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STATISTICS**

**Tracing the Irish State's National Broadband
Intervention Process: The hidden
complexities of the Mapping Process
Revealed**

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Declaration

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Summary

For the majority of people living in Europe, having access to reliable high speed broadband services is very much the norm. This is typically the case in urban and suburban locations and in fact in most towns and large villages across Europe. Broadband Service Providers target more densely populated locations, they offer consumers a variety of different broadband products and will periodically upgrade their networks to keep pace with consumer demand and stay competitive. Unfortunately, this is very much 'not the norm' for an enormous number of European citizens living in more rural, less densely populated areas. In fact, in 2023 the European Commission reported that over 32% of rural areas across Europe still did not have access to any high-speed broadband services at all. Addressing this digital divide has been a key priority for political leaders across Europe for over a decade but despite this political focus, this digital divide continues to persist.

It is generally accepted that Service Providers, (these are commercial operators who provide retail and/or wholesale broadband services to their customers, herein referred to as 'Service Providers'), will cover the majority of premises across any given State, however Governments must intervene to ensure high speed broadband services are brought to those most difficult to reach premises where commercial operators will not cover. However, EU Member States must adhere to State Aid rules and gain State Aid Approval before they can actually intervene in the broadband market. As demonstrated through my research, a fundamental part of this State Aid Approval exercise is the 'Mapping Process'. The Mapping Process identifies the locations which will be part of any State's intervention. This process is both scientifically and politically challenging, it is highly contentious and has far reaching consequences for a wide range of stakeholders. Typically, the Mapping Process is the lengthiest part of the State Aid Approval process, undertaken over several years. Therefore, if solutions can be found to speed up this Mapping Process, then the whole State Aid Approval exercise will be fast tracked and ultimately EU Member State's interventions in the market will be accelerated.

This research sets out to highlight the issues and identify solutions by leveraging the experience gained through the State Aid Approval exercise undertaken in Ireland as part of the Irish State's National Broadband Plan. The research reveals when the Mapping Process is needed and for what purpose; it then outlines what is needed to design and implement a Mapping Process effectively. By conducting a detailed academic analysis of a real-life project and systematically identifying the necessary steps that were involved, the research identifies recommendations to deliver both improvements and efficiencies. The findings will be of great benefit to the EU Commission, EU Member States and the respective Government agencies who are tasked with undertaking future Mapping Processes. Ultimately it will help them gain State Aid Approval for their projects faster than ever before. This is the key to ensuring all citizens across Europe gain access to high-speed broadband services at the earliest opportunity possible.

Some of the learnings from this research could also be of relevance in other sectoral policy areas where EU Member States are proposing to intervene in what are generally fully liberalised markets. What will be explained throughout the thesis is that the Mapping Process is fundamentally about accurately describing the state of a market in circumstances where the market is continually evolving. This is true of other markets. Lessons from how Ireland successfully addressed this challenge could be of help in other sectors.

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Glossary and Definitions

BEREC – Body of European Regulators for Electronic Communications.

ComReg – ComReg is the statutory body responsible for the regulation of the electronic communications sector (telecommunications, radio communications, broadcasting transmission and premium rate services) and the postal sector in Ireland.

DAE - A Digital Agenda for Europe is one of the seven flagship initiatives outlined in the European Commission's Europe 2020 strategy. Published in May 2010, it sets out to define the key enabling role of digital services needed to support this realization of this strategy.

DECC - the Department of the Environment, Climate and Communications in Ireland, from 2020 to 2024. The name of the Irish Government Department responsible for communications policy, including policies relating to broadband at the time of writing.

DCCAE - the Department of Communications, Climate Action, and Environment in Ireland, from 2016 to 2020. The name of the Irish Government Department responsible for communications policy over that period.

DCENR - the Department of Communications, Energy and Natural Resources in Ireland, from 2007 to 2016. The name of the Irish Government Department responsible for communications policy over that period.

Department – The general term used in this document to refer to the Irish Government Department responsible for Communications policy. From 2020 to 2024 this was DECC, previous to this, from 2016 to 2020 this was called DCCAE and previous to this again from 2007 to 2016 this was called DCENR.

DESI - The Digital Economy and Society Index is a composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU

Member States in digital competitiveness. A DESI report is published annually identifying the progress made across Europe by each EU Member State against these digital performance indicators.

DG Competition or DG Comp - Directorate-General (DG) for Competition, is the administrative branch within the EU Commission which oversees and enforces EU competition rules.

Digital Single Market Strategy, DSