the "Fin Input" of the financial model along with other ad-hoc annual costs. Authorities to provide a breakdown of what costs they are including in row 76 of the "Fin Input" tab.
EVCP Capital Enabling Costs (ex VAT)	**7kW AC** - £2,200 **22kW AC** - £2,200 **50kW DC** - £4,000	**Residential 7kW** - £2,120 **7kW AC** - £2,120 **22kW AC** - £2,161 **50kW DC** - £6,430	General civil works cost (£330 - £1,000) plus risk share, preliminaries and overheads.	Assumed to include costs with acquiring and preparing the site such as forming new car parking bays and landscaping
EVCP Capital EVI + Installation Costs (ex VAT)	**7kW AC** - £5,650 **22kW AC** - £6,000 **50kW DC** - £33,400	**Residential 7kW** - £6,460 **7kW AC** - £6,460 **22kW AC** - £6,749 **50kW DC** - £40,330	Based on previously supplied quotes for EVCI and install, with remaining risk share.	The costs relating to the purchase, installation, and commissioning of EV infrastructure. Source, EST Draft Electric Vehicle Infrastructure Guide (EVIG) plus c.7.5% for inflation.
EVCP "standard" DNO costs (ex VAT)	**7kW AC** - £2,000 **22kW AC** - £2,000 **50kW DC** - £4,000	**7kW AC -** £682 to £3,682 **22kW AC** – £5,000 to £27,000 **50kW DC -** £9,773 to £52,773	Range of sample quotes provided by the Councils. DNO costs vary depending on location classification (urban, rural and islands).	Non-material "standard" DNO connection costs
Material DNO costs	Project Specific	£1,072,308		To be itemised separately in the financial model. Ensure there is no double count with Capital Cost Contingency allowances.
Capital Cost Contingency	Project Specific	15%		On the assumption that no one-off cost allowances have been added to account risk, suggest applying a contingency of 15%. Where quotes are available and the scope of works well defined this could be reduced.
Exiting Asset Transfer Costs	Project Specific	£20,000		Where existing assets are transferred into a concession, assume a reasonable capital cost allowance for refreshing such assets to enable a similar level of functionality of the new assets to be provided.
EVCP Useful Asset Life	Project Specific	10 years		A range of 8 to 10 years depending on technology adopted Model with one major asset refresh midlife.
EVCP Replacement Costs	100%	100%		Assume that cost of replacing the EVI at its end-of-life mid-way through the concession is equal to the initial installation costs. The financial model will

Cost Heading	SFT Value	Modelled Value	Reason for Difference	Background Information
				index such costs to the year in which they are incurred.
Inflation - OPEX	2.5%	2.5%		Whilst current rates of inflation are considerably higher, the assumption is that general inflation over the course of the concession period will on average be in line with Government targets.
Target Equity IRR	17.5%	17.5%		This an assumed rate for assessing the level of capital subsidy. How actual projects are financed, and the cost of finance will vary for project to project.

Source: Mott MacDonald

8.4 Summary

The total capital costs required for funding are approximately £5,400,000. This will be met through private sector investment, grant funding from the Scottish Government and through operational cashflow. By maximising private sector investment, whilst ensuring an attractive rate of return, the grant requirement is optimised to approximately £3,200,000.

In choosing commercial Model B, all future revenues, risks and costs are to be the responsibility of the private sector, and therefore there is no further financial burden on the Ayrshire Councils. As in the Commercial Case, on the basis that:

- EVCI is a relatively early stage technology and future demand uncertain,
- It has significant development and operational complexity, and
- The three Ayrshire Councils, like other local authorities in Scotland, operate under tight capital constraints

Commercial Model B is therefore recommended to progress the EVCI scheme by Ayrshire Councils.

Further study is required to set out the exact details of the concession agreement between public and private parties and to better understand the market attractiveness of this investment.

9 The Management Case

9.1 Introduction

The EVI included within this business case takes the 173 existing publicly-funded and managed EVCP in North, East and South Ayrshire, and combines it with a plan for 426 additional EVCP (complete with land and connections), predicted to be required to cover increasing demand to 2025 and to ensure a just transition with equitable coverage. The existing EVI will need upgrading when required and maintaining; the new EVI procuring, installing, and then maintaining and upgrading.

Successful delivery at this scale requires good governance, strong programme management, and collaborative working between the three Councils and Ayrshire Roads Alliance (ARA) (working on behalf of EAC & SAC). The partners have chosen to work together to deliver the procurement, installation and management of this package of EVI (working with commercial partners); this Management Case sets out the high-level approach for them to do this.

9.2 Governance and Management

9.2.1 Approvals, Joint Working, and Timescales

Each of the three Councils and ARA have their own internal approvals process to allow for the procurement (and plan for procurement) of the EVI commercial partner, sign-off of the funding and f inancing plans, and approval of this business case. This includes the need to present papers for approval to committees and Cabinets. This requirement brings the risk of delays or amendments to the planned procurement and programme development as set out in this business case document. Expected key approval timescales are as follows:

- Each of the Councils will need to take this final business case document through their Executive Leadership Team (or equivalent) then to Cabinet for approval. This process will most likely take two-three months from receipt of the final version of this document. It is expected that this process will begin in October 2022.
- Each of the Councils may also need to take the final procurement documentation through the same approval processes. This includes the use of PINs, if used (as recommended). Timescales for this are not currently known, as legal advice may be required during the process.

The three Councils (inclusive of ARA) are in the process of setting up an Inter-Entity Agreement (IEA) as a precursor to a formal Memorandum of Understanding (MoU). These will:

- Set out the governance processes to allow the three Councils to work together to procure, manage and deliver the EVI programme described in this business case.
- Agree which Council will take on the Lead Organisation role (currently the three organisations are in an informal partnership, with NAC as the lead organisation).
- It should be noted that a template IEA (and potentially MoU) is being progressed by SFT with their legal advisors as a pro forma that can be used by councils and other organisations entering into mutual delivery of EVI Pathfinder projects. The three Ayrshire Councils are in discussions with SFT to pilot the development and implementation of this template.

To ensure efficient and effective management, the three Councils and ARA will divide delivery of the EVI programme into three stages:

- Stage 1 – Business Case (almost complete). Development of this business case document, overseen by Officers at NAC and ARA, with senior Officers involved as required.
- Stage 2 – Procurement & Development. The further development of this business case and the procurement strategy, including identification of a (or some) commercial partner(s), and developing the governance required to achieve the required Council approvals. Senior management, procurement, legal and financial representatives will also be involved as required. Transport Scotland has allocated funding for Council staff and consultancy time to cover this stage. At the time of writing, it has been assumed that the funding for all three councils will be sufficient to cover procurement costs if the councils work and procure together, as recommended.
- Stage 3 – Monitoring & Delivery of the capital works and commercial operation. Overseeing contract awards and monitoring contractual delivery, including ensuring commercial partners deliver to time and budget, dealing with problems and issues, and reporting on progress (including quarterly progress updates to SFT and Transport Scotland).

9.2.2 Organisation and Team

Two options have been considered for project/programme management of the EVI roll-out, spend and financial reporting:

1. Setting up a team to deliver that combines the three Councils (and/or ARA), which is given the terms of reference and governance structure to allow them to operate as an arms-length delivery organisation on behalf of the three Councils. Such a team would be delegated the funding, and would manage development, delivery, and operation of the new EVI network and the commercial partner(s).
2. Each Council operating separately from a financial and management perspective (although EAC and SAC would do this via ARA) with the allocated funding used to pay for the EVI planned for their area in this business case. While the financing and management issues (e.g. responding to local people and monitoring maintenance requirement s) would be divided, the steering group would still provide coordination between the Councils and ensure economies of scale are exploited and the same standards maintained. Procurement could still be joint, and the same commercial partner(s) could deliver across all three Council areas, but be paid through the two organisations (NAC and ARA).

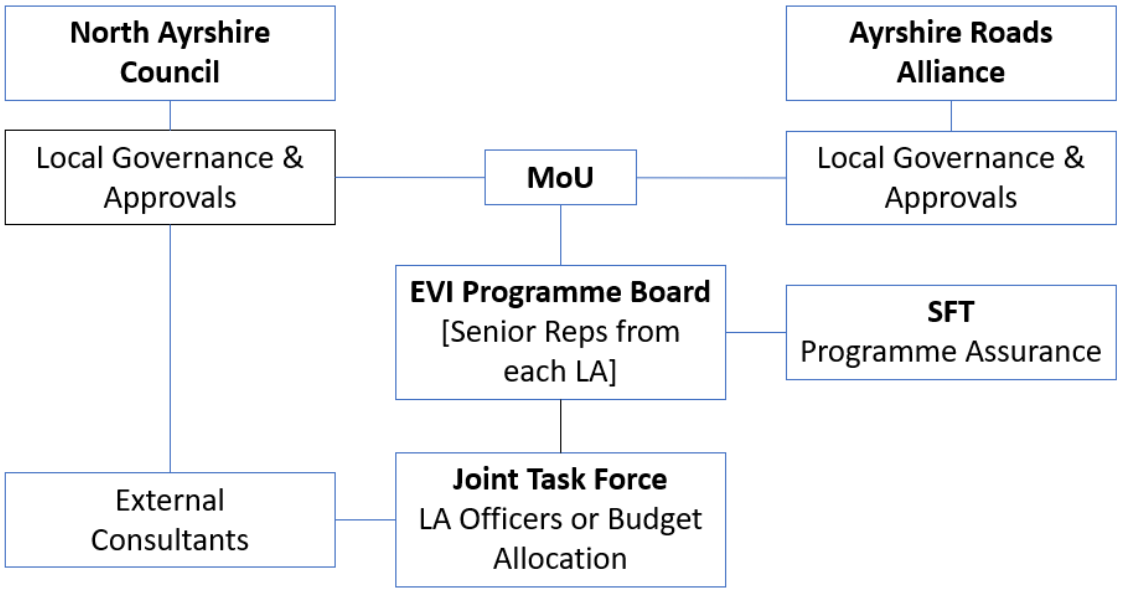
While the second option is more complex in the long-run, it is easier to set up and mobilise in the short-term. A more collaborative, arms-length approach (the first option) would:

- Ensure more consistency;
- Provide more efficiencies and economies of scale; and
- Consolidate skills; but it would also
- Require revenue-sharing and payment-sharing to be organised, which could be complex;
- Require provision for liabilities to be correctly apportioned; and
- Be affected by differences in approach, politics and governance between authorities.

Given the rapid timescales required to deliver the EVI planned in this business case, the second option is currently recommended.

SFT have also recommended option 1. In this option, the strategy, planning and procurement phase of work (i.e. Stage 2 as set out in section 9.2.1) could have the following governance structure:

Figure 9.1: SFT-Suggested Project Procurement & Development Organogram



Source: SFT, 2022

SFT have also suggested the scope of the joint-working set out above would be to[27]:

1. Identify the need for EVI to meet forecast demand and policy priorities.
2. Target areas of need where private sector investment on its not viable.
3. Introduce a common tariff regime that supports fair pricing & private investment.
4. Enable a high-quality service, but not to be responsible for day-to-day delivery.
5. Explore the best approach to appointing a partner(s) to expand, operate and maintain all existing and new EVI.
6. Recover the cost of managing future contracts through the tariff charged.
7. Retain a proportion of the tariff charged to help further develop the network
8. Identify the preferred long-term joint working and partnership model.

Note that tasks 1-3 have already been progressed through Stage 1 (this business case document) of the project, but will require further refinement and confirmation.

Specialist technical, legal, procurement and financial support (ie 'External Consultants' in Figure 9.1) may be required to assist the teams in the Councils and ARA to develop, deliver, or operate the EVI roll-out. NAC used the Scotland Excel Framework to procure support to develop this business case on behalf of itself and ARA, and it is anticipated that the same approach would be used if additional specialist support was required.

9.3 Risk Management and Mitigation

At this early stage of development, a register of high-level risks has been developed, including plans for their mitigation. This risk register should become a live document, and an agenda item on Steering Group (and later Delivery Group) meetings to adjust and add to. As more detail is possible, a Monte Carlo and/or Quantified Risk Register is likely to be appropriate.

The risk register is shown in Table 9.1.

[27] This scope was provided in a presentation in September 2022 from SFT, entitled "NAC - ARA Joint Working Option - Pre-Contract Phase"

Table 9.1: High-Level Risk Register

No.	Category	Name	Description	Likelihood	Probability	Impacts	Proposed Mitigation
1	Programme	Delayed procurement	Difficulties setting up and arranging management of the EVI roll-out	Medium	40%	Delayed procurement, and thus capital works.	Selection of second option for project/ programme management
2	Funding & financing	Incorrect cost estimation	Underestimated costs for the EVI required, potentially due to inflation and/or global delivery issues	Medium	60%	Insufficient funds to deliver EVI, requiring either a reduction in EVI commissioned, or additional funding from Council (or other) budgets	Real costs supplied to develop Asset Register; inclusion of risk allowance; refinement of cost estimate after business case but before procurement
3	Stakeholders/ consultation/ third parties	Selected locations objected to by the public or land owners	To install the EVI, consultation is required. Land owners or local people may object in some locations	Low	20%	Reduction in amount of EVI that can be delivered, or requirement to find alternative sites which could lead to delays or cost increases, or lower demand sites being selected	Use of council-owned land where possible to host EVI; socialisation of community to the plan and its benefits; early engagement with the public or land owners where possible
4	Land, planning & environmental	Below-ground or ground conditions constraints	Presence of utilities or similar, or unstable ground mean a site cannot be used for a charger to be installed	Medium	30%	In most cases it should be possible to adjust the site of a charger to accommodate, but in some cases the same impacts as risk 3 may apply	Surveys where required; inclusion of risk allowance; alternative sites considered
5	Governance	IEU/MoU Failure	Failure to agree terms for joint-working, or breakdown of joint-working agreement	Low	15%	Delays and cost increases through the three Councils needing to separate their procurement, delivery and/or management approaches. Failure to exploit efficiencies & economies of scale	Early working together to develop IEU and MoU, including involvement from senior Officers, to ensure terms agreeable to all and roles/responsibilities well set out. Good (and defined) communication between organisations
6	Funding & financing	Market conditions change	Increase in electricity costs and/or flooding of market with demand relative to operators able to enter contracts	Medium	40%	Unattractive market proposition leading to inability to install and operate numbers of EVI required and funded; conversely, increase in electricity costs could reduce demand for EVs and thus EVIs	Early market engagement at next stage of project delivery; re-running of demand model if required; intel from SFT on market

No.	Category	Name	Description	Likelihood	Probability	Impacts	Proposed Mitigation
7	Funding & financing	Inflationary pressures	Increase in cost of EVI itself, materials or costs to install	Medium	35%	Rising costs but fixed funding will lead to reduced number of EVI charging units being delivered	At Stage 2, joint-working group to test impact and develop alternative delivery pipeline scenarios if required.

9.4 Timetable and Next Steps

The timescales for this EVI programme are not yet fixed but at a high-level are expected to be:

Month/year	Key tasks
October 2022	• Submission of draft business case document to SFT for consideration • Scoping of next steps and methodology for Stage 2, including considering procurement of support and resourcing requirements
November 2022	• Process to agree and establish IEA • Finalisation of business case
December 2022	• Submission of final business case document to SFT for consideration • Internal approval process of the business case document within each of the three Ayrshire Councils begins • Approval process for IEA ideally underway or complete • Procurement of consultancy support (if required) for Stage 2 may be underway
Q4 2022-23	• Approval process continues and completes (to Leadership Team/Cabinet) • Feasibility work on site infrastructure (including energy) and capital works requirements • Development of procurement/tender documentation for suppliers • Commencement of procurement process with commercial suppliers
Q1 2023-24	• Consultation if required for key sites
Q2 2023-24	• Commercial partners in place • Commencement of capital works for new EVI • Existing asset replacement where required
Q3 2023-24	• Commencement of service delivery
2024-26	• EVI programme in place, with installation of new EVI ongoing, and service delivery ongoing

9.5 Summary

The Management Case sets out the emerging approach by which the three Councils propose to work together, the risks to delivery, and the timescales for delivery.

It should be noted that this is a rapidly progressing programme and timescales may require amendments as it involves (with agreement from SFT).

The Financial Case assumes that the EVI programme will be fully operational from 2023-24, with some funding and delivery occurring towards the end of 2022-23. By 2026, all EVI replacements and new infrastructure set out in this business case will be in place.

Appendices

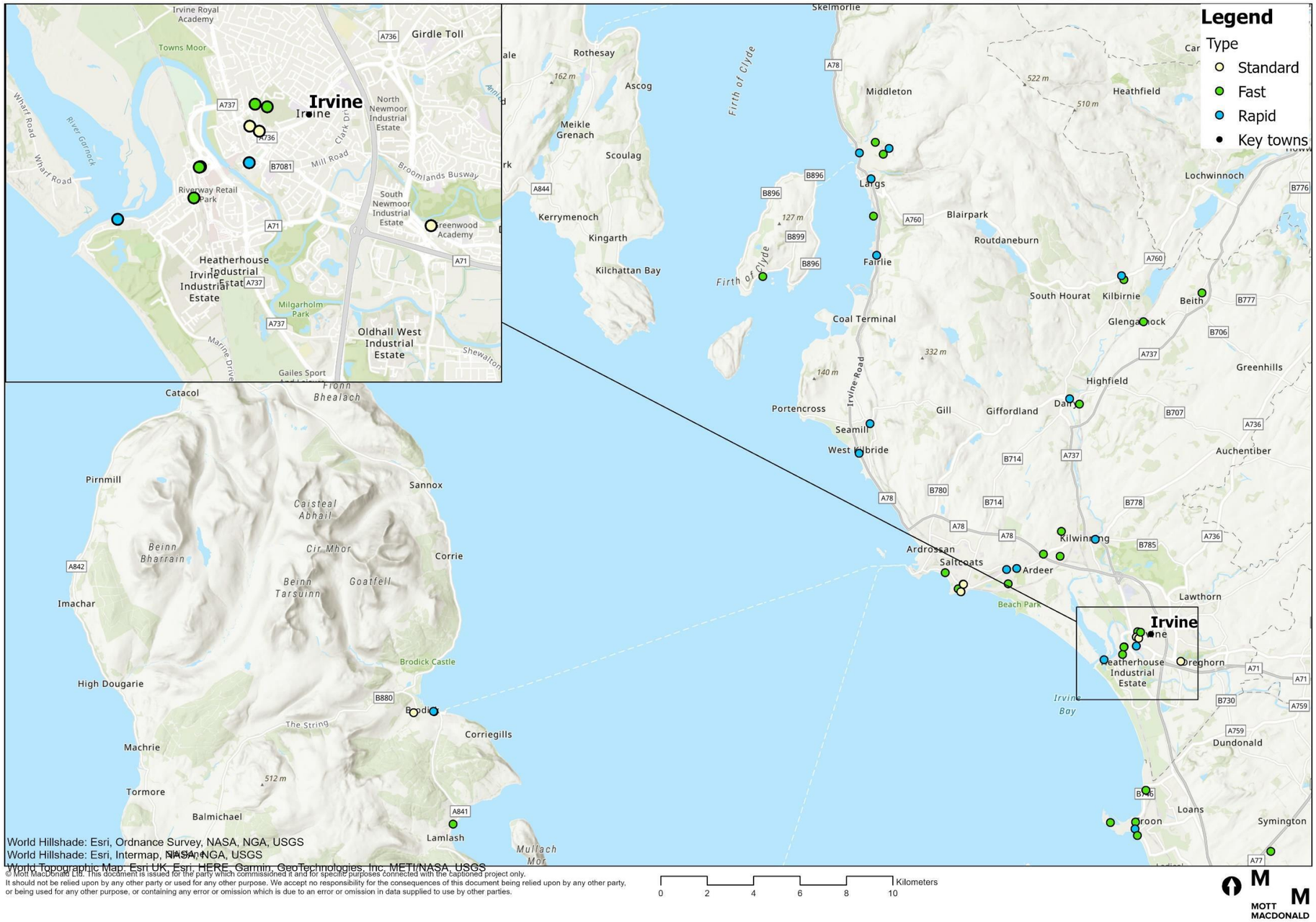
A. Existing EV Charger Locations 108
B. Vision Workshop 112
C. Survey Results 113
D. Assumption Log 121
E. Electric Vehicle Charging Inf rastructure Forecast Methodology 126
F. Grid Capacity Assessment 137
G. Identified Potential Charger Locations 140

A. Existing EV Charger Locations

The existing public EVCI locations for each Council area are provided in the following figures.

A.1 North Ayrshire

Figure A.1: North Ayrshire Council Existing EVCI Locations

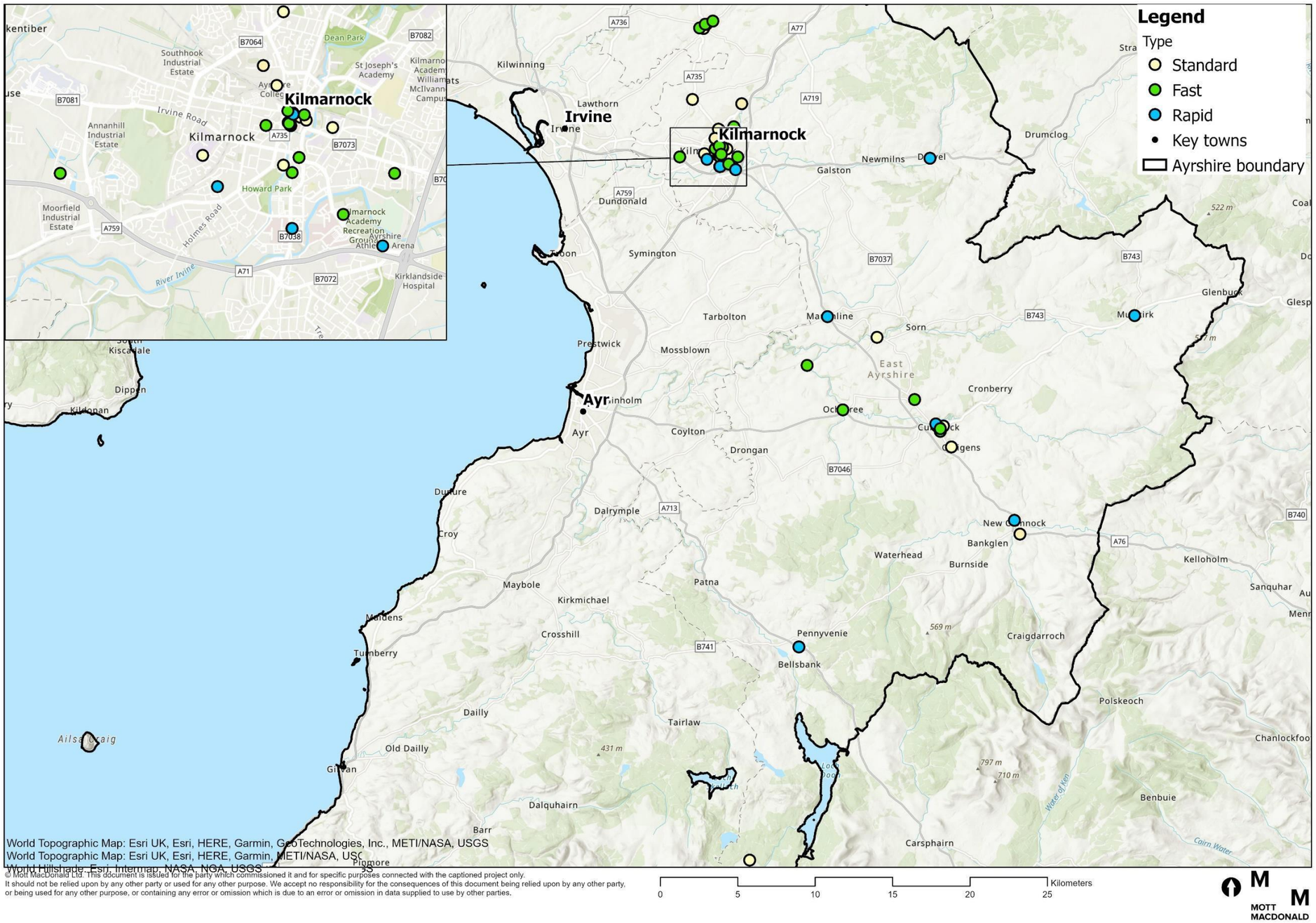


World Hillshade: Esri, Ordnance Survey, NASA, NGA, USGS
World Hillshade: Esri, Intermap, NASA, NGA, USGS
World Topographic Map: Esri UK, Esri, HERE, Garmin, GeoTechnologies, Inc, METI/NASA, USGS

Source: North Ayrshire Council, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

A.2 East Ayrshire

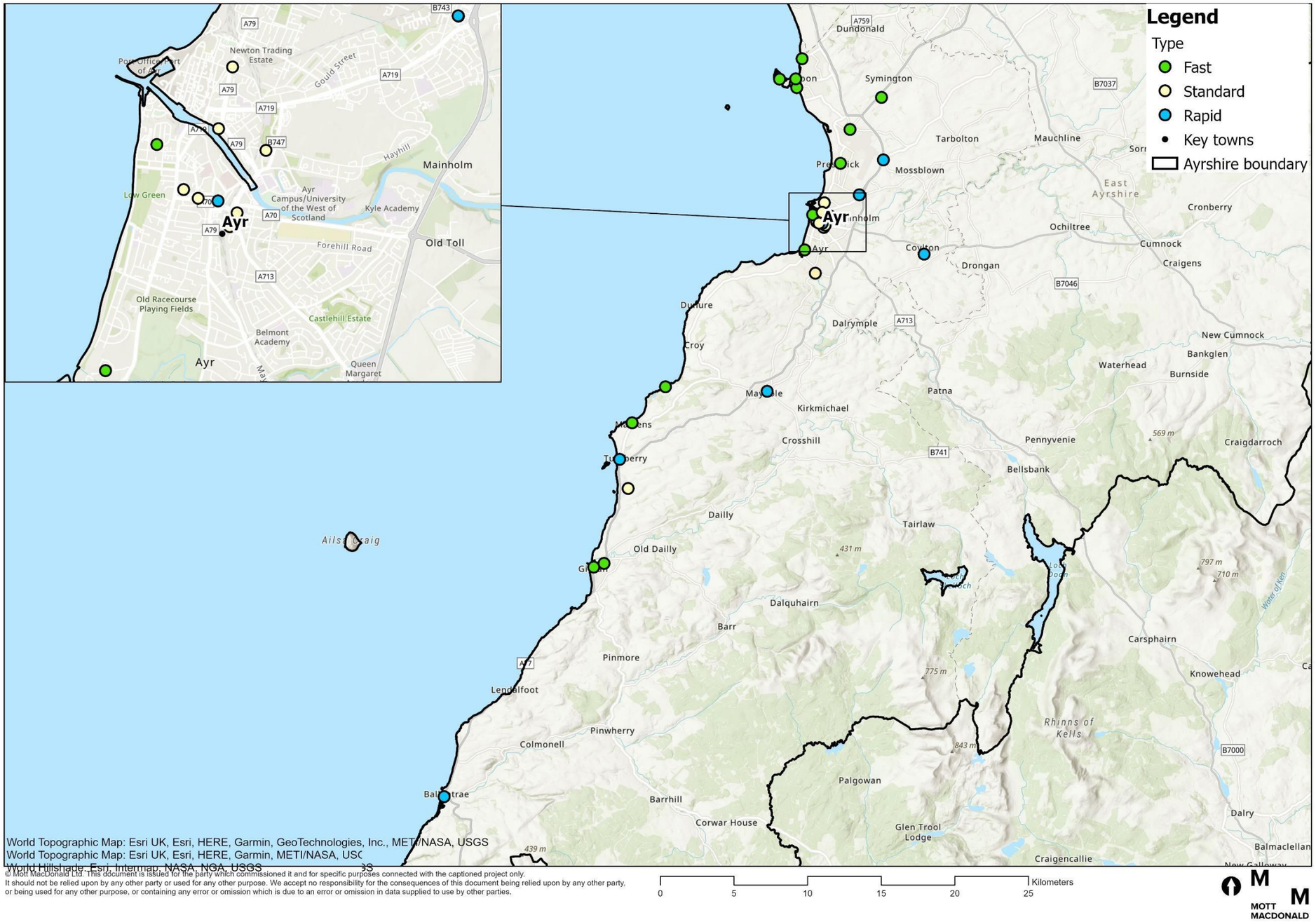
Figure A.2: East Ayrshire Council Existing EVCI Locations



Source: Ayrshire Roads Alliance, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

A.3 South Ayrshire

Figure A.3: South Ayrshire Council Existing EVCI Locations

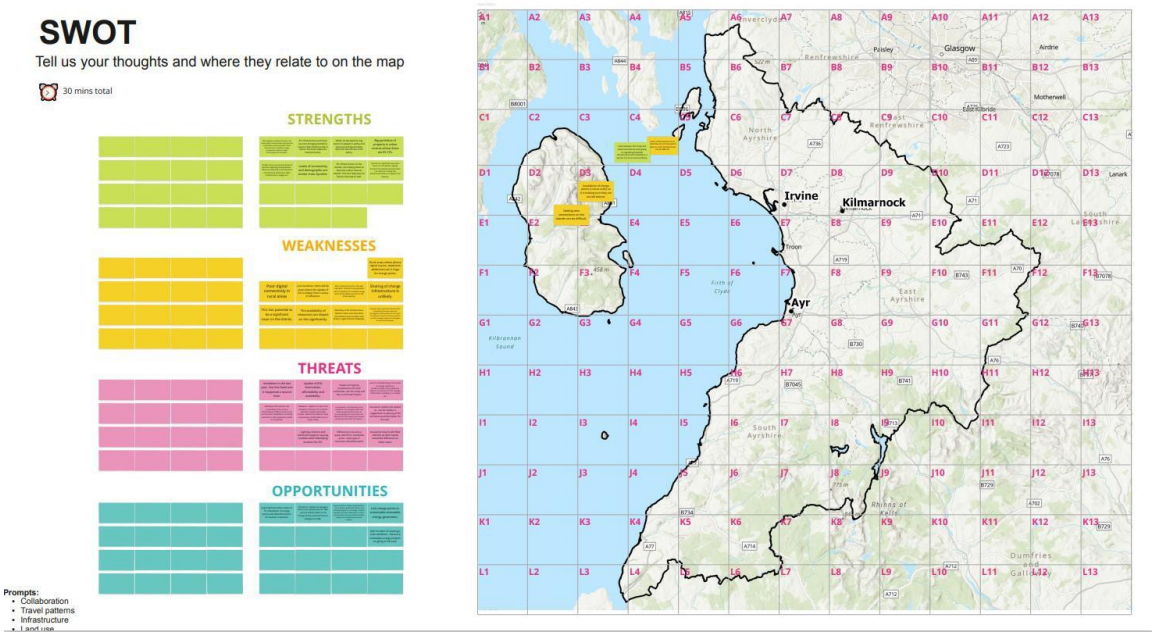


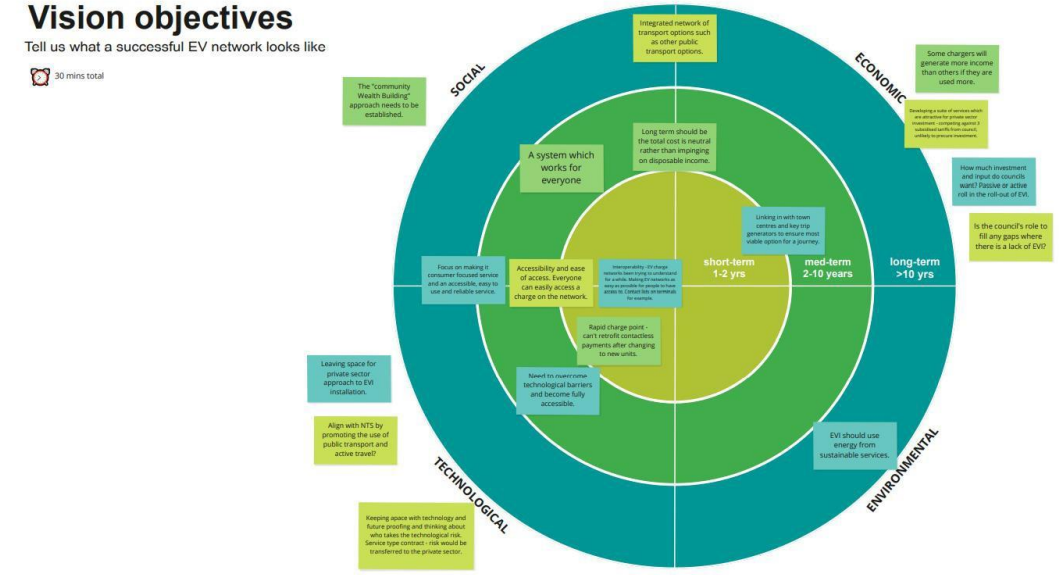
Source: Ayrshire Roads Alliance, ChargePlace Scotland, Zap-Map, Department for Transport National ChargePoint Database

B. Vision Workshop

A visioning workshop was held with key stakeholders from NAC & ARA in March 2022, the outputs of which were used to develop the vision and objectives. Screenshots from the interactive sessions are below. Larger versions can be provided on request.

Figure B.4: Visioning Workshop Outputs (Interactive Whiteboard Slides)





Source: Mott MacDonald

C. Survey Results

C.1 Introduction

North Ayrshire Council and Ayrshire Roads Alliance (South & East Ayrshire Councils) are working together to develop a business case to deliver public Electric Vehicle (EV) charging infrastructure to meet future demand. To better understand the needs of residents and businesses so that future public electric charging infrastructure can be planned to meet their needs, two surveys were produced, one for businesses and one for individuals (primarily residents). In total, there were 70 responses from the businesses survey and 450 responses from the residents' survey.

This technical note outlines the methodology and survey results.

C.2 Methodology

The survey was produced using Microsoft Forms, a site that enables anonymous surveys to be produced and the results be exported and analysed. Two separate surveys were created to better understand the needs of residents and business individually and were comprised of 15 and 19 questions respectively.

The resident's survey has 15 main questions (with extra sub-questions). The survey uses a combination of qualitative and quantitative questions which were developed to aid the understanding of current EV ownership and charging habits, and future aspirations for the charge network. This will help to plan a network which directly corresponds to the needs of all users expressed in these surveys.

The survey for businesses has 19 questions which aim to capture the current charging habits and future needs of businesses, and their future charging requirements and desires. In particular the questions in this survey focus on fleet vehicles and customer/staff/visitor parking and charging.

The results f rom both surveys will help to provide an overview of the current charging behaviours of users, capture any issues or challenges, and gauge an understanding of the future aspirations for the network. In so doing, it is hoped that future public charging infrastructure can planned to provide a network which is accessible, easy to use and meets the needs of all users – enabling a just transition.

C.3 Survey Results

C.3.1 Residents Survey

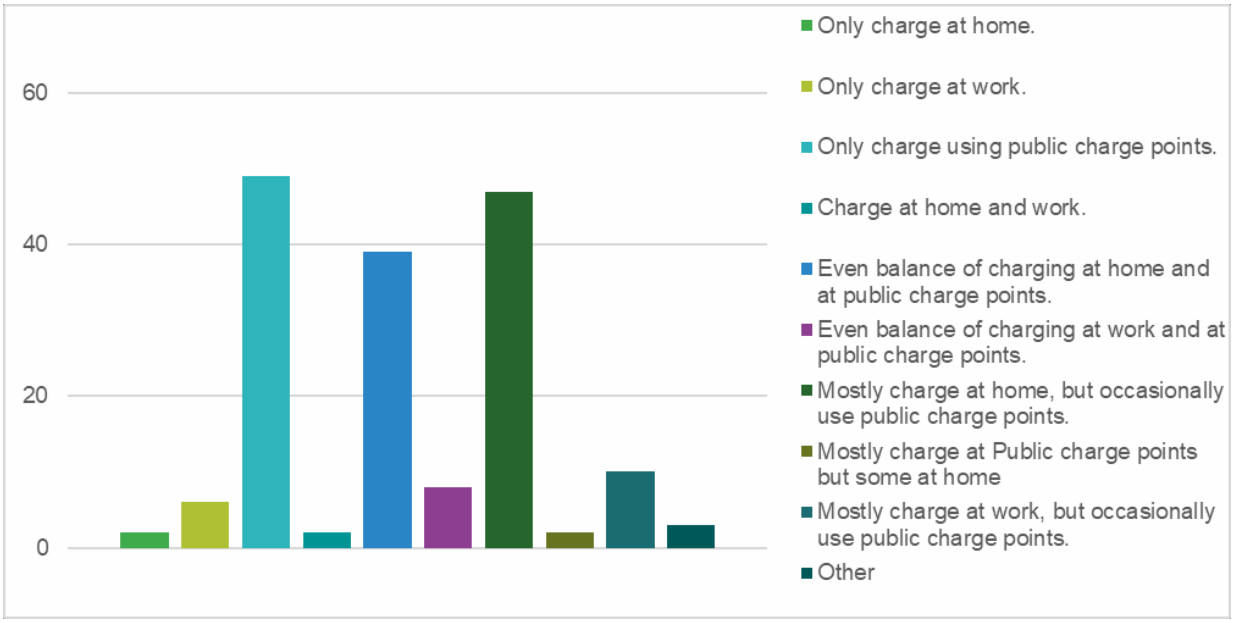
Some key results that emerged from the resident's survey are outlined below:

- 52% of 401 individuals responding currently own an electric vehicle.
- 64% of 445 individuals responding are planning to buy an electric vehicle or change their current electric vehicle.
- When asked which type of EV they are planning to buy in the future, 66% out of 286 answered Battery Electric Vehicle (BEV) (electric only, no other fuel) and 27% answered Plug-in hybrid (plug in electric, also petrol/diesel powered).
- 90% of 442 individuals stated they would like access to more EV charge points in their area.

Figure C.5 shows where/how respondents who own a BEV normally charge their vehicles. This shows that the majority of individuals gave three responses: they only charge using public

charge points; they use an even balance of charging at home and at public charge points; or they mostly charge at home, but occasionally use public charge points.

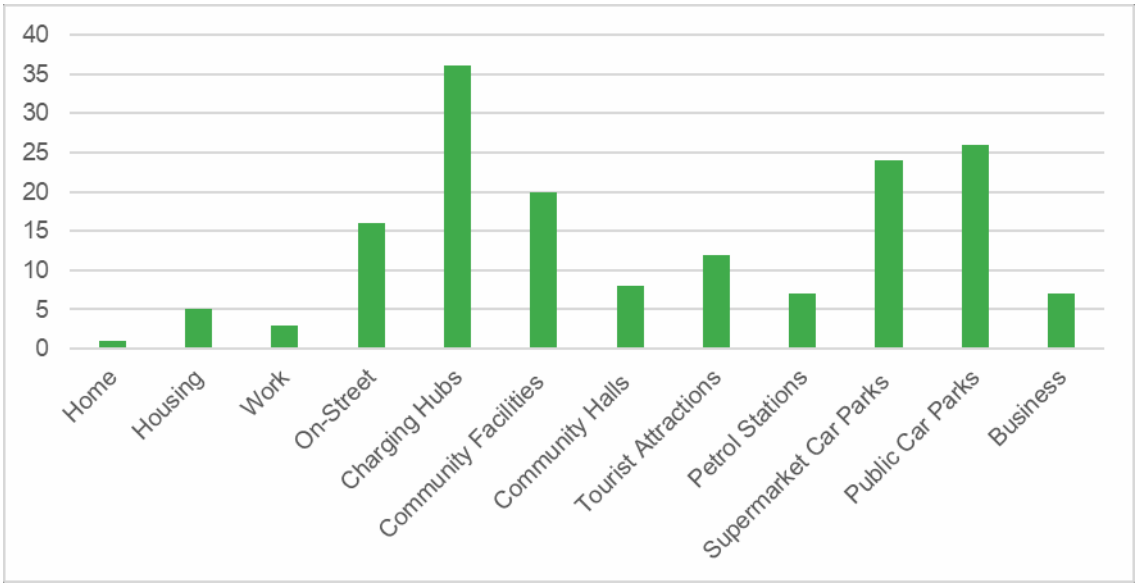
Figure C.5: Battery Electric Vehicle owners – how/where you normally charge your vehicle



Source: Mott MacDonald, April 2022 Ayrshire EV survey, Individuals, base of 168

Figure C.6 shows that for Battery Electric Vehicles, the most preferred location to charge EVs in Ayrshire is at charging hubs as well as public car parks, supermarket car parks, and community facilities. Charging at home is the least favoured method of charging, however these home responses could represent EV owners who do not have access to off street parking and therefore home charging. A low response rate for home charging preference could be due to the majority of existing EV users already having the ability to charge at home.

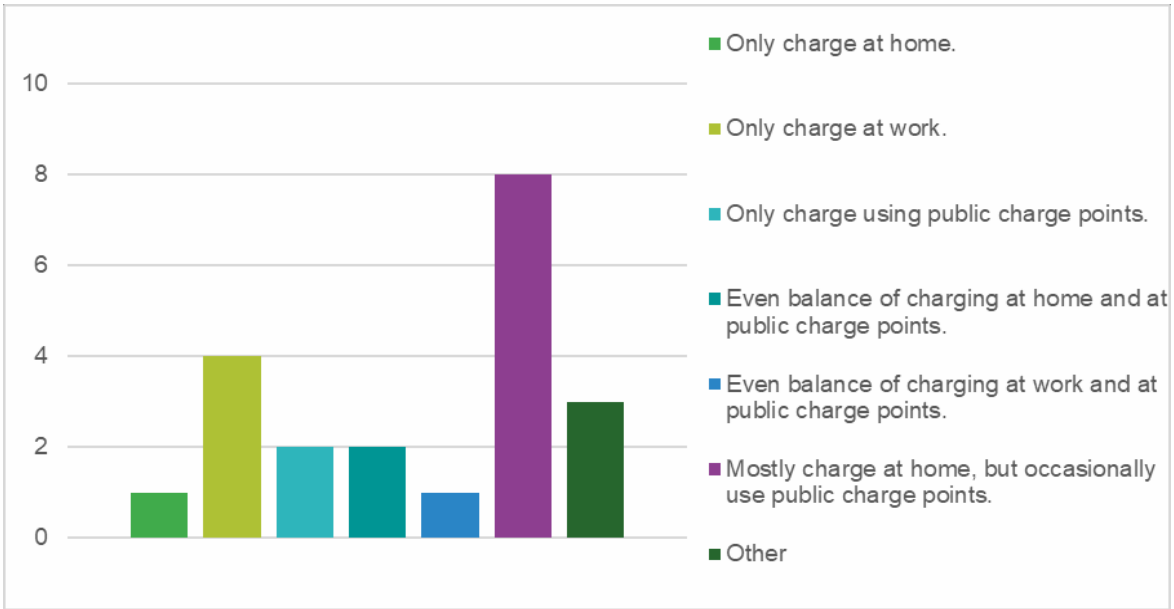
Figure C.6: BEV Preferred Charging Location



Source: Mott MacDonald, April 2022 Ayrshire EV survey, individuals, base of 165.

Figure C.7Figure C.7: shows where/how respondents who own a Plug-in Hybrid Vehicle normally charge their vehicles. This shows the majority (38%) mostly charge at home, but occasionally use public charge points or only charge at work (19%).

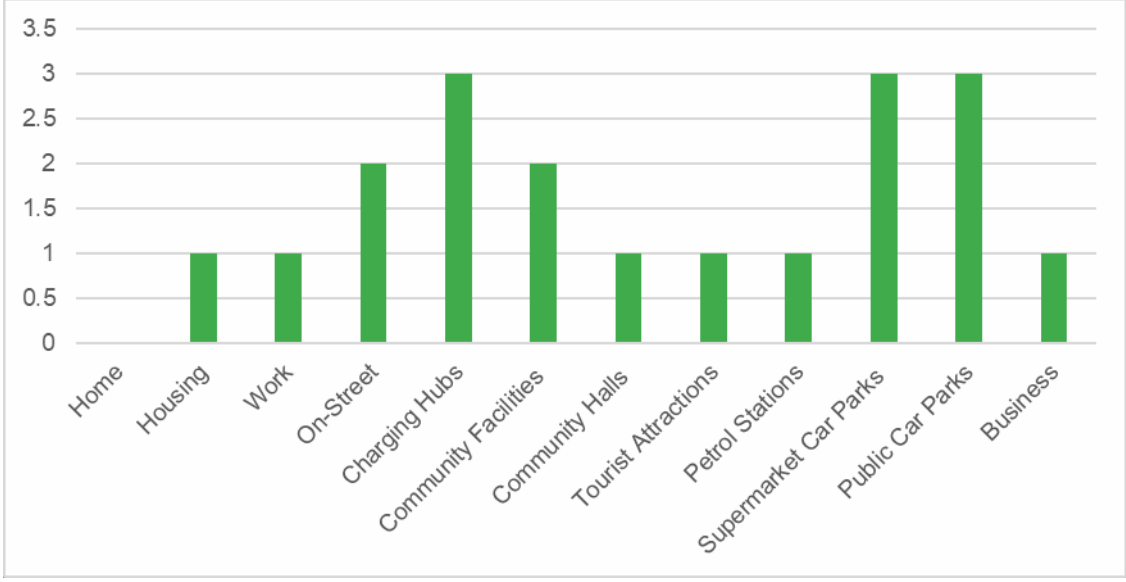
Figure C.7: Plug-in Hybrid Vehicle owners – how/where you normally charge your vehicle



Source: Mott MacDonald, April 2022 Ayrshire EV survey, Individuals, base of 21

Figure C.8 shows the preferred charging location for those who own a Plug-In Electric Vehicle; the most popular locations are again, charging hubs, supermarket car parks and public car parks. Similarly, charging at home was the least popular as well as charging at / on work premises. The preferred charging locations for BEVs and PHEVs both suggest that charging preferences are largely focused around publicly accessible charge points.

Figure C.8: PHEV Preferred Charging Location



Source: Mott MacDonald, April 2022 Ayrshire EV survey, individuals, base of 19.

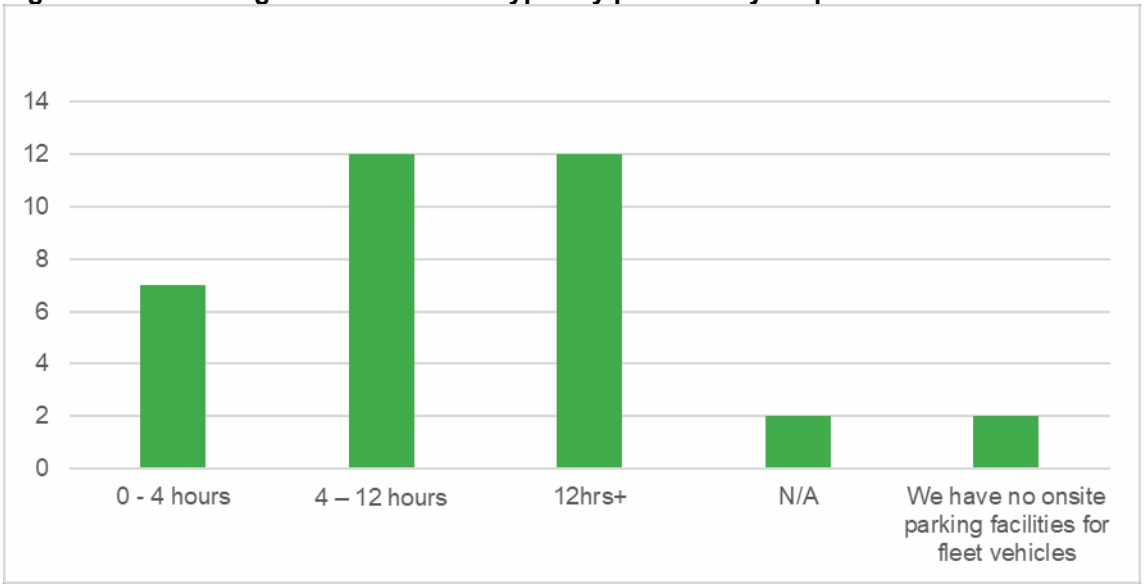
C.3.2 Businesses survey

Some key results that came from the businesses survey are outlined below:

- 50% of the 70 businesses who responded own fleet vehicles.
- 82% of businesses who already own fleet vehicles plan to buy EVs for the fleet in the next five years.
- Only 18% of the 70 businesses provide EV charging points, of those only one business provides EV charge sockets for their customers/public, and the majority provide them for Visitors / Staff / Fleet.
- 52% of businesses plan to install EV chargers in the next 5 years.
- 91% stated that they would like more EV charge points in their area, with the majority selecting Charging Hubs and Public Car Parks are the preferred location.

Figure C.9 shows how long fleet vehicles are typically parked on businesses' premises for. The majority of businesses answered between 4-12 hours or 12+ hours.

Figure C.9: How long are fleet vehicles typically parked on your premises for?



Source: Mott MacDonald, April 2022 Ayrshire EV survey, businesses, base of 35

C.4 Conclusion

This technical note has provided an overview of the results of both surveys which provide an insight into current EV ownership (for residents and business-use) and current charging behaviour.

The residents survey results suggest there is already a strong demand for charging infrastructure in Ayrshire with over half of respondents currently owning an EV. The results also suggest that the demand for EVs in Ayrshire will continue to rise, 64% of respondents stated they were planning to buy a new or change their current EV. These results are indicative of increasing future demand for both electric vehicles *and* charging infrastructure within Ayrshire.

The majority of respondents illustrated they predominately charge their EVs at work or using public charge points, with very few respondents charging at home; this suggests that most residents rely on the public charge network and not home-charging. This therefore demonstrates the importance of the public network in Ayrshire is as it is the primary method of charging for most EV drivers.

The results of the business survey illustrates that a large proportion of the businesses plan to buy EVs for their fleet within the next five years however, the charging infrastructure does not currently match the demand with only 18% of businesses providing charge points and only half plan to install charging infrastructure in the next 5 years. These results suggest there could be a gap in the number of EVs used by businesses and the number of charge points available for these vehicles, and therefore increased pressure on the public network. Although, 91% of businesses stated that they would like more EV charge points in their area, with the majority selecting Charging Hubs and Public Car Parks are the preferred location which reinforces that the demand is already there despite the physical infrastructure not in place yet.

Overall, the results of both surveys suggest there is already a strong demand for EVs in Ayrshire and the behaviour of both residents and businesses is shifting to see an increasing uptake of EVs in the future. The current public network is significantly relied upon but the charging facilities at businesses are not yet able equipped to meet the future needs of businesses and their f leet vehicles.

C.5 Survey Questions - Residents

1. Please provide your full postcode to help us to plan where drivers would like to see more EV infrastructure
2. Do you currently own / have access (eg: through a car club) to a car?
   a. Yes, go to Q3
   b. No, go to Q7
3. What is your typical daily car mileage?
   a. 0-20 miles
   b. 21-30 miles
   c. 31-50 miles
   d. 51-75 miles
   e. 76-100 miles
   f. 100+
4. Do you currently own / have access to an electric vehicle? (this includes Battery Electric (BEV) / Plug in Hybrid (PHEV) / non plug in hybrid vehicles)
   a. Yes
   b. No, go to Q7
5. Please select which type of electric vehicle you currently own/ have access to:
   a. Battery Electric Vehicle (electric only, no other fuel)
   b. Plug in hybrid (plug in electric, also petrol/diesel powered)
   c. Non plug in hybrid
6. Which of the following best describes how/where you normally charge your vehicle? (select one)
   a. Only charge at home.
   b. Mostly charge at home, but occasionally use public charge points.
   c. Even balance of charging at home and at public charge points.
   d. Only charge at work.
   e. Mostly charge at work, but occasionally use public charge points.
   f. Even balance of charging at work and at public charge points.
   g. Charge at home and work.
   h. Only charge using public charge points.

i. Other (please specify)

7. Are you planning to buy an electric vehicle in the future or change your current electric vehicle?
   a. Yes I am planning to buy an EV in the next year
   b. Yes but I am planning to purchase an EV in the longer term (more than one year away)
   c. No, go to Q
8. If you are planning to buy an EV in the future, please select the type you plan on buying:
   a. Battery Electric Vehicle (electric only, no other fuel)
   b. Plug in hybrid (plug in electric, also petrol/diesel powered)
   c. Non plug in hybrid
   d. Other (please specify)
   e. N/A
9. No (please explain why–
   a. I don't plan to buy a car
   b. I don't drive
   c. Price
   d. Range
   e. Access to EV charge points
   f. Choice of models
   g. I plan on keeping my current EV
   h. Other
10. Would you like more access to EV charge points in your area?
   a. Yes
   b. No
11. If no, please explain why.
12. Where would you prefer to charge your vehicle?
   a. Charging Hubs
   b. Petrol Station/Services
   c. Supermarket Carparks
   d. Community halls
   e. Public Car Parks
   f. Housing Developments
   g. Community Facilities (Leisure centres, Libraries, schools, health centres etc.)
   h. Tourist Attractions
   i. On-Street
   j. Private Business Addresses (Café, Restaurants, etc.)
   k. Other (please specify)
13. How far would you be prepared to walk to access a charge point?
   a. 0-3min
   b. 3-5mins
   c. 5-10mins
   d. 10mins+
14. Could you expand on your answer, why have you answered as you did?

15. Please enter any further comments, concerns, or opinions about Electric Vehicle charging points below

C.6 Survey questions – Businesses

1. Please provide your business name
2. What sector is your business in? (Please select one)
   a. Agriculture, hunting, forestry and fishing
   b. Arts and creative industries
   c. Banks & financial services
   d. Business management consultants and Business Services
   e. Computer & related activities
   f. Construction, Architects & surveyors
   g. Design
   h. Education & training
   i. Electricity, gas & water supply & energy
   j. Health & social work
   k. Hotels & restaurants
   l. Insurance
   m. Legal
   n. Manufacturing & engineering
   o. Marketing, web/graphic design, media& PR, print
   p. Mining & quarrying
   q. Other business services
   r. Public administration & defence
   s. Real estate, renting & business activities & social housing
   t. Recreation, sports and leisure
   u. Telecommunications
   v. Tourism
   w. Transport, storage & communication
   x. Wholesale & retail trade
   y. Other (please state)
3. Information about fleet (this excludes grey fleet where staff use their own vehicles for trips for work purposes). Do you have any fleet vehicles?
   a. Yes
   b. No
4. How many fleet vehicles do you have in your fleet?
5. How long are fleet vehicles typically parked on your premises for?
   a. 0 - 4 hours
   b. Up to 4 hours
   c. 4 – 12 hours
   d. 12hrs+
   e. We have no onsite parking facilities for fleet vehicles

   f. N/A
6. Do you plan to buy/lease any EVs for your fleet in the next 5 years?
   a. Yes
   b. No
   c. N/A
7. If yes, how many?
8. If no, please state why.
9. Existing access to EV charging points - Does your business provide EV charging points?
10. Please select the options below that your business provides EV charge sockets for (please select all that apply)
   a. Visitors / Staff / Fleet
   b. Customers / Public
11. How many EV charge sockets do you provide for visitors / staff / fleet?
12. How many EV charge sockets do you provide for customers and public?
13. Future provision of EV charging points - Is your business planning to install EV chargers in the next 5 years? (or further chargers if EV chargers are already provided).
   a. Yes
   b. No
14. How many chargers do you plan on installing for visitors / staff / fleet?
15. How many chargers do you plan on installing for customers and public?
16. Would you like more access to EV charge points in your area?
   a. Yes
   b. No
17. if yes, where would you prefer charge points to be provided? (please select all that apply)
   a. Charging Hubs
   b. Petrol Station/Services
   c. Supermarket Carparks
   d. Community halls
   e. Public Car Parks
   f. Housing Developments
   g. Community Facilities (Leisure centres, Libraries, schools, health centres etc.)
   h. Tourist Attractions
   i. On-Street
   j. Private Business Addresses (Café, Restaurants, etc.)
   k. Other (please specify)
18. if no, please state why.
19. Please enter any further comments, concerns, or opinions about Electric Vehicle charging points below

D. Assumption Log

ID	Workstream	Subject	Assumption Description	Any supporting data?	Date Identified	Assumption Status	Comment
CE1	Cost Estimates	Maintenance Contingency	Maintenance costs have been provided based on quotes from BP Pulse of £495 for AC and £1,595 for DC chargers. This has been supplemented with an annual contingency pot based on 2021 repair costs split between each EVCI.	N/A	10/08/2022	Open	
CE2	Cost Estimates	DNO Costs	DNO grid connection costs are based on the SPEN document, assuming 20 fast chargers result in a £100k grid connection	Electric_Vehicle_Handbook.pdf (spenergynetworks.co.uk)	07/07/2022	Open	
DF1	Demand Forecast	Forecasting of the total number of BEVs	No vehicle fleet age/survival rate has been applied. The total number of vehicles predicted will likely be higher than 'actual' as it does not account for vehicles being taken off the road.	N/A	23/03/2022	Open	Technology is continually improving therefore survival rate is likely to increase due to ease of servicing and fewer moving parts for EVs. Scottish Transport Statistics No. 39 Table 1.6 shows average vehicle age increasing over time.
DF2	Demand Forecast	Proportion of vehicles in LA to Scotland/UK	It has been assumed that all local authorities will have a fixed proportion of the overall total number of vehicles registered. Using DfT data is has been calculated that Scotland accounts for 7.6% of the total number of vehicles in the UK, while East Ayrshire accounts for 2.3%, North Ayrshire 2.4% and South Ayrshire 2.2%.	N/A	23/03/2022	Open	
DF3	Demand Forecast	BEV cars and LGVs	Assumed all first time registered cars and LGVs in 2036 will be BEVs due to the ban of petrol and diesel cars and LGVs in 2030 and PHEV cars and LGVs in 2035.	N/A	23/03/2022	Open	
DF4	Demand Forecast	Forecasting the total number of BEV and	Latest Scottish Transport Statistics indicates there are 0 BEV taxis or PHVs registered (2019). To enable to the forecast, a nominal	N/A	18/03/2022	Open	

ID	Workstream	Subject	Assumption Description	Any supporting data?	Date Identified	Assumption Status	Comment
		PHEV taxis and PHVs	value of 1 registered vehicle has been used for 2020.				
DF5	Demand Forecast	Forecasting the minimum and maximum total number of BEV and PHEV taxis and PHVs	For the upper bound forecast - assume it cannot go beyond the maximum value for the lower bound forecast. E.g. if the maximum lower bound value for PHVs is 389 in 2036, and when the upper bound forecast gets close to that value, such as 354 in 2032, assume that between 2032 and 2036 the forecast will slow and plateau to 389. If the upper bound continued above the maximum lower bound value, it will be unrealistic as the fleet size of taxis/PHVs have stay fairly consistent over the years.	N/A	18/03/2022	Open	
EVM1	EV Model	Walking distance from Chargers	Assumed maximum residential walking distance from public chargers is 5 minutes (400 meters)	N/A	02/04/2022	Open	
EVM2	EV Model	On/off street parking	Filtering for only residential properties without off-street parking has not been implemented in the model	N/A	02/04/2022	Closed	This has since been implemented. AI on/off-street parking analysis aligns with Scottish Household Survey data with over 90% accuracy.
EVM3	EV Model	Existing EV infrastructure	Data is pulled from DfT's National Charge Point registry. Data was cross-checked with ChargePlace Scotland and Zap-Map, then verified by the councils.	N/A	02/04/2022	Closed	All sites confirmed by NAC/SAC/EAC. NAC informed MM on 05/08/22 on additional sites being progressed in 2022/23

ID	Workstream	Subject	Assumption Description	Any supporting data?	Date Identified	Assumption Status	Comment
EVM4	EV Model	Primary substation data	Data taken from the SPEN Distributed Generation Heat maps. Spare capacity is calculated as follows: Spare_Capacity_MVA = Group_Firm_Capacity_MVA - Group_Maximum_Load_MVA. This is a worst case scenario for spare capacity at primary substations as Maximum_Load_MVA is the highest recorded load. In reality the load may very rarely reach this level. The resultant spare capacity value is used to determine how many and the type of EV chargers that can be installed. This is based on the spare capacity of the closest primary substation to the proposed site.	N/A	02/04/2022	Open	Data used in the SPEN Distributed Generation Heat maps is downloaded from AGOL where it is publically available
EVM5	EV Model	Residential clustering	Residential clusters have been identified in the OS AddressBase Plus data using ArcGIS Pro cluster analysis. The EV Model is limited to the identified cluster areas to avoid analysing potential locations in very remote areas	N/A	02/04/2022	Open	
EVM6	EV Model	Rapid Charging Provision	Assumed that petrol stations will provide rapid charging facilities as the adoption of EV increases. Some Ayrshire petrol stations already offer EV charging and we assume this will increase	N/A	20/06/2022	Open	
EVM7	EV Model	Forecast EVCP Utilisation	Utilisation of proposed charge points have been set based on average utilisation of existing units, dependent on kW output.	NAC/ARA Utilisation Data	29/06/2022	Open	
IF1	Infrastructure Forecast	Plug-In Hybrid Vehicle Energy Demand	PHEVs are assumed to have 37% of electricity requirements than BEV due to driving in electric only mode 37% of the time.	International Council on Clean Transportation	18/03/2022	Open	

ID	Workstream	Subject	Assumption Description	Any supporting data?	Date Identified	Assumption Status	Comment
IF2	Infrastructure Forecast	Taxi/private hires	**Holding Assumption:** Both BEV and PHEV taxis/private hires are assumed to undertake 80% of charging privately and 20% at rapids (with off-street parking), while no off street parking is assumed to undertake 50% of charging at residential charging and 50% at rapids.	London 2030 Electric Vehicle Infrastructure Strategy	18/03/2022	Closed	Very different demographics in Ayrshire compared to London. These values will inform the stakeholder engagement sessions and are only holding assumptions. Charging preferences were revised based on the online survey responses from the stakeholder engagement.
IF3	Infrastructure Forecast	Annualisation Factor	Annualisation factor assumed to be 362 days	N/A	18/03/2022	Open	This data could be refined following the stakeholder review.
IF4	Infrastructure Forecast	Households with off-street parking	The proportion of households with access to off-street parking within the local authority area has been found to be 53% in NAC, 56% in EAC and 64% in SAC.	Scottish House Condition Survey, Parking Provision Table 3	30/03/2022	Open	These values impact the recommended EVCI as different household parking arrangements have different requirements for charging infrastructure
IF5	Infrastructure Forecast	LGV Ownership	Assumed Ayrshire LGV ownership is the same as UK wide - 53% are privately owned.	DfT Vehicle Licensing VEH0402	01/04/2022	Open	
IF6	Infrastructure Forecast	Forecast Traffic Volumes	Transport Scotland produced a Traffic Forecast in 2018, and have published traffic data up to 2019. The Scottish Government have published a target to reduce vehicle km by 20% by 2030, but are mainly targeted at towns and cities. Therefore, annual traffic forecasts have continued to be utilised as 20% reduction is targeted at towns/cities.	N/A	01/04/2022	Open	Confirmed with Ayrshire Councils
IF7	Infrastructure Forecast	ULEV Annual Vehicle km	The calculated annual average vehicle km driven is assumed to be the same as BEV - i.e. no behaviour change based on fuel type.	N/A	18/03/2022	Open	
IF8	Infrastructure Forecast	Vehicle Efficiency	Assumed that current BEV effiency does not improve and remains the same in the future forecast years as current vehicle models available in 2022, as a conservative assumption.	N/A	18/03/2022	Open	

ID	Workstream	Subject	Assumption Description	Any supporting data?	Date Identified	Assumption Status	Comment
IF9	Infrastructure Forecast	Vehicle Mileage	Assumed the DfT UK vehicle mileage by vehicle type has the same distribution as the Ayrshire councils.	N/A	18/03/2022	Open	
IF10	Infrastructure Forecast	Proportion of Vehicle Types	Assumed the future proportion of vehicle types for Ayrshire remains the same as per the 2020 data.	N/A	18/03/2022	Open	
IF11	Infrastructure Forecast	Private cars with off street parking charging assumption	**Holding Assumption:** Assumed that 90% of BEV/PHEV charging will be done privately, 10% at destination chargers (for PHEV) and 5% at destination and rapids for BEVs.	London 2030 Electric Vehicle Infrastructure Strategy	18/03/2022	Closed	Very different demographics in Ayrshire compared to London. These values will inform the stakeholder engagement sessions and are only holding assumptions. Charging preferences were revised based on the online survey responses from the stakeholder engagement.
IF12	Infrastructure Forecast	Private cars without off street parking charging assumption	**Holding Assumption:** For PHEV, assumed 20% charging will be private, 50% at residential charging hubs and 30% at destination chargers. For BEV, assumed 20% charging privately, 45% at residential charging hubs, 5% at destination and 30% at rapid.	London 2030 Electric Vehicle Infrastructure Strategy	18/03/2022	Closed	
IF13	Infrastructure Forecast	LGV depot based fleet charging assumption	**Holding Assumption:** Assumed that 90% of depot based PHEV fleets will be charged privately, 5% on residential and 5% on destination. BEV 80% charged privately and 20% on rapids.	London 2030 Electric Vehicle Infrastructure Strategy	18/03/2022	Closed	
IF14	Infrastructure Forecast	LGV private owned	**Holding Assumption:** For PHEV, assumed 55% of charging is private, 20% residential, 20% destination and 5% on rapids. For BEV, assumed 45% private, 15% residential charging hub and 40% at rapid chargers.	London 2030 Electric Vehicle Infrastructure Strategy	18/03/2022	Closed	

E. Electric Vehicle Charging Infrastructure Forecast Methodology

This section outlines the full methodology undertaken to forecast the total uptake of EVs in Ayrshire by 2025 and 2030. The results from this forecast were used to forecast the EVCI required, also outlined within this section.

Assumptions required to enable the forecasts to be derived are listed in Appendix D. If new data becomes available and/or any assumptions made are no longer valid, then the forecast will need to be reassessed.

E.1 Electric Vehicle Forecast Methodology

This section outlines the methodology in deriving the forecast number of EVs within the Ayrshire local authority areas, as part of the initial stage of the EVCI forecast.

E.1.1 Existing Electric Vehicle Forecasts Analysed

A range of potential future outcomes were derived for Ayrshire, using existing EV forecasts produced by a range of industries including energy, vehicle manufacturing and transportation, alongside government policy.

E.1.1.1 National Grid – Future Energy Scenarios 2021

The Future Energy Scenarios (FES) 2021[28] provides four different viable scenarios for how energy could be supplied and consumed from 2021 to 2050, to ensure that the target of net zero is achieved by 2050. The FES 2021 is produced by National Grid and aims to 'inform network planning, investment decisions and government policy'. The four scenarios are as follows:

- **Steady Progression** – the slowest credible decarbonisation, with minimal behaviour change. This scenario will not achieve net zero by 2050. This assumes decarbonisation will occur in power and transport, but not in heat.
- **Consumer Transformation** – will achieve decarbonisation at the same rate as 'System Transformation' by changing the way consumers use energy. This assumes there is flexibility within the demand side.
- **System Transformation** – will achieve decarbonisation at the same rate as 'Consumer Transformation' by changing the way in which energy is generated and supplied. This assumes there is flexibility within the supply side.
- **Leading the Way** – the fastest credible decarbonisation, with significant consumer behaviour and lifestyle change, and world-leading technology and investment.

Each of these scenarios differs through making different assumptions, including consumer behaviour change and providing subsidies for private EVs, and provides different pathways for the growth in the EV market.

FES 2021 takes into account the petrol and diesel vehicles, and PHEVs ban, in 2030 and 2035, respectively.

[28] Future Energy Scenarios (FES) 2021, National Grid ESO. July 2021.

E.1.1.2 Society of Motor Manufacturers and Traders' New Car Market Outlook to 2035

The Society of Motor Manufacturers and Traders (SMMT) New Car Market Outlook[29] is an independent review of the current vehicle market and forecasts the transition from Internal Combustion Engine (ICE) vehicles to electrified vehicles, from 2020 to 2035.

The SMMT New Car Market Outlook outlines four different scenarios: central, high (maximalist), high – private only and low (unsupported). Each of these scenarios differs through making different assumptions such as the end of sale date of Hybrid Electric Vehicles (HEVs), provision of infrastructure, and vehicle production rate, as well as considering current government policy commitments.

The document aims to inform how enablers including incentives and infrastructure, and key barriers including affordability can influence transition from ICE vehicles to EVs, to reach net zero.

The document states that the BEV market comprised of 6.6% of new car sales in 2020, but will increase, based on the central scenario, to 25% in 2025, 75% in 2030, and 100% in 2035. SMMT expects full market penetration by BEV in 2035, as they anticipate some overlap with the 2035 PHEV ban.

E.1.1.3 Transitioning to Zero Emission Cars and Vans: 2035 Delivery Plan

The 2035 Delivery Plan[30] outlines potential pathways to achieving the Government's commitment of phasing out new petrol and diesel cars and vans by 2030, and the Government's requirement for all new cars and vans to be Zero Emission Vehicles (ZEVs) by 2035. The 2035 Delivery Plan's pathways are set out as a percentage of new vehicle sales accounted for by ULEVs and ZEVs.

The 2035 Delivery Plan indicates that for cars there will be a greater uptake of ULEVs compared to BEVs up until 2030 and 2035. However, for vans there will be a slower uptake f rom 2020 to 2030, but a quicker uptake from 2030 to 2035. This indicates that the van market is less mature than the car market, with fewer options available.

The document acknowledges that the EV uptake has move faster than previous projected. In the 2013 strategy document *"Driving the Future Today"*[31], it was predicted that the ULEV market share would be between 3 to 7% by 2020, however in 2020 the ULEV market share was 10%.

The document sets out a wide range of commitments with supporting incentives, infrastructure commitments and sustainability-based strategies, to ensure that the phase out dates can be achieved, along with monitoring milestone, outlining investments and policy initiatives.

E.1.1.4 Decarbonising the Scottish Transport Sector

The Decarbonising the Scottish Transport Sector report was produced by Element Energy[32], on behalf of Transport Scotland. It analyses the transport policies necessary to achieve the national climate targets set out by the Scottish Government in 2019. The report investigated different scenarios such as business as usual (using existing policy measures) and a full intervention

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[29] Society for Motor Manufacturers and Traders (SMMT) New Car Market and Parc Outlook to 2035 by Powertrain Type at 11th June 2021.

[30] Transitioning to Zero EmissionCars and Vans: 2035 Delivery Plan, HM Government. July 2021.

[31] Driving the Future Today – A strategy for ultralowemission vehicles in the UK, Office for Low Emission Vehicles, September 2013.

[32] Decarbonising the Scottish Transport Sector – Summary Report. September 2021. Element Energy on behalf of Transport Scotland.

(rapid introduction of low and zero-emission technologies, reduced vehicle kilometres, increased active travel and reduced travel demand).

The report highlights that EVs are crucial in the future transport mix, but also recognises that reliable charging infrastructure is required, to enable the transition from ICE to EVs. Therefore, investment in EV charging infrastructure is important in ensuring that the Scottish Government's climate targets are met.

The report focuses on calculating the maximum annual permissible emissions from the transport sector annually, to ensure the targets set out by the government are met. The report does not provide a forecast on the anticipated growth of EVs within Scotland.

E.1.2 Data Sources

The data sources utilised in the demand forecasting are outlined within this section.

A baseline of the total number of registered BEV and ULEV cars, LGVs, taxis and private hires was created using DfT and STS data. This baseline was used to create five different forecasts for the total of number of these vehicles by 2025 and 2030, through extrapolating the baseline and using an additional four sources listed in Section 6.1.1.1.

E.1.2.1 Department for Transport VEH01 Statistical Data Set

Df T and Driver Vehicle Licensing Agency (DVLA) annually publishes vehicle statistics[17] for the United Kingdom, which provides an insight into the current vehicle fleet. The statistics and data provide the number of license vehicles and new registrations for a given year, is broken down by the type of vehicle, the characteristics of vehicles and a geographic breakdown.

The following data sets have been utilised to derive a baseline of the number of EV cars and LGVs on the road in Ayrshire.

- VEH0105 – Licensed vehicles by body type and local authority: United Kingdom;
- VEH0132 – Licensed ultra low emission vehicles by local authority: United Kingdom;
- VEH0133 – Licensed ultra low emission vehicles by body type and propulsion or fuel type: United Kingdom;
- VEH0150 – Vehicles registered for the first time by body type, monthly: Great Britain and United Kingdom.

The Df T data used are correct as of 13th January 2022.

E.1.2.2 Scottish Transport Statistics

Similar to the DfT data, Transport Scotland publishes the Scottish Transport Statistics annually which provides an insight into the current vehicle fleet in Scotland.

The following data sets have been used to derive a baseline of the number of EV taxis and private hires on the road in Ayrshire.

- Table 1.4 – Taxi, private hire cars and drivers licensed by local authority area, 2020;
- Table 13.9 – Number of new registrations by body type and propulsion type in Scotland during 2019 (Thousands);
- Table 13.10 – Number of licensed vehicles by body type and propulsion type in Scotland as of 31 December 2019 (Thousands).

The latest edition of the STS data (No. 39 2020[18]) was released in 2021.

E.1.2.3 Future Energy Scenarios 2021 Data Workbook

The 2021 FES Document[28] sets out four different pathways: consumer transformation, system transformation, leading the way and steady progression, based on the envisaged energy supply and consumption in the future. Both 'consumer transformation' and 'leading the way' sees the 2030 ban on petrol and diesel cars and vans, set out by the UK Government, achieved, whereas both the 'system transformation' and 'steady progression' sees the 2030 ban date missed and achieved in 2032 and 2035, respectively.

The following data sets have been used:

- CV.35: Number of BEV cars on the road;
- CV.36: Number of BEV vans on the road;
- CV.j: Number of PHEV cars on the road;
- CV.k Number of PHEV vans on the road.

The FES data used are correct as of 17th December 2021.

E.1.2.4 Society of Motor Manufacturers and Traders' New Car Market Outlook to 2035

SMMT's New Car Market Outlook to 2035[29] forecasts are based on two different outlooks:

- New car market: the total number of new cars on the road per year; and
- Car parc: the total number of cars on the road, factoring in the current vehicle survival rates and assumes that the current survival rates are maintained.

Only the new car market data has been used to forecast the total number of EVs, as automotive technology improves so does vehicle survival rates.

E.1.2.5 Transitioning to Zero Emission Cars and Vans: 2035 Delivery Plan

The 2035 delivery plan[30] presents two graphs that illustrates the potential proportion of new cars and vans sales that will be ULEVs and ZEVs, taking into consideration the phasing out of new petrol and diesel cars and vans by 2030, with the aim of all new cars and vans to be fully ZEVs from 2035.

The trendlines from the graphs have been replicated and have been used for the Ayrshire forecasts.

E.1.2.6 Decarbonising the Scottish Transport Sector

The Decarbonising the Sottish Transport Sector report[32] was provided to Mott MacDonald, with permission to use, by Scottish Future Trust. It is noted that none of the scenario pathways outlined in the forecast are official Scottish Government Policy.

The report reviews the changes Scotland must undertake to meet its 2045 net zero target. One of the studies include analysing the differing levels of ZEV uptake, and has produced forecasts based on four different policy scenarios:

- Policy scenario 0: 'Introduction of low emission vehicles in line with current policy support';
- Policy scenario 1: 'Rapid introduction of Zero Emission fuels':
- Policy scenario 2: As per policy scenario 1 and 'shift away from private car use supported by the rollout of MaaS';
- Policy scenario 3: As per policy scenario 2 and 'reduction in number of trips and trip distances due to changes in commuting and shopping behaviour and improved access to services close to people's homes.'.

As part of the study, a dataset illustrating the vehicle stock, per vehicle type per year, for each policy scenario is provided.

E.1.3 Electric Vehicle Forecast Baseline

A baseline of existing BEVs and PHEVs, within Ayrshire, is required to enable a forecast. The baseline for cars and LGVs were derived using DfT data, however as data for taxis and private hires is collected separately by the Scottish Government, STS data was used. Data from 2015 onwards was used as this was when all datasets were based upon UK wide sources, to ensure consistency.

Df T data sets VEH0132 and VEH0150 were used for BEV and PHEV cars and LGVS. Whilst VEH0132 provides the total number of BEVs and PHEVs by local authorities, it does not distinguish between different vehicle types (cars, LGVs etc.). VEH0150 is the for vehicles registered for the first time and separates the data by vehicle types. Therefore, it was used to work out the percentage of one type of vehicle. However, an assumption was made that that the percentages, of one type of vehicle, will be the same for the total amount of vehicles registered. To forecast the number of BEV and PHEV cars and LGVs, the percentages calculated using VEH0150 were applied to the total number of BEVs and PHEVs from VEH0132.

STS datasets were used for BEV and PHEV taxis and private hire, however as the datasets only provide information for taxis, it has been assumed that private hires would follow the same trend as BEVs. The STS dataset shows that 0 BEV and 91 'Hybrid Electric' taxis were registered in 2019. As the dataset does not distinguish between PHEV and Hybrid Electric Vehicles (HEVs), it was assumed that the total number of registered PHEV taxis was 0. Therefore, for 2020 a nominal value of 1 was used for the baseline to enable the forecasts to work.

Once the baseline was established, a range of forecasts were then derived using the literature.

E.1.3.1 Forecast using DfT and STS Data

BEV cars and LGVs:

To derive the number of vehicles registered, by body type, for Ayrshire, it was assumed that all local authorities will have a fixed proportion of the overall total of vehicles registered in the UK, and thus VEH0150 could be used for the forecast. The following steps were taken:

1. Using VEH0105, the total number of registered vehicles, per annum, for Scotland and Ayrshire were found. The average ratio between Ayrshire and Scotland were calculated over 2015 – 2020 was 2.6%;
2. This percentage was then applied to VEH0150 to calculate the total number of different vehicles registered for the first time in Ayrshire, between 2015 and 2020;
3. Comparing the proportion of first-time registered vehicles to the total number of registered vehicles in Ayrshire, between 2015 – 2020, a lower bound and an upper bound was derived, using the lowest and highest percentage, respectively.

The forecasting process is outlined as follows:

1. Plot the total number of registered vehicles from 2015 to 2020, using data from VEH0105.
2. Find the difference between the total number of vehicles from the latest year by the previous year.
3. Plot the total number of first-time registered BEV vehicles from 2016 to 2020. It was assumed that there is no car loss between the years;

4. Apply a line of best fit to the plotted values and continue the line to 2036. This is when all first-time registered cars and LGVs should be ZEVs, as all new cars and LGVs will be required to be ZEVs from 2035 onwards;
5. Calculate the minimum and maximum number of vehicles registered for the first time, for each year, using the lower and upper bound calculated in step 3 above;
6. Plot the baseline values and the minimum and maximum number of vehicles registered for the first time in 2036. Using a line of best fit, estimate the number of vehicles registered for the first time from 2021 to 2035 (inclusive).
7. Sum the values cumulatively to get the total number of BEVs in the years up to and including 2035.

PHEV cars and LGVs:

The forecasting process is outlined as follows:

1. Plot the PHEV baseline values and calculate the percentage of PHEV cars/LGVs to BEV cars/LGV, for 2015 to 2020;
2. Set 0% for the year 2036 (as all first-time registered cars and LGVs will be required to be BEV from 2035) and plot along with the percentages calculated in step 1.
3. Apply a line of best fit to estimate the proportion of PHEV cars/LGVs to BEV cars/LGVs;
4. Multiply the calculated percentages with the minimum and maximum BEV cars/LGVs forecast, to forecast the minimum and maximum number for PHEV cars/LGVs registered for the first time.
5. Sum the values cumulatively (from 2021 onwards) to derive the total number of PHEVs in the years to 2030.

BEV taxis and Private Hires:

A similar approach was taken as the BEV cars and LGVs methodology for taxis and privates hires using the STS data.

The forecasting process is outlined as follows:

1. Plot the total number of registered taxis/private hires from 2015 to 2020;
2. Apply a line of best fit and continue the line to 2036, to forecast the total number of vehicles;
3. Plot the baseline value of 1 for the year 2020 and the total number of taxis/private hires registered in 2036;
4. Apply a line of best fit to estimate the total number of BEV taxis/private hires registered in 2021 to 2035 (inclusive). This forecast will be used as the minimum total number of BEV taxis/private hires registered;
5. Calculate the maximum number of vehicles registered for the first time, by calculating the percentage difference between the maximum and minimum number of BEV cars and applying the percentage increase to the minimum forecast. This method assumes that the trend for taxis and private hires follows the same trend for cars.

PHEV taxis and Private Hires:

The forecasting process involves multiplying the percentages calculated for the PHEV cars and LGVs methodology with the minimum and maximum forecasts calculated in the BEV taxis and private hires methodology.

E.1.3.2 Forecast based on FES 2021 Data

1. Sheets CV.35, CV.36, CV.j and CV.k, within the FES 2021 data workbook have predicted the total number of BEVs and PHEVs for Scotland, per annum for cars and LGVs, from 2020 to 2048. The trendlines for consumer transformation', 'system transformation', 'steady

progression' and 'leading the way' were replicated by calculating the percentage difference of the total number of BEVs/PHEVs between each year. The trends were then applied to the baseline values of each type of vehicle. It has been assumed that taxis and private hires will follow the same trend for cars.

E.1.3.3 Forecast based on SMMT 2021 Data

2. The SMMT data forecasts the number of new BEV and PHEV cars for Scotland, per annum, from 2020 to 2035. The trendlines for 'low', 'central' and 'high' were replicated by calculating the percentage difference of the total number of BEVs/PHEVs between each year. The trends were then applied to the baseline values of each type of vehicle. This only forecasts the number of new BEVs/PHEVs per annum, therefore the values are summed cumulatively to get the total number of BEV/PHEVs cars in the years up to 2030. It has been assumed that LGVS, taxis and private hires will follow the same trend for cars.

E.1.3.4 Forecast based on the Road to 2035 Data

The Road to 2035 data provides a low and high estimate of the percentage of new car and van sales (separately) per annum for both ULEVs and ZEVs. It has been assumed that ZEVs are BEVs, and PHEVs is the difference between ULEVs and ZEVs.

Cars and LGVs

The percentage bounds were applied to the minimum and maximum number of cars and LGVs registered for the first time to 2036. The minimum and maximum number of cars and LGVs registered for the first time were calculated using the same methodology as BEV cars and LGVs in section 130E.1.3.1. This only forecasts the number of new BEVs per annum, therefore the values (from 2021 onwards) were summed cumulatively to get the total number of BEVs in the years up to 2030.

Taxis and Private Hires

As there is no data for the number of taxis/private hires registered for the first time, a nominal value of 1 has been used in the year 2020, and the same trend for cars and LGVs applied for both taxis and private hires.

E.1.3.5 Forecast based on Decarbonising the Scottish Transport Sector

The growth rates for 'Policy scenario 0', 'Policy scenario 1', 'Policy scenario 2', and 'Policy scenario 3' were calculated from the Element Energy dataset which forecasts the total number of different vehicle stock, per annum, for Scotland from 2011 to 2045. The growth rates were then applied to the baseline values for each type of vehicle, for Ayrshire.

E.2 Electric Vehicle Charging Infrastructure Forecast Methodology

This section outlines the secondary element of the EVCI forecast by calculating the energy requirements based on the EV forecasts.

E.2.1 Data Inputs

E.2.1.1 Department for Transport VEH01 Statistical Datasets

The Df T vehicle statistics datasets[17] were utilised for the EVCI forecast, namely the VEH0105 and VEH0132 (a to c) data tables.

E.2.1.2 Scottish Transport Statistics No.39 2020 Edition

Transport Scotland regularly publish the Scottish Transport Statistics (STS)[18], which is a dataset on transport data and analysis within Scotland. Elements within Chapter 5 of the STS were utilised in the EVCI forecasting to derive a range of localised road traffic data for North, East and South Ayrshire.

The data tables used from the STS are as follows:

- Table 4.2: Local Authority Road Network (km) – filtered to the Ayrshire councils.
- Table 5.4: Traffic on major roads (by type) and minor roads – filtered to the Ayrshire councils.
- Table 5.5: Total traffic on major and minor roads since 2009 – f iltered to the Ayrshire councils.
- Table 11.27d: Transport Model for Scotland: inter-zonal trips made on an average weekday within Scotland, circa. 2018 (Vehicle trips: cars and goods vehicles only).

E.2.1.3 Vehicle Efficiencies

As the battery size, vehicle efficiency and subsequent range of EVs vary between manufacturers and models, an average efficiency for each vehicle type was required in the calculations. As no public database for all types of EV within the UK exists, a range of data sources was used instead. The EV Database[33] has a comprehensive dataset for electric cars, with the “Energy Consumption” section utilised to obtain an overall average.

For LGVs, a literature review was undertaken to derive average efficiencies for vans on sale in the UK. The energy consumption was calculated based on the typical range quoted compared to the battery size to derive a rate of kWh per km.

E.2.1.4 London 2030 Electric Vehicle Infrastructure Strategy

Building on the EV Infrastructure Delivery Plan[34], the strategy[35] outlines the metropolitan area can deliver the required EV charging infrastructure to support the decarbonisation of the transport sector. It details what the London councils are required to do to meet this aim.

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[33] Electric Vehicle Database – Energy Consumption. https://ev-database.uk/cheatsheet/energy-consumption-electric-car

[34] London Electric Vehicle Infrastructure Delivery Plan, The Mayor’s Electric Vehicle Infrastructure Taskforce, June 2019

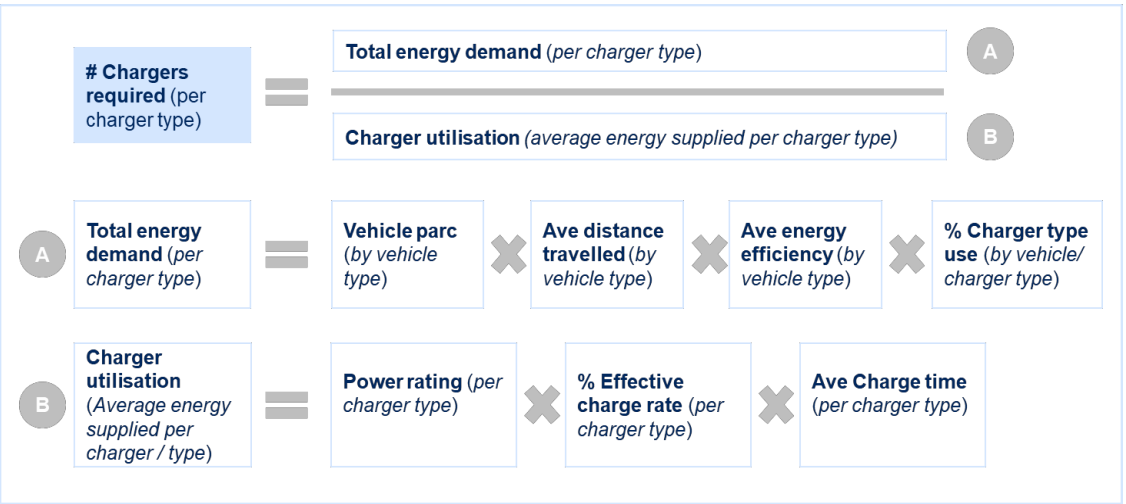
[35] London 2030 Electric Vehicle Infrastructure Strategy, Transport for London and Mayor of London. December 2021

E.2.1.5 North, East and South Ayrshire Councils Charging Infrastructure

E.2.2 Methodology

The calculation for the required number of EVCI, by type, is split into two distinct components: (A) the total energy demand by charger type and (B) charger utilisation. The overall process is shown in Figure E.10.

Figure E.10: Calculation to obtain the Number of Chargers by Type



Source: Figure C2, London 2030 Electric Vehicle Infrastructure Strategy.

E.2.2.1 Part A: Total Energy Demand (by Charger Type)

Part A of the calculation, for the required number of EVCI, is to calculate the total energy demand. This is based on the number of vehicles (vehicle parc), by type, multiplied by the average annual distance travelled by vehicle type, all for a given year.

The vehicle parc was obtained using the EV demand forecast output by vehicle type from Section 6.1.1. The average distance travelled by each vehicle type was calculated using Scottish Transport Statistics data on the annual distance travelled on trunk and local authority roads. 2019 data was used as a baseline. Due to the uncertainties as a result of the Covid-19 pandemic and potential impact of the Scottish Government target of reducing vehicle km travelled by 20%, it was assumed that the 2019 baseline data would not be impacted by these factors, during the study period of Ayrshire's road network.

The distance travelled for EVs in 2019 was calculated by multiplying the annual figure from the 2019 baseline with the ratio of forecasted number of EVs to forecasted total vehicle fleet. From this, dividing the distance travelled by the forecasted number of EVs, the average distance travelled per vehicle can be determined and applied to future years. This assumes that the average distance travelled per vehicle remains consistent in future years.

From this, the annual energy demand per vehicle type is calculated by multiplying the average efficiency of the vehicle type to the calculated average distance travelled. This enables the energy requires for each EV to travel the average annual miles.

Finally, the total energy demand is then calculated per method of charging: private (home/work), residential charging hub, destination and rapid. Assumptions on how vehicle owners and operators will charge their vehicle were made and are detailed in Appendix D.

The main determining factor on which charging method would be used was the availability of off-street parking. It was assumed that all households with off-street parking would be capable of recharging an EV. The percentages of households with off-street parking in Ayrshire are summarised in

Table 7.3.

The total energy demand of private energy demands is removed from the calculation as this is out of the scope of the project.

E.2.2.2 Part B: Charger Utilisation

Charger utilisation is calculated per charger type and is based on the following:

- Power rating of each type of charger, which is the typical output of the charger type. The calculated values have been conservatively assumed based on typical power outputs in 2022.
- Effective charge rate, which is the typical output received by the vehicle. This value can be lower than the power rating of the charger due to grid constraints or power demands at the time, e.g. if all chargers at the site are being utilised simultaneously.
- Average daily charge time, which is the assumed time the charger is in operation per day.

The calculated utilisation values were estimated for residential and destination charging only, as rapid charging utilisation was obtained from the average daily utilisation between July and December 2021 prior to tariffs being introduced. The values are summarised in Table E.1.

Table E.1: Charger Utilisation Calculation Values

	Power Rating (kW)	Effective Charge Rate (%)	Average Daily Charge Time
Residential Charging (Slow/Fast)	7	50%	6
Destination Charging (Slow/Fast)	22	50%	6
Rapid Charging	50	75%	4

The values from this table are then multiplied by an annualization factor (number of days in a year minus the main public holidays) to calculate the charger utilisation.

E.2.3 Overall Charger Requirements

The energy demand calculated in Part A is divided by the annual charger utilisation calculated in Part B to yield the requirement for each charger type.

The charger requirements have been calculated for the low, central and high EV forecasts for both 2026 and 2030 forecast years calculated.

F. Grid Capacity Assessment

F.1 North Ayrshire

Table F.2: North Ayrshire Council Grid Capacity Analysis Outputs from the EV Optimisation Model

Substation	Firm Capacity (MVA)	Max Load (MVA)	Total Resi EVCI	Max Resi Charger Load (kW)	Total Dest. EVCI	Max Dest. Charger Load (kW)	Total Rapid EVCI	Max Rapid Charger Load (kW)	Spare Capacity (MVA)	Total NAC Charger Load (MVA)	Potential Private Sector Load (MVA)	Remaining Capacity (MVA)
Fairlie	14.00	1.71	0	0	2	14	1	50	12.29	0.06	0.09	12.20
Kilbirnie	23.00	13.97	4	28	24	408	5	250	9.03	0.69	1.20	7.82
Dalrymple Drive	24.00	14.31	14	98	24	198	1	50	9.69	0.35	2.11	7.59
Stevenston	21.00	15.23	2	14	23	251	1	50	5.77	0.32	1.79	3.97
Irvine	21.00	19.04	2	14	14	188	1	50	1.96	0.25	0.01	1.95
Largs	24.00	8.91	8	56	14	158	3	150	15.09	0.36	0.94	14.16
Hunterston	10.00	4.96	2	14	14	308	4	200	5.04	0.52	0.81	4.23
Byrehill	24.00	8.67	10	70	6	102	1	50	15.33	0.22	0.76	14.57
Saltcoats Main	40.00	15.52	16	112	30	360	8	400	24.48	0.87	0.60	23.89
Finnock Bog	10.00	5.24	0	0	4	28	1	50	4.76	0.08	0.22	4.54
Ravenspark	21.00	8.95	6	42	4	28	0	0	12.05	0.07	0.03	12.02
Riverside	40.00	2.52	12	84	6	132	2	100	37.48	0.32	0.68	36.80
New Cumnock	5.00	2.83	2	14	0	0	0	0	2.17	0.01	0.15	2.02

F.2 East Ayrshire

Table F.3: East Ayrshire Council Grid Capacity Analysis Outputs from the EV Optimisation Model

Substation	Firm Capacity (MVA)	Max Load (MVA)	Total Resi EVCI	Max Resi Charger Load (kW)	Total Dest. EVCI	Max Dest. Charger Load (kW)	Total Rapid EVCI	Max Rapid Charger Load (kW)	Spare Capacity (MVA)	Total EAC Charger Load (MVA)	Potential Private Sector Load (MVA)	Remaining Capacity (MVA)
Lethanhill	10.00	3.61	8	56	8	86	1	50	6.39	0.19	0.22	6.17
Stewarton	24.00	9.89	8	56	10	130	0	0	14.11	0.19	0.59	13.52
Langlands Street	21.00	10.49	14	98	43	436	8	400	10.51	0.93	2.02	8.49
Cumnock	24.00	9.21	14	98	22	244	2	100	14.79	0.44	0.60	14.18
New Cumnock	5.00	2.83	2	14	0	0	1	50	2.17	0.06	0.15	2.02
Grassyards	23.00	13.16	28	196	22	214	0	0	9.84	0.41	0.26	9.58
Mauchline	10.00	6.16	4	28	10	70	3	150	3.84	0.25	0.36	3.48
Kilmarnock	24.00	18.23	4	28	8	86	0	0	5.77	0.11	0.18	5.59
Darvel	10.00	2.16	6	42	8	86	1	50	7.84	0.18	0.21	7.63
Newmilns	24.00	5.78	16	112	4	88	0	0	18.22	0.20	0.39	17.83
Killoch Colliery	21.00	12.83	2	14	4	28	1	50	8.17	0.09	0.22	7.95
Glengall	21.00	13.64	2	14	2	44	0	0	7.36	0.06	0.19	7.17
Queens Drive	24.00	6.79	8	56	0	0	0	0	17.21	0.06	0.06	17.15

F.3 South Ayrshire

Table F.4: South Ayrshire Council Grid Capacity Analysis Outputs from the EV Optimisation Model

Substation	Firm Capacity (MVA)	Max Load (MVA)	Total Resi EVCI	Max Resi Charger Load (kW)	Total Dest. EVCI	Max Dest. Charger Load (kW)	Total Rapid EVCI	Max Rapid Charger Load (kW)	Spare Capacity (MVA)	Total #SAC Charger Load (MVA)	Potential Private Sector Load (MVA)	Remaining Capacity (MVA)
Troon	24.00	15.28	16	112	18	216	3	150	8.72	0.48	1.13	7.59
Mill Street	21.00	17.85	24	168	32	374	3	150	3.15	0.69	3.22	-0.07
Glengall	21.00	13.64	14	98	8	176	0	0	7.36	0.27	0.19	7.17
Monkton	21.00	15.73	10	70	10	130	1	50	5.27	0.25	0.38	4.89
Drumley	10.00	6.23	8	56	4	88	3	150	3.77	0.29	0.65	3.12
Girvan	24.00	15.80	20	140	6	102	4	200	8.20	0.44	0.41	7.80
Heathfield Rd Ayr	21.00	10.64	18	126	6	132	0	0	10.36	0.26	0.15	10.21
Maybole	10.00	7.44	14	98	10	160	1	50	2.56	0.31	0.46	2.10
Old Bridge Road	24.00	10.67	2	14	6	72	0	0	13.33	0.09	0.04	13.29
Riverside	40.00	2.52	2	14	2	44	1	50	37.48	0.11	0.68	36.80
Pinwherry	9.00	2.17	8	56	0	0	0	0	6.83	0.06	0.03	6.81
Lethanhill	10.00	3.61	2	14	0	0	0	0	6.39	0.01	0.22	6.17

G. Identified Potential Charger Locations

G.1 North Ayrshire

G.1.1 Destination Chargers (7kW to 22kW)

Table G.5: North Ayrshire Council – List of Proposed Destination Charger (7kW to 22kW) Sites

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D1	Afton Road Car Park, Stevenston	KA20 3EY	226690	641901	Car Park	1	22.0	Stevenston	Assumed average 22kW. Moved from Schoolwell St car park at NAC request.
D2	Ardeer Youth and Community Centre, Stevenston	KA20 3NB	226903	641227	Off-Street	2	7.0	Stevenston	Assumed average 7kW. Reduced from 22kW at NAC request.
D3	Auchenharvie Academy, Stevenston	KA20 3JW	225873	641727	Off-Street	2	7.0	Stevenston	Assumed average 7kW. Reduced from 22kW at NAC request.
D4	Auchenharvie Leisure Centre, Stevenston	KA20 3JR	225627	641672	Off-Street	2	7.0	Stevenston	Assumed average 7kW. Reduced from 22kW at NAC request.
D5	Beith Community Centre	KA15 2BQ	234794	654187	Off-Street	1	22.0	Kilbirnie	Assumed average 22kW
D8	Blackwaterfoot Car Park, Blackwaterfoot	KA27 8ET	189584	628142	Car Park	1	22.0	Hunterston	Assumed average 22kW.
D9	Bradshaw Street Car Park, Saltcoats	KA21 5HR	224788	641215	Car Park	1	7.0	Saltcoats main	Assumed average 7kW
D10	Caledonia Car Park, Irvine	KA12 0AA	232265	639129	Car Park	3	7.0	Dalrymple Drive	Assumed average 7kW. Reduced from 22kW at NAC request.
D11	Castlepark Community Centre, Irvine	KA12 9LQ	232220	640573	Off-Street	2	7.0	Ravenspark	Assumed average 7kW. Reduced from 22kW at NAC request.
D12	Civic Centre, Ardrossan	KA22 8HJ	223129	642413	Car Park	1	7.0	Saltcoats Main	Assumed average 7kW. Changed from Glasgow St.
D14	Dalry Primary School/Community Sports Hub	KA24 5DR	228904	649386	Off-Street	2	7.0	Kilbirnie	Assumed average 7kW.
D15	Eglinton Park, Irvine	KA12 8TA	231924	641862	Off-Street	2	7.0	Irvine	Assumed average 7kW. Moved from St Mark's/Annick Primary at NAC request. Reduced from 22kW at NAC request.
D16	Garnock Community Campus, Garnock	KA14 3BJ	232476	652767	Off-Street	1	22.0	Kilbirnie	Assumed average 22kW. Complement existing charger
D18	Garrison House, Millport	KA28 0DJ	216446	655034	Off-Street	1	22.0	Hunterston	Assumed average 22kW.
D19	Gateside Street Car Park, Largs	KA30 9LG	220409	659411	Car Park	1	7.0	Largs	Assumed average 7kW. Moved from Main St
D20	Girdle Toll, Irvine	KA11 1AQ	233943	640268	Off-Street	1	22.0	Riverside	Assumed average 22kW utilisation.
D21	Glen Road, West Kilbride	KA23 9BL	220540	648288	On-Street	1	22.0	Hunterston	Assumed average 22kW.
D22	Invercloy Car Park, Brodick, Isle of Arran	KA27 8BD	201496	636066	Car Park	1	22.0	Saltcoats Main	Assumed average 7kW. Reduced from 22kW at NAC request. Moved from Shore Road.
D23	Kilmeny Terrace Car Park, Saltcoats	KA22 8DX	223582	642136	Car Park	1	7.0	Saltcoats Main	Assumed average 7kW. Changed from South Crescent Road.
D24	Largs Campus, Largs	KA30 9EU	221260	659995	Off-Street	1	22.0	Largs	Assumed average 22kW. Complement existing charger
D25	Main Road Fairlie Car Park, Fairlie	KA29 0AB	221013	655410	Car Park	1	7.0	Fairlie	Assumed average 7kW. Moved from Jetty Road.
D26	Main Street Car Park, Dreghorn	KA11 4AH	235244	638219	Car Park	1	22.0	Riverside	Assumed average 22kW.
D28	New St Car Park, Dalry	KA24 5AF	229395	649356	Car Park	1	7.0	Kilbirnie	Assumed average 7kW
D29	Newton Street Car Park, Kilbirnie	KA25 6HN	231530	654381	Car Park	1	7.0	Kilbirnie	Assumed average 7kW
D30	Portencross Car Park	KA23 9QA	217661	648796	Car Park	1	22.0	Hunterston	Assumed average 22kW.
D32	Roslin House, Stevenston	KA20 3JL	226270	641923	Off-Street	1	22.0	Stevenston	Assumed average 22kW. Moved from Lockhart ASN Campus at NAC request.
D33	Seafront Car Park, Largs	KA30 8LZ	220198	659574	Car Park	2	7.0	Largs	Assumed average 7kW. Reduced from 22kW at NAC request.
D36	Silverburn Road Car Park, Whitling Bay	KA28 8PS	204544	626213	Car Park	1	22.0	Hunterston	Assumed average 22kW.
D37	Skelmorlie Community Centre	PA17 5AH	219537	668047	Off-Street	2	7.0	Finnock Bog	Assumed average 7kW. Complement existing charger. Reduced from 22kW at NAC request.
D38	Smith Street Car Park, Dalry	KA24 5BZ	229291	649450	Car Park	2	22.0	Kilbirnie	Assumed average 22kW.
D39	Springside Community Centre	KA11 3BG	236989	638788	Off-Street	1	22.0	Riverside	Assumed average 22kW.

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D41	Strand, Beith	KA15 1DT	234831	653882	On-Street	1	22.0	Kilbirnie	Assumed average 22kW
D42	The Portal, Irvine	KA12 0BT	232319	638980	Car Park	2	7.0	Dalrymple Drive	Assumed average 7kW. Reduced from 22kW at NAC request.
D43	Viking Centre, Largs	KA30 8QL	220227	660048	Car Park	2	7.0	Largs	Assumed average 7kW. Complement existing charger. Reduced from 22kW at NAC request.
D44	Volunteer Hall Car Park, Irvine	KA12 0DA	232282	638770	Car Park	2	7.0	Dalrymple Drive	Assumed average 7kW. Reduced from 22kW at NAC request.
D45	West Kilbride Community Centre, West Kilbride	KA23 9EH	220304	648379	Off-Street	1	22.0	Hunterston	Assumed average 22kW. Moved from Main St Car Park
D46	Woodlands Primary, Irvine	KA12 0PU	232706	639415	On-Street	2	7.0	Dalrymple Drive	Assumed average 7kW utilisation. Proposed outside school in parking bays for versatility across the day. Reduced from 22kW at NAC request.
D47	Woodwynd Car Park, Kilwinning	KA13 6AE	230392	643392	Car Park	1	22.0	Byrehill	Assumed average 22kW. Complement existing charger

Source: Mott MacDonald

G.1.2 Rapid Chargers (50kW)

Table G.6: North Ayrshire Council – List of Proposed Rapid Charger (50kW) Sites

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D6	Bellman's Close Car Park, Beith	KA15 2AX	234904	654081	Car Park	2	50.0	Kilbirnie	Assumed average 50kW. Provides rapid charging in area with limited options close to A737
D7	Blackwaterfoot Car Park, Blackwaterfoot	KA27 8ET	189584	628142	Car Park	1	50.0	Hunterston	Assumed average 50kW. No rapid chargers in West of island. Suggest priortise rapid over destination
D13	Cumbrae Ferry Terminal	KA28 0HQ	218329	658621	Off-Street	1	50.0	Hunterston	Assumed average 50kW. Provides rapid charging for vehicles waiting on the ferry.
D17	Garnock Community Campus, Garnock	KA14 3BJ	232476	652767	Off-Street	1	50.0	Kilbirnie	Assumed average 50kW. Complement existing charger and provides rapid charging in area with limited options
D27	Main Street Car Park, Dreghorn	KA11 4AH	235244	638219	Car Park	1	50.0	Riverside	Assumed average 50kW. Provides rapid charging in area with limited options close to B7081
D31	Princes Street, Ardrossan	KA22 8GA	222900	642108	On-Street	2	50.0	Saltcoats Main	Assumed average 50kW. Provides rapid charging for vehicles in town centre near ferry
D34	Seafront Car Park, Largs	KA30 8LZ	220198	659574	Car Park	2	50.0	Largs	Assumed average 50kW
D35	Ship House Car Park, Lamlash	KA27 8LT	202642	631042	Car Park	1	50.0	Saltcoats Main	Assumed average 50kW.
D40	Springside Primary School, Station Road	KA11 3AZ	236775	638748	Off-Street	1	50.0	Riverside	Assumed average 50kW. Provides rapid charging in area with limited options close to B7081

Source: Mott MacDonald

G.1.3 Residential Chargers (<7kW)

Table G.7: North Ayrshire Council – List of Proposed Residential Charger (<7kW) Sites

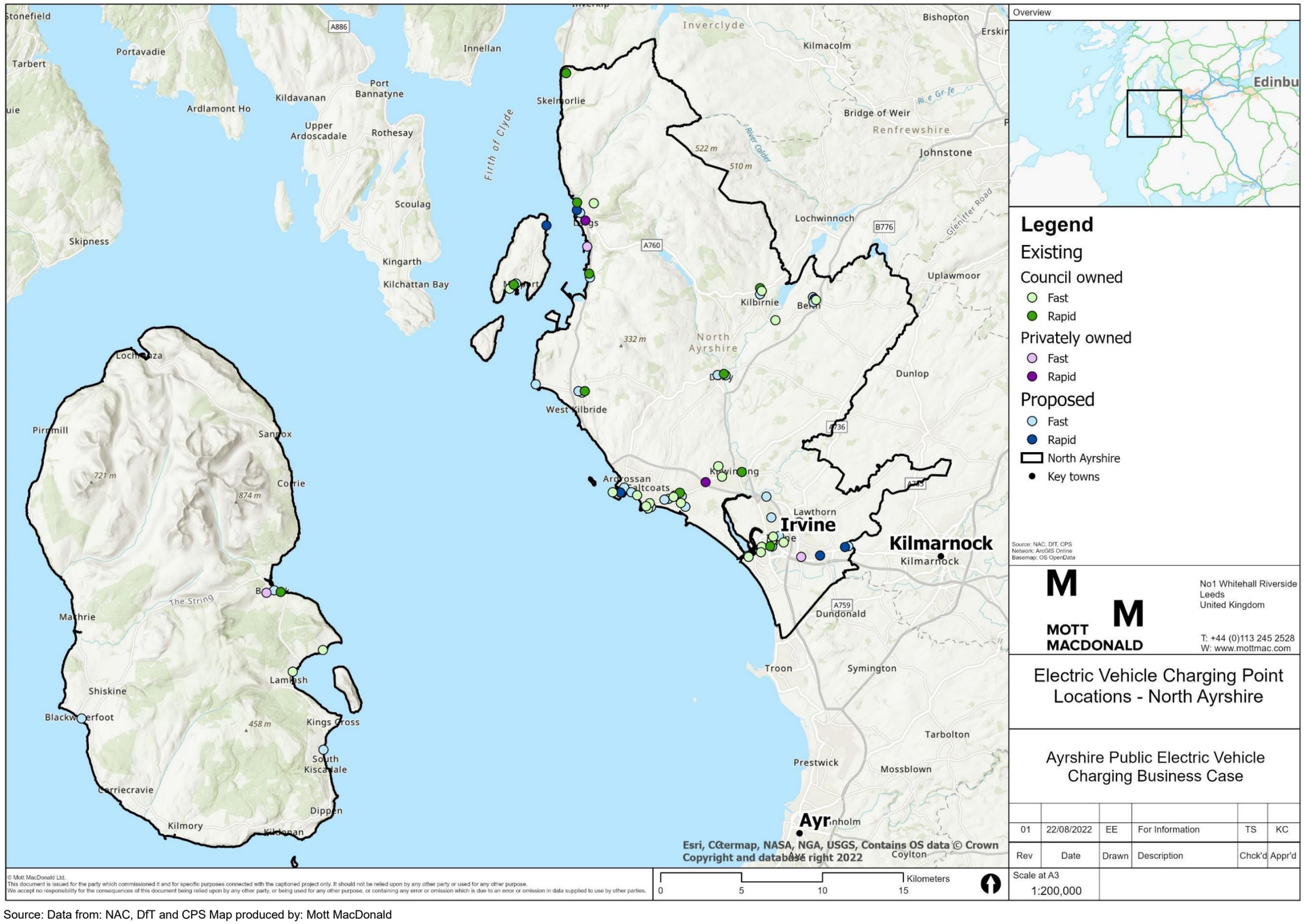
Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
R1	Anderson Drive, Saltcoats	KA21 6AS	225015	642464	On-street	2	7.0	Saltcoats Main	Assumed average 7kW
R2	Argyle Road, Saltcoats	KA21 5AF	224284	641994	On-street	2	7.0	Saltcoats Main	Assumed average 7kW
R3	Baird Avenue, Kilwinning	KA13 7AP	230244	643970	On-Street	2	7.0	New Cumnock	Assumed average 7kW
R4	Bensley Avenue, Irvine	KA11 1AH	233991	640216	Car Park	2	7.0	Dalrymple Drive	Assumed average 7kW
R5	Blacklands Avenue, Kilwinning	KA13 6HU	230254	642711	Car Park	2	7.0	Byrehill	Assumed average 7kW
R6	Braehead, Girdle Toll, , Irvine	KA11 1BE	233688	640462	Car park	2	7.0	Dalrymple Drive	Assumed average 7kW
R7	Brisbane Rd, Largs	KA30 8NW	220494	659962	On-Street	2	7.0	Largs	Assumed average 7kW
R8	Broomfield Place, Largs	KA30 8LA	220374	658766	On-street	2	7.0	Largs	Assumed average 7kW
R9	Broomlands Drive, Irvine	KA12 0DT	232488	638677	On-street	2	7.0	Dalrymple Drive	Assumed average 7kW
R10	Burns Avenue, Saltcoats	KA21 6HD	225013	642983	On-Street	2	7.0	Saltcoats Main	Assumed average 7kW
R11	Carment Drive, Stevenston	KA20 3LD	227021	641210	On-street	2	7.0	Stevenston	Assumed average 7kW
R12	Claremont Crescent, Kilwinning	KA13 7HF	229889	643467	On-Street	2	7.0	Byrehill	Assumed average 7kW

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
R13	Corserine Bank, Irvine	KA11 1LH	234001	639459	Car Park	2	7.0	Dalrymple Drive	Assumed average 7kW
R14	Dickson Drive, Irvine	KA12 9AH	232254	640450	On-Street	2	7.0	Ravenspark	Assumed average 7kW
R15	Dundonald Road, Irvine	KA11 4DB	235282	638120	Car park	2	7.0	Riverside	Assumed average 7kW
R16	Garelet Place, Irvine	KA11 1EX	234742	638956	Car Park	2	7.0	Riverside	Assumed average 7kW
R17	Garnock St, Dalry	KA24 4AW	229225	649001	On-Street	2	7.0	Kilbirnie	Assumed average 7kW
R18	Gladstone Road, Saltcoats	KA21 5LF	225018	641641	On-Street	2	7.0	Saltcoats Main	Assumed average 7kW. Changed from Windmill Wynd
R19	Glasgow Street, Isle of Cumbrae	KA28 0DP	216750	655014	On-street	2	7.0	Hunterston	Assumed average 7kW
R20	Glenapp Place, Kilwinning	KA13 6TQ	229504	642704	On-Street	2	7.0	Byrehill	Assumed average 7kW
R21	Haco Street, Largs	KA30 9BG	220765	659907	On-Street	2	7.0	Largs	Assumed average 7kW. Moved from Greenock Road
R22	Harbour Street, Irvine	KA12 8PZ	231310	638384	Car Park	2	7.0	Irvine	Assumed average 7kW
R23	Heatherstane Way, Irvine	KA11 1DU	235314	638925	Car Park	2	7.0	Riverside	Assumed average 7kW
R24	Holehouse Road, Largs	KA30 9JH	221003	659714	On-Street	2	7.0	Largs	Assumed average 7kW
R25	Ladeside Court, Kilbirnie	KA25 6BG	231157	653999	On-Street	2	7.0	Kilbirnie	Assumed average 7kW. Moved from Holmhead.
R26	Lanfine Way, Irvine	KA11 1BT	234004	640710	Car Park	2	7.0	Dalrymple Drive	Assumed average 7kW
R27	Lewis Wynd, Irvine	KA11 1HL	234020	638946	Car park	2	7.0	Dalrymple Drive	Assumed average 7kW
R28	Lismore Drive, Irvine	KA11 4JF	235002	637756	Car Park	2	7.0	Riverside	Assumed average 7kW
R29	Manuel Terrace, Irvine	KA11 4BY	235247	637877	On-Street	2	7.0	Riverside	Assumed average 7kW
R30	Milldown Place, Irvine	KA11 1EF	235256	638705	Car park	2	7.0	Riverside	Assumed average 7kW
R31	Montgomerie Street, Ardrossan	KA22 8HP	222996	642461	On-street	2	7.0	Saltcoats Main	Assumed average 7kW
R32	Morar Place, Irvine	KA12 9PU	232238	640971	Car Park	2	7.0	Ravenspark	Assumed average 7kW
R33	Muirside Road, Saltcoats	KA13 6NA	229165	642829	On-Street	2	7.0	Byrehill	Assumed average 7kW
R34	Newfield Place, Irvine	KA11 1NS	234524	640225	Car Park	2	7.0	Dalrymple Drive	Assumed average 7kW
R35	Princes Street, Ardrossan	KA22 8DQ	223012	641957	On-street	2	7.0	Saltcoats Main	Assumed average 7kW
R36	Redburn Place, Irvine	KA12 9BQ	231734	640461	Car Park	2	7.0	Ravenspark	Assumed average 7kW
R37	Stanley Road, Adrossan	KA22 7DL	223743	643428	On-Street	2	7.0	Saltcoats Main	Assumed average 7kW
R38	Sundrum Place, Kilwinning	KA13 6SP	229649	642917	Car Park	2	7.0	Byrehill	Assumed average 7kW
R39	Victoria Road, Saltcoats	KA21 5LG	224993	641712	On-street	2	7.0	Saltcoats Main	Assumed average 7kW

Source: Mott MacDonald

G.1.4 Proposed Destination and Rapid Charging Sites

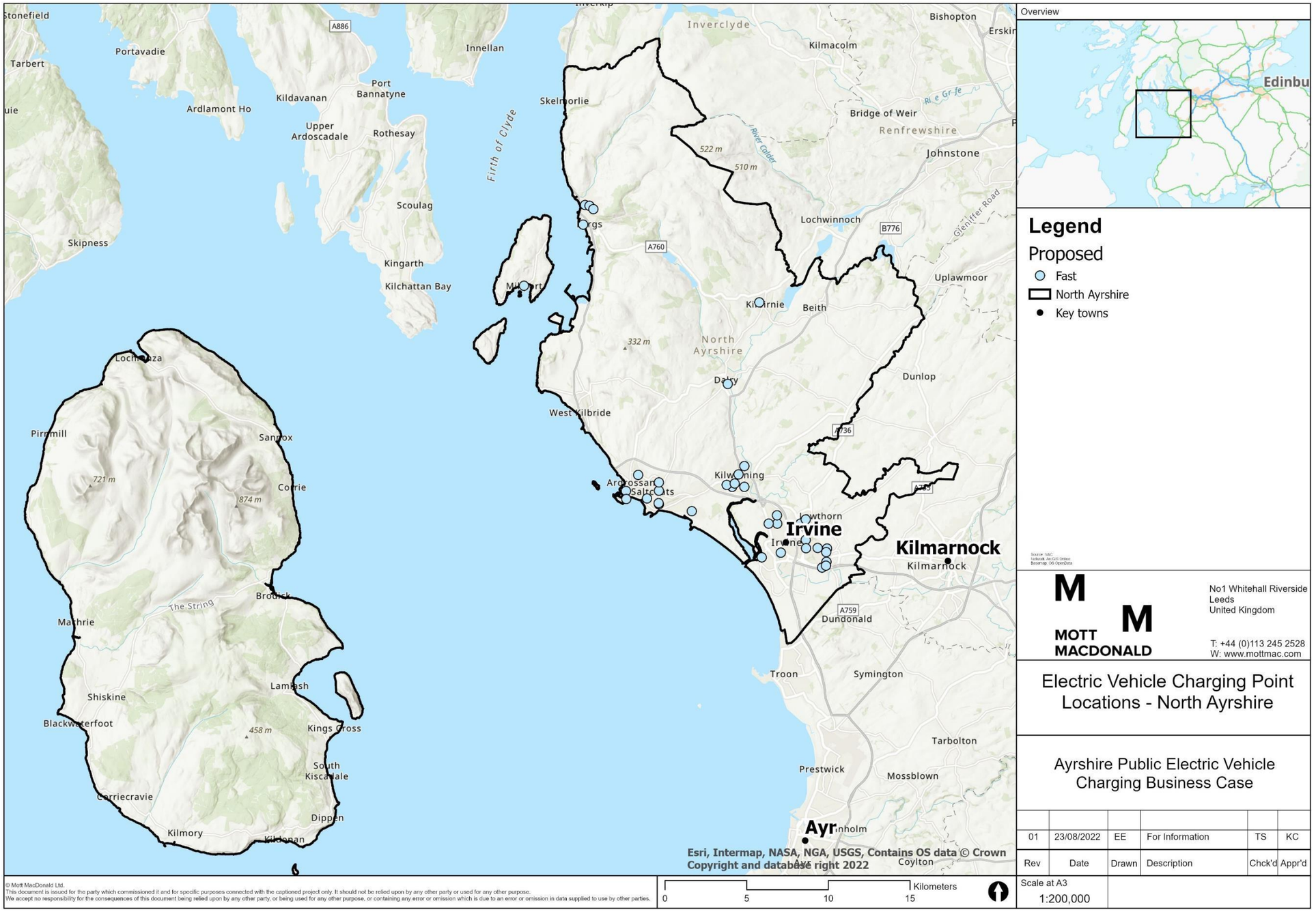
Figure G.11: North Ayrshire Potential Destination and Rapid EV Charger Locations



Source: Data from: NAC, DfT and CPS Map produced by: Mott MacDonald

G.1.5 Proposed Residential Charging Sites

Figure G.12: North Ayrshire Potential Destination and Rapid EV Charger Locations



Source: Data from: NAC Map produced by: Mott MacDonald

G.2 East Ayrshire

G.2.1 Destination Chargers (7kW to 22kW)

Table G.8: East Ayrshire Council – List of Proposed Destination Charger (7kW to 22kW) Sites

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D1	Avenue Square Car Park, Stewarton	KA3 5AP	241987	646017	Off-Street	1	7	Stewarton	Complement existing chargers in car park. Assumed average 7kW utilisation
D2	Barr Street Car Park, Galston	KA4 8HU	250138	636466	Off-Street	1	22	Newmilns	Assumed average 22kW utilisation
D3	Church Lane Car Park, Galston	KA4 8HE	250102	636711	Off-Street	1	22	Newmilns	Assumed average 22kW utilisation
D4	Darvel Primary School/Sports Centre	KA17 0BT	256476	637805	Off-Street	1	22	Darvel	Assumed average 22kW utilisation
D6	Drongan Centre	KA7 7AY	244622	618478	Off-Street	1	7	Killoch Colliery	Assumed average 7kW utilisation
D7	Drongan Community Centre	KA6 7BZ	244469	618136	Off-Street	1	7	Killoch Colliery	Assumed average 7kW utilisation
D8	East George Street Car Park, Kilmarnock	KA1 1GB	242857	638154	Off-Street	1	7	Langlands Street	Complement existing chargers in car park. Assumed average 7kW utilisation
D9	East Main St, Darvel	KA17 0AB	256389	637494	On-Street	2	7	Darvel	Assumed average 7kW utilisation
D10	Foregate Car Park, Kilmarnock	KA1 1LU	242940	638139	Off-Street	3	7	Langlands Street	Complement existing chargers in car park. Assumed average 7kW utilisation
D11	Gatehead Road Car Park, Crosshouse	KA2 0AH	239319	638323	Off-Street	1	7	Langlands Street	Assumed average 7kW utilisation
D13	Glaisnock Street Car Park, Cumnock	KA18 1JS	256910	619934	Off-Street	1	7	Cumnock	Complement existing chargers in car park. Assumed average 7kW utilisation
D14	Grange Academy/Leisure Centre, Kilmarnock	KA1 2EN	241688	637777	Off-Street	3	7	Kilmarnock	Assumed average 7kW utilisation
D15	Loudoun Street Car Park, Mauchline	KA5 5BE	249707	627209	Off-Street	1	7	Mauchline	Complement existing chargers in car park. Assumed average 7kW utilisation
D16	Main Street, Dalrymple	KA6 6DF	235938	614525	On-Street	1	22	Glengall	Assumed average 22kW utilisation
D17	Mauchline Primary School	KA5 6AW	250093	627330	Off-Street	2	7	Mauchline	Assumed average 7kW utilisation
D18	Multi-storey Car Park, Kilmarnock	KA1 1LU	242924	638094	Off-Street	3	7	Langlands Street	Complement existing chargers in car park. Assumed average 7kW utilisation
D19	Patna Resource Centre	KA6 7LX	241564	610255	Off-Street	1	22	Lethanhill	Assumed average 22kW utilisation
D20	Ranouldcoup Road, Darvel	KA17 0JU	256378	637374	Off-Street	1	7	Darvel	Complement existing chargers in car park. Assumed average 7kW utilisation
D21	Rose Reilly Sports Centre, Stewarton	KA3 3DN	241407	645810	Off-Street	1	7	Stewarton	Complement existing chargers in car park. Assumed average 7kW utilisation
D23	St Joseph's Leisure Centre, Kilmarnock	KA3 7SL	243852	638603	Off-Street	3	7	Grassyards	Assumed average 7kW utilisation
D24	Tanyard Car Park, Cumnock	KA18 1BG	256716	620058	Off-Street	1	7	Cumnock	Complement existing chargers in car park. Assumed average 7kW utilisation

Source: Mott MacDonald

G.2.2 Rapid Chargers (50kW)

Table G.9: East Ayrshire Council – List of Proposed Rapid Charger (50kW) Sites

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D5	Drongan Centre	KA7 7AY	244622	618478	Off-Street	1	50	Killoch Colliery	Assumed average 50kW utilisation
D12	Gatehead Road Car Park, Crosshouse	KA2 0AH	239319	638323	Off-Street	1	50	Langlands Street	Assumed average 50kW utilisation
D22	Saint Germain Street Car Park, Catrine	KA5 6RQ	252852	625887	Off-Street	1	50	Mauchline	Assumed average 50kW utilisation. Complement existing charger

Source: Mott MacDonald

G.2.3 Residential Chargers (<7kW)

Table G.10: East Ayrshire Council – List of Proposed Residential Charger (<7kW) Sites

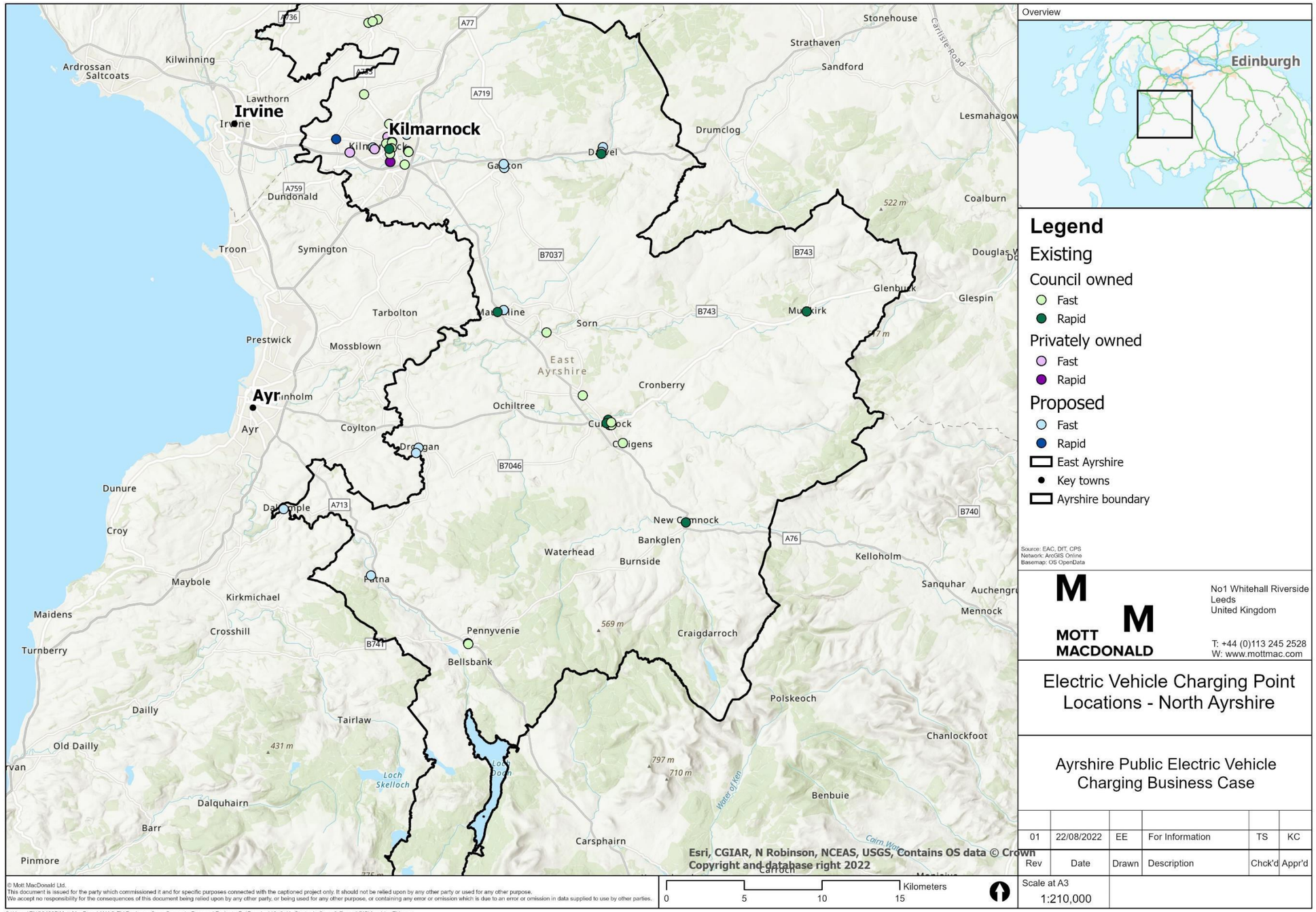
Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
R1	Anderson Place Car park, Kilmarnock	KA3 7JU	244583	638993	Car park	2	7	Grassyards	Assumed average 7kW utilisation
R2	Ardgour Road	KA3 2AE	242517	639473	On-street	2	7	Langlands Street	Assumed average 7kW utilisation
R3	Avisyard Avenue, Cumnock	KA18 3BL	258270	618703	On-Street	2	7	Cumnock	Assumed average 7kW utilisation
R4	Barbieston Road, Auchinleck	KA18 2EJ	255517	622200	On-street	2	7	Cumnock	Assumed average 7kW utilisation
R5	Barclay Drive, Kilmarnock	KA3 7PD	244279	638946	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R6	Barshare Road, Cumnock	KA18 1NH	257778	619707	Car Park	2	7	Cumnock	Assumed average 7kW utilisation
R7	Bath Street, Kilmarnock	KA3 1HX	242777	638985	Car park	2	7	Langlands Street	Assumed average 7kW utilisation
R8	Birch Ave, Dalrymple	KA6 6EB	236535	614476	On-street	2	7	Glengall	Assumed average 7kW utilisation
R9	Blair Avenue, Hurlford	KA1 5BD	245272	636452	On-street	2	7	Queens Drive	Assumed average 7kW utilisation
R10	Burnton Place, New Cumnock	KA18 4EU	262298	612934	On-street	2	7	New Cumnock	Assumed average 7kW utilisation
R11	Cairnduff Place, Stewarton	KA3 5QN	242759	646228	Car park	2	7	Stewarton	Assumed average 7kW utilisation
R12	Castle Croft, Dalmellington	KA6 7RD	248262	605720	On-street	2	7	Lethanhill	Assumed average 7kW utilisation
R13	Catherine Drive, Galston	KA4 8BU	249271	636417	On-street	2	7	Newmilns	Assumed average 7kW utilisation
R14	Cessnock Avenue,Hurlford	KA1 5EE	245797	636212	On-street	2	7	Queens Drive	Assumed average 7kW utilisation
R15	Dalgleish Avenue, Cumnock	KA18 1QY	257742	620087	On-Street	2	7	Cumnock	Assumed average 7kW utilisation
R16	Dallowie Road, Patna	KA6 7ND	241754	609946	On-street	2	7	Lethanhill	Assumed average 7kW utilisation
R17	Dalry Road, Stewarton	KA3 3AN	241499	645958	On-street	2	7	Stewarton	Assumed average 7kW utilisation
R18	Dean Street, Kilmarnock	KA3 1EA	243000	638674	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R19	Edgar Avenue, Cumnock	KA18 1TQ	257534	619952	On-Street	2	7	Cumnock	Assumed average 7kW utilisation
R20	Fleming Street, Darvel	KA17 0HQ	256021	637456	On-street	2	7	Darvel	Assumed average 7kW utilisation
R21	Forbes Place, Kilmarnock	KA3 7RQ	244013	638918	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R22	Gibson Street, Kilmarnock	KA1 2PL	241771	638200	On-street	2	7	Langlands Street	Assumed average 7kW utilisation
R23	Gilfoot, Newmilns	KA16 9HT	252514	637209	On-Street	2	7	Newmilns	Assumed average 7kW utilisation
R24	Glebe Road, Galson	KA4 8DT	250041	636463	On-street	2	7	Newmilns	Assumed average 7kW utilisation
R25	Glebe Road, Kilmarnock	KA1 3BA	243257	637462	On-street	2	7	Queens Drive	Assumed average 7kW utilisation
R26	Greenhead, Newmilns	KA16 9AX	254037	637195	Car Park	2	7	Newmilns	Assumed average 7kW utilisation
R27	Grougar Road, Kilmarnock	KA3 6LD	244962	637456	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R28	High Street, Newmilns	KA16 9EA	253746	637480	On-street	2	7	Newmilns	Assumed average 7kW utilisation
R29	Hillmoss, Kilmaurs	KA3 2RS	240571	641212	On-street	2	7	Langlands Street	Assumed average 7kW utilisation
R30	John Morton Crescent, Darvel	KA17 0JJ	256983	637694	On-street	2	7	Darvel	Assumed average 7kW utilisation
R31	Jubilee Drive, Stewarton	KA3 5PR	242546	646183	On-street	2	7	Stewarton	Assumed average 7kW utilisation
R32	Kennedy Drive, Kilmarnock	KA3 7TQ	244345	639410	Car Park	2	7	Grassyards	Assumed average 7kW utilisation
R33	Kirkton Road, Fenwick	KA3 6DP	246482	643528	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R34	Lindsay Gardens, Kilmarnock	KA3 7PU	244532	639186	Car park	2	7	Grassyards	Assumed average 7kW utilisation
R35	Littlemill Place, Rankinston	KA6 7HE	245110	614428	Car Park	2	7	Lethanhill	Assumed average 7kW utilisation
R36	MacIntosh Place, Kilmarnock	KA3 7NG	239235	638136	Car Park	2	7	Grassyards	Assumed average 7kW utilisation
R37	Macphail Drive, Kilmarnock	KA3 7EU	244274	637963	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R38	Main Road, B7061, Fenwick	KA3 6AL	246254	642978	On-street	2	7	Grassyards	Assumed average 7kW utilisation

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
R39	Main Street, Dunlop	KA3 4AN	240771	649447	On-street	2	7	Stewarton	Assumed average 7kW utilisation
R40	Main Street, Ochiltree	KA18 2PD	250630	621144	On-Street	2	7	Killoch Colliery	Assumed average 7kW utilisation
R41	Main Street, Sorn	KA5 6HU	255525	626470	On-street	2	7	Mauchline	Assumed average 7kW utilisation
R42	Meiklewood Road, Kilmarnock	KA3 2EL	242757	639968	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R43	Menzie Avenue, Cumnock	KA18 3DE	257508	618944	On-Street	2	7	Cumnock	Assumed average 7kW utilisation
R44	Merrick Road, Kilmarnock	KA1 3TA	243537	635705	On-street	2	7	Kilmarnock	Assumed average 7kW utilisation
R45	Nelson Street, Newmilns	KA16 9AP	253300	637242	On-street	2	7	Newmilns	Assumed average 7kW utilisation
R46	Orchard Street, Galston	KA4 8EB	249735	636472	On-street	2	7	Newmilns	Assumed average 7kW utilisation
R47	Paterson Street, Dalmellington	KA6 7RS	247790	606185	On-street	2	7	Lethanhill	Assumed average 7kW utilisation
R48	Rennie Street, Kilmarnock	KA1 3AB	243018	637687	On-street	2	7	Queens Drive	Assumed average 7kW utilisation
R49	Rugby Road, Kilmarnock	KA1 2DW	242187	637495	On-street	2	7	Langlands Street	Assumed average 7kW utilisation
R50	School Road, Auchinleck	KA18 2HZ	255028	622214	On-street	2	7	Cumnock	Assumed average 7kW utilisation
R51	Shields Road, Newmilns	KA16 9HG	253052	637200	On-street	2	7	Newmilns	Assumed average 7kW utilisation
R52	South Dean Road, Kilmarnock	KA3 7RF	243542	638686	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R53	Temple Street, Darvel	KA17 0DR	256257	637452	On-street	2	7	Darvel	Assumed average 7kW utilisation
R54	Wardneuk Drive, Kilmarnock	KA3 2EF	243039	639687	On-street	2	7	Grassyards	Assumed average 7kW utilisation
R55	Wellwood Street, Muirkirk	KA18 3RR	269649	627503	On-street	2	7	Mauchline	Assumed average 7kW utilisation
R56	West Woodstock Street, Kilmarnock	KA1 2JH	242274	637966	On-street	2	7	Langlands Street	Assumed average 7kW utilisation
R57	Witchknowe Road, Kilmarnock	KA1 4LQ	243014	636045	Car Park	2	7	Kilmarnock	Assumed average 7kW utilisation
R58	Woodbank Road, Kilmarnock	KA2 0ET	239744	638499	On-street	2	7	Langlands Street	Assumed average 7kW utilisation

Source: Mott MacDonald

G.2.4 Proposed Destination and Rapid Charging Sites

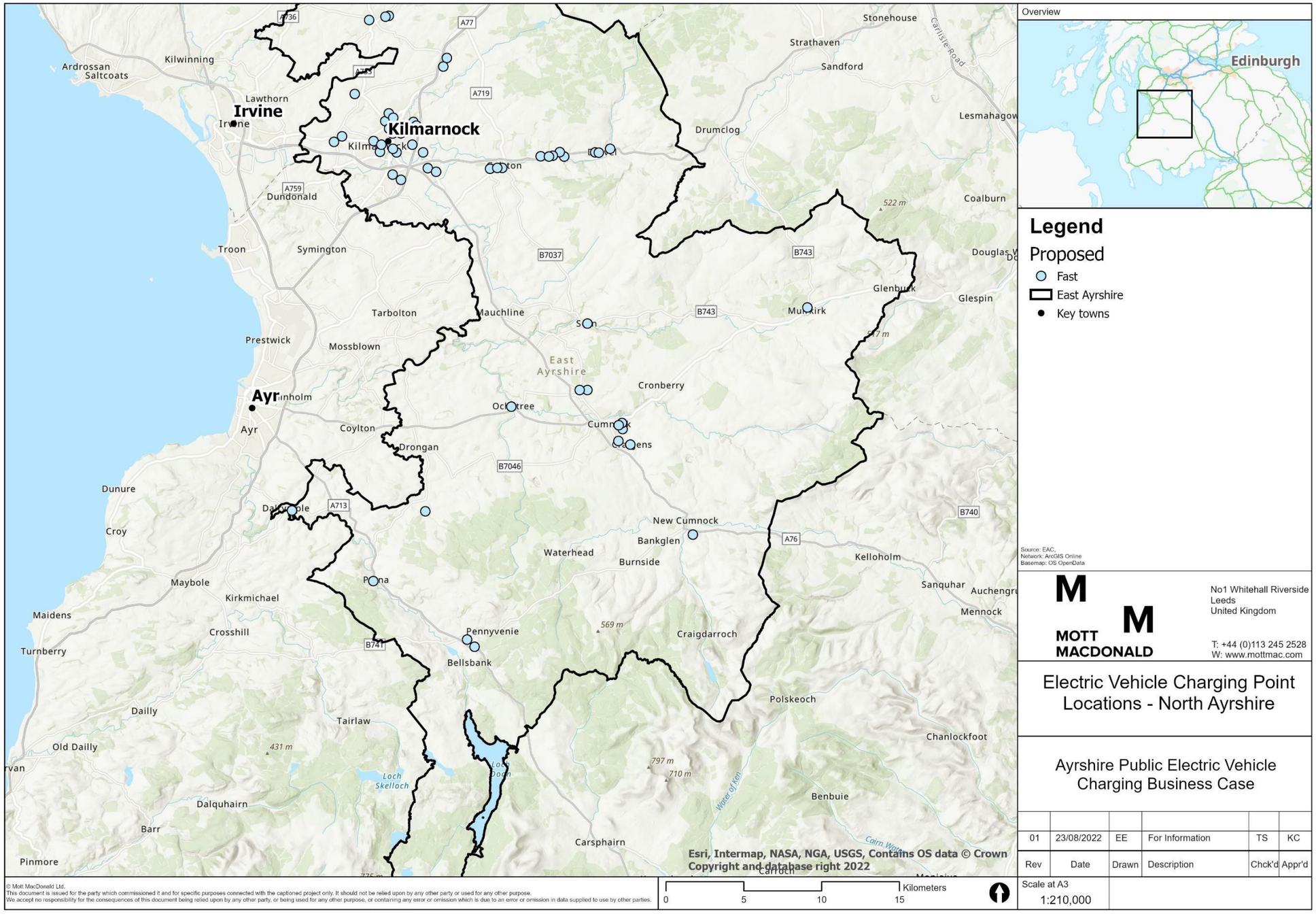
Figure G.13: East Ayrshire Potential Destination and Rapid EV Charger Locations



Source: Data from: EAC, DfT and CPS Map produced by: Mott MacDonald

G.2.5 Proposed Residential Charging Sites

Figure G.14: East Ayrshire Potential Destination and Rapid EV Charger Locations



Source: Data from: EAC Map produced by: Mott MacDonald

G.3 South Ayrshire

G.3.1 Destination Chargers (7kW to 22kW)

Table G.11: South Ayrshire Council – List of Proposed Destination Charger (7kW to 22kW) Sites

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D1	Annbank Primary School, Mossblown	KA6 5DZ	240574	624467	Off-Street	1	22	Drumley	Average 22kW utilisation used
D2	Ayr Academy, Ayr	KA8 0SZ	235135	621446	Off-Street	1	22	Mill Street	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D3	Barns Crescent Car Park, Ayr	KA7 2BW	233606	621478	Off-Street	2	7	Mill Street	Rapid EVCP assumed provided by private sector in Ayr. Average 7kW utilisation used
D5	Beach Road Car Park, Troon	KA10 6SG	232494	632409	Off-Street	2	7	Troon	Average 7kW utilisation used
D6	Belmont Academy, Ayr	KA7 3SN	234418	619980	Off-Street	1	22	Glengall	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D7	Braehead Primary School, Ayr	KA8 9PJ	235178	622657	Off-Street	1	22	Heathfield Rd Ayr	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D8	Citadel Leisure Centre, Ayr	KA7 1JB	233272	622285	Off-Street	2	7	Mill Street	Rapid EVCP assumed provided by private sector in Ayr. Average 7kW utilisation used
D11	Crosshill Community Centre, Crosshill	KA19 7RJ	232791	606568	Off-Street	1	22	Maybole	Average 22kW utilisation used
D12	Dalmilling Primary School, Ayr	KA8 0PD	236059	622694	Off-Street	1	22	Old Bridge Road	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D13	Forehill Primary School, Ayr	KA7 3JU	235333	620734	Off-Street	1	22	Glengall	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D14	Heathfield Primary School, Ayr	KA8 9DR	234959	624118	Off-Street	1	22	Heathfield Rd Ayr	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D15	Kincaidston Primary School, Ayr	KA7 3YN	234739	619399	Off-Street	1	22	Glengall	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D16	Kingcase Primary School, Ayr	KA9 2DG	235034	624540	Off-Street	1	22	Heathfield Rd Ayr	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D17	Main Street, Dundonald	KA2 9HL	236595	634410	On-Street	1	22	Riverside	Average 22kW utilisation used
D19	Marr College, Troon	KA10 7AB	233223	631399	Off-Street	1	22	Troon	Average 22kW utilisation used
D20	Maybole Community Campus, Maybole	KA19 8BP	229242	609674	Off-Street	2	7	Maybole	Average 7kW utilisation used
D21	Maybole Town Hall, Maybole	KA19 7BZ	230026	609879	Off-Street	1	22	Maybole	Average 22kW utilisation used
D22	Muirhead Activity Centre, Troon	KA10 7AZ	233766	631653	Car park	2	7	Troon	Also serves nearby housing. Assumed 7kW utilisation
D23	New Road Car Park, Ayr	KA8 8HE	234044	622802	Off-Street	1	7	Mill Street	Rapid EVCP assumed provided by private sector in Ayr. Average 7kW utilisation used
D24	Newton Primary School, Ayr	KA8 8JL	234217	622442	Off-Street	1	22	Mill Street	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D25	Old Street Car Park, Girvan	KA26 9EY	218661	598163	Off-Street	2	7	Girvan	Average 7kW utilisation used
D26	South Beach Road Car Park, Troon	KA10 6EF	232186	630791	Off-Street	2	7	Troon	Average 7kW utilisation used
D27	Southcraig School, Ayr	KA7 2ND	234140	620438	Off-Street	1	22	Mill Street	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D28	St John's Primary School, Ayr	KA8 0JB	234445	622324	Off-Street	1	22	Mill Street	Rapid EVCP assumed provided by private sector in Ayr. Average 22kW utilisation used
D29	Tarbolton Primary School, Tarbolton	KA5 5QD	243056	627077	Off-Street	1	22	Drumley	Average 22kW utilisation used
D31	The Carrick Centre, Maybole	KA19 7DE	229897	610041	Off-Street	1	22	Maybole	Average 22kW utilisation used
D33	Whitletts Activity Centre, Ayr	KA8 9RW	235866	623000	Car park	2	7	Old Bridge Road	Also serves nearby housing. Assumed 7kW utilisation

Source: Mott MacDonald

G.3.2 Rapid Chargers (50kW)

Table G.12: South Ayrshire Council – List of Proposed Rapid Charger (50kW) Sites

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D4	Barrhill Memorial Hall	KA26 0PP	223210	582338	Car park	1	50	GIRVAN	Limited rapid charger provision, Average 50kW utilisation assumed.
D9	Coylton Shops, Coylton	KA6 6PH	240669	619819	Off-Street	1	50	DRUMLEY	Limited rapid charger provision, Average 50kW utilisation assumed.
D10	Crosshill Community Centre, Crosshill	KA19 7RJ	232791	606568	Off-Street	1	50	MAYBOLE	Limited rapid charger provision, Average 50kW utilisation assumed.
D18	Main Street, Dundonald	KA2 9HE	236558	634552	On-Street	1	50	RIVERSIDE	Limited rapid charger provision, Average 50kW utilisation assumed.

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
D30	Tarbolton Primary School, Tarbolton	KA5 5QD	243056	627077	Off-Street	1	50	DRUMLEY	Limited rapid charger provision, Average 50kW utilisation assumed.
D32	Troon Swimming Pool, Troon	KA10 6XQ	232103	631258	Off-Street	2	50	Troon	Limited rapid charger provision, Average 50kW utilisation assumed.

Source: Mott MacDonald

G.3.3 Residential Chargers (<7kW)

Table G.13: South Ayrshire Council – List of Proposed Residential Charger (<7kW) Sites

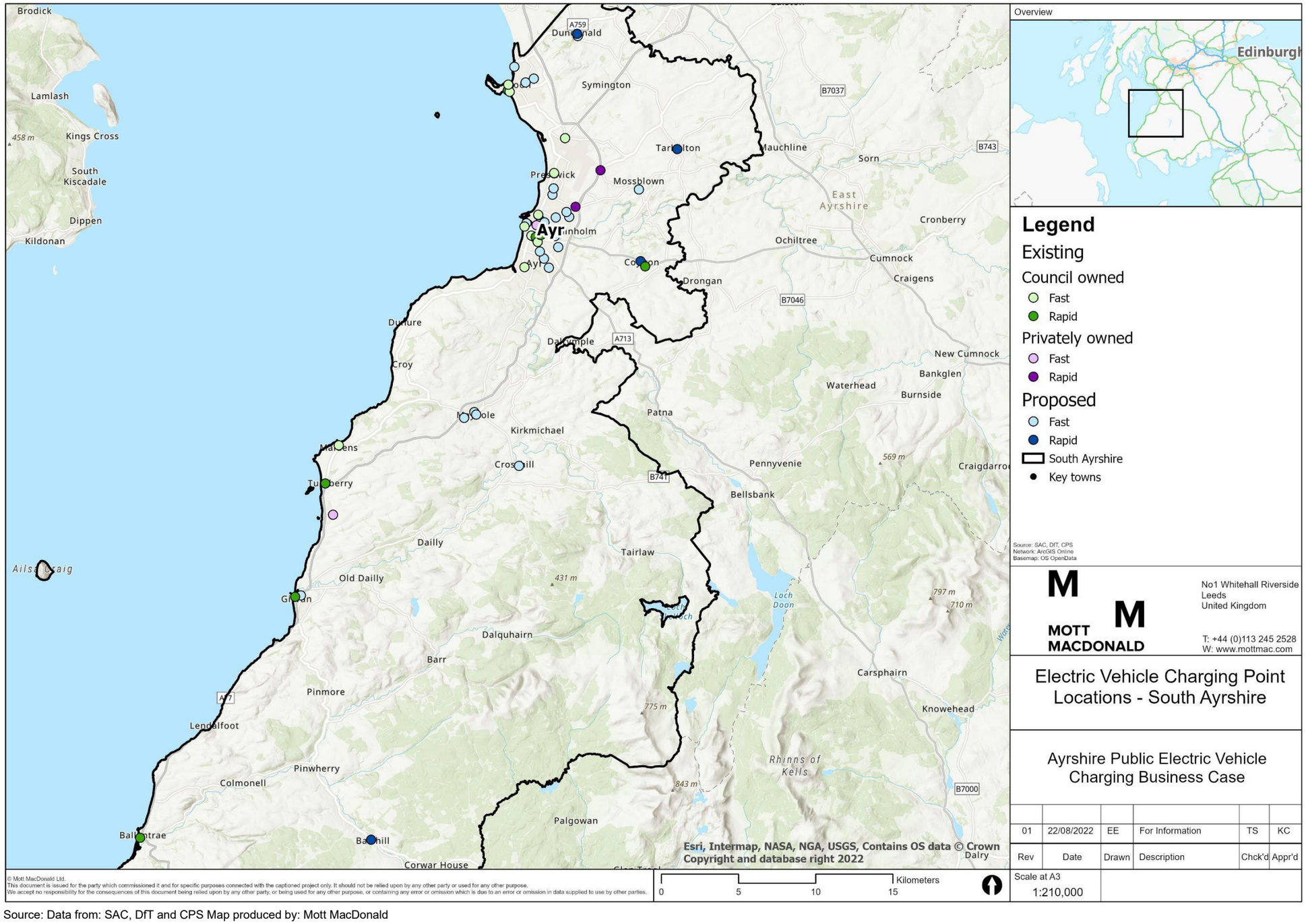
Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
R1	Main Street, Barrhill	KA26 0QP	223453	582150	On-street	2	7	Pinwherry	On A714 but enough space.
R2	Main Street, Ballantrae	KA26 0NA	208411	582488	On-street	2	7	Pinwherry	On A77 but serves some properties
R3	Arran Avenue, Ballantrae	KA26 0NT	208313	582828	Car park	2	7	Pinwherry	Limited locations for parking
R4	Hyslop Crescent, Colmonell	KA26 0SE	214910	585990	On-street	2	7	Pinwherry	Parking bays on road
R5	Willow Drive, Girvan	KA26 0DE	218720	596712	On-street	2	7	Girvan	Moved into marked parking bays
R6	Piedmont Road, Girvan	KA26 0DS	218781	597054	On-street	2	7	Girvan	Moved into marked parking bays
R7	Henrietta Street, Girvan	KA26 9AN	218371	597540	On-street	2	7	Girvan	On A77 but serves many properties without driveways
R8	Kerr Court, Girvan	KA26 0BP	218802	597386	On-street	2	7	Girvan	Many shared parking areas
R9	Arran Court, Girvan	KA26 0EG	219007	597276	On-street	2	7	Girvan	housing estate with shared parking areas
R10	Dalrymple Street, Girvan	KA26 9BG	218543	597604	On-street	2	7	Girvan	Potentially busy street
R11	Troweir Road, Girvan	KA26 9EB	218973	598135	On-street	2	7	Girvan	on-street parking bays.
R12	Montgomerie Street, Girvan	KA26 9HS	218764	598348	On-street	2	7	Girvan	Potentially high demand - many properties without off-street parking.
R13	Main Street, Dailly	KA26 9SB	226971	601576	On-street	2	7	Girvan	Potentially limited on-street space
R14	Main Street, Straiton	KA19 7NF	238143	604911	On-street	2	7	Lethanhill	Potentially limited on-street space
R15	Main Road, Kirkoswald	KA19 8HY	223932	607534	Car park	2	7	Maybole	Car Parking at side at road
R16	Kirkoswald Road, Maidens	KA26 9NS	221352	607932	Car park	2	7	Girvan	Appears to be a turning circle of some kind
R17	Patna Road, Kirkmichael	KA19 7PJ	234316	608946	On-street	2	7	Maybole	Potentially too restricted
R18	Murray Gardens, Maybole	KA19 7AZ	230039	609435	Car park	2	7	Maybole	Potentially too restricted. Limited space as on a hill.
R19	Carrick Street, Maybole	KA19 7DN	229849	609891	On-street	2	7	Maybole	Now one-way street so improved opportunities for on-street charging.
R20	Ladywell Road, Maybole	KA19 7BE	230070	609786	Car park	2	7	Maybole	Limited potential sites - hilly location with no off-street parking.
R21	Minnoch Crescent, Maybole	KA19 8DW	229656	610322	Car park	2	7	Maybole	housing estate with shared parking areas
R22	Kennedy Drive, Dunure	KA7 4LT	225478	615757	On-street	2	7	Maybole	Narrow streets, some with driveways
R23	Kincaidston Drive, Ayr	KA7 3YL	234844	619228	Car park	2	7	Glengall	residential car park
R24	Sorrel Drive, Ayr	KA7 3XP	235120.9524	619115.2959	Car park	2	7	Glengall	housing estate with shared parking areas
R25	Goukscroft Park, Ayr	KA7 4DS	232728	619328	Car park	2	7	Glengall	housing estate with shared parking areas
R26	Heather Park, Ayr	KA7 3XJ	235203	619271	Car park	2	7	Glengall	housing estate with shared parking areas
R27	Fenwickland Avenue, Ayr	KA7 3QD	234495	619624	On-street	2	7	Glengall	
R28	Trefoil Place, Ayr	KA7 3XG	235119	619443	Car park	2	7	Glengall	housing estate with shared parking areas
R29	Wood Park, Ayr	KA7 3SL	234786	619805	On-street	2	7	Glengall	Large amount of housing without off-street parking
R30	Lorne Terrace, Hillhead	KA6 6JX	242041	619743	On-street	2	7	Drumley	
R31	Kyle Crescent, Coylton	KA6 6NP	240765	620062	Car park	2	7	Drumley	housing estate with limited parking
R32	Southfield Park, Ayr	KA7 2NU	234150	620244	Car park	2	7	Mill Street	Marked bays on street
R33	Hillfoot Road, Ayr	KA7 3LF	235064	620369	On-street	2	7	Mill Street	Parking bays on road

Ref.	Site	Post Code	X Coordinate	Y Coordinate	Location	EVCP	Max kW Output	Primary Substation	Comment
R34	Glencairn Road, Ayr	KA7 3HJ	234940	620708	On-street	2	7	Mill Street	
R35	Orchard Avenue, Ayr	KA7 3EJ	234643	620831	On-street	2	7	Mill Street	
R36	Bellevue Crescent, Ayr	KA7 2DP	233541	621169	On-street	2	7	Mill Street	side street with no off-street parking
R37	Ballantine Drive, Ayr	KA7 2RG	233943	620793	On-street	2	7	Mill Street	side street with no off-street parking
R38	Fairfield Road, Ayr	KA7 2AU	233311	621431	On-street	2	7	Mill Street	
R39	Charlotte Street, Ayr	KA7 1DZ	233426	621910	On-street	2	7	Mill Street	Plenty of options on-street
R40	Campbell Court, Ayr	KA8 0SE	235344	621804	On-street	2	7	Mill Street	side street
R41	Elba Street, Ayr	KA8 0DQ	234146	622136	On-street	2	7	Mill Street	
R42	York Street, Ayr	KA8 8AN	233520	622483	On-street	2	7	Mill Street	Range of potential locations in vicinity
R43	Princes Court, Ayr	KA8 8HX	234085	622615	Car park	2	7	Mill Street	Flatted development
R44	Thomson Street, Ayr	KA8 9QB	235484	622862	On-street	2	7	Heathfield Rd Ayr	
R45	Campbell Street, Ayr	KA8 9AR	234391	623126	On-street	2	7	Heathfield Rd Ayr	Narrow street
R46	St George's Road, Ayr	KA8 9HN	234623	623131	On-street	2	7	Heathfield Rd Ayr	
R47	Low Road, Ayr	KA8 9SB	236308	623177	Car park	2	7	Old Bridge Road	
R48	Oswald Road, Ayr	KA8 8LT	234170	623563	On-street	2	7	Heathfield Rd Ayr	Street not well overlooked.
R49	Annpit Road, Ayr	KA8 9BZ	234565	623771	On-street	2	7	Heathfield Rd Ayr	
R50	Moor Park Crescent, Prestwick	KA9 2NL	235333	624138	Car park	2	7	Heathfield Rd Ayr	
R51	Arcon Court, Mossblown	KA6 5BT	240034	625000	Car park	2	7	Drumley	Narrow streets, some with driveways
R52	Rowanbank Road, Prestwick	KA9 1DS	236115	625215	On-street	2	7	Heathfield Rd Ayr	
R53	Marina Road, Prestwick	KA9 1QZ	234728	625607	On-street	2	7	Heathfield Rd Ayr	Narrow street
R54	Bank Street, Prestwick	KA9 1PT	234927	625615	On-street	2	7	Heathfield Rd Ayr	Limited on-street parking
R55	Blackford Crescent, Prestwick	KA9 2LW	236107	626175	Car park	2	7	Monkton	
R56	Shawfarm Place, Prestwick	KA9 1JQ	235773	626394	Car park	2	7	Monkton	
R57	Kirk Street, Prestwick	KA9 1AU	235155	626486	On-street	2	7	Monkton	
R58	Shawfarm Gardens, Prestwick	KA9 2GZ	235645	626579	Car park	2	7	Monkton	Risk of abuse from adjacent Prestwick Airport
R59	Beechwood Road, Tarbolton	KA5 5RF	243380	627134	On-street	2	7	Drumley	Some properties have driveways
R60	Bank Street, Troon	KA10 6AL	231664	630905	On-street	2	7	Troon	
R61	Ailsa Road, Troon	KA10 6DB	231216	631021	On-street	2	7	Troon	
R62	Gilles Street, Troon	KA10 6QH	232629	631382	On-street	2	7	Troon	Street could be too narrow, but plenty of tenement properties.
R63	Buchan Road, Troon	KA10 7BT	233581	631621	On-street	2	7	Troon	
R64	Main Street, Loans	KA10 7EX	234543	631677	On-street	2	7	Troon	Main St could be too narrow.
R65	Main Street, Symington	KA1 5QG	238264	631532	On-street	2	7	Monkton	Side road off Main St
R66	Hawthorn Place, Troon	KA10 6QA	232721	631802	On-street	2	7	Troon	
R67	Logan Drive, Troon	KA10 6QF	232845	631840	On-street	2	7	Troon	Most properties in vicinity do not have off-street parking. Sufficient on-street space.
R68	Burnfoot Avenue, Troon	KA10 6RE	232584	632296	Car park	2	7	Troon	Outside Barassie Primary School, limited on-street parking. Communal parking area more suitable.
R69	Castleview, Dundonald	KA2 9JB	236365	635090	Car park	2	7	Riverside	Limited on-street parking, suggest using the nearby car park

Source: Mott MacDonald

G.3.4 Proposed Destination and Rapid Charging Sites

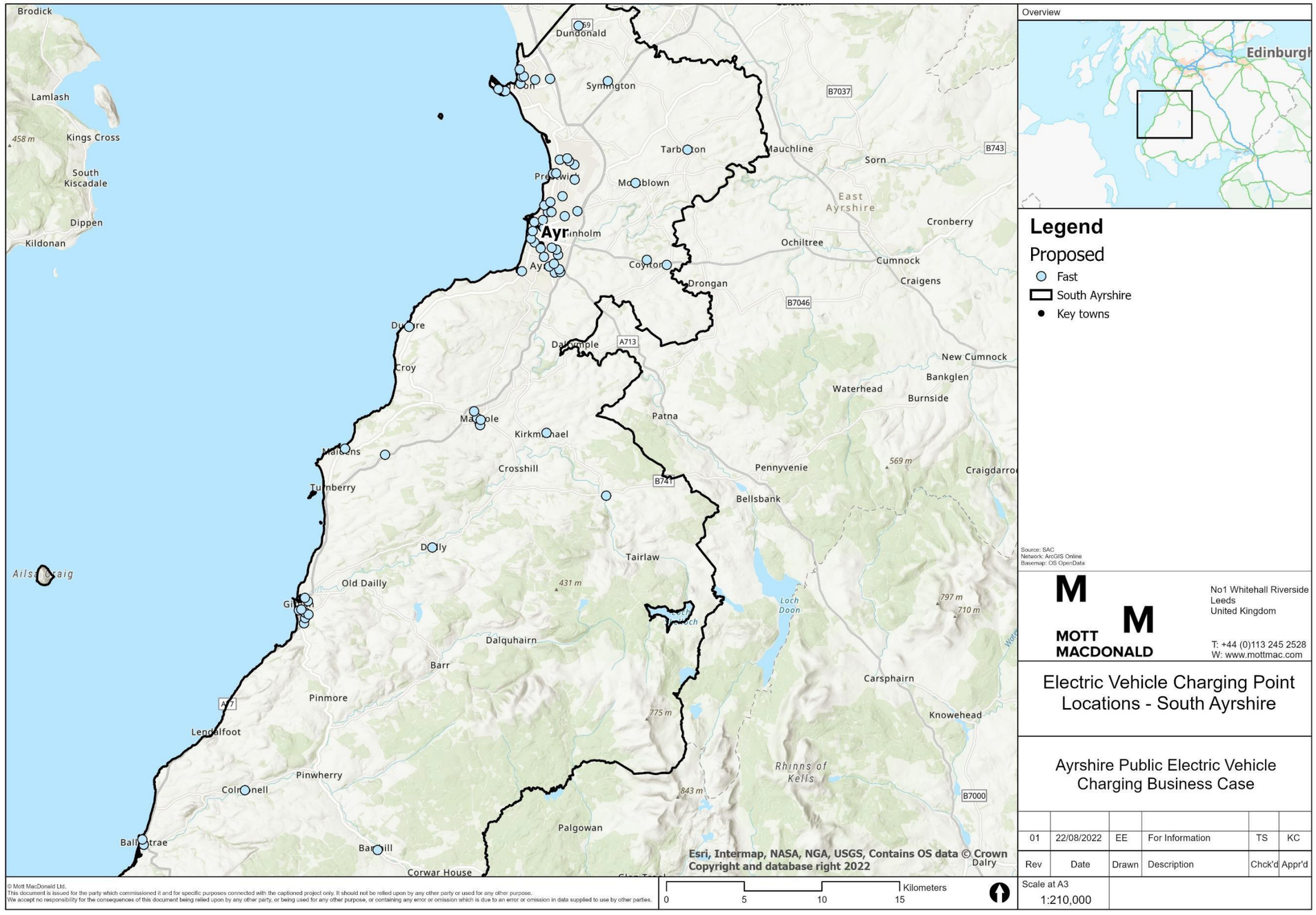
Figure G.15: South Ayrshire Potential Destination and Rapid EV Charger Locations



Source: Data from: SAC, DfT and CPS Map produced by: Mott MacDonald

G.3.5 Proposed Residential Charging Sites

Figure G.16: South Ayrshire Potential Destination and Rapid EV Charger Locations



Source: Data from: SAC Map produced by: Mott MacDonald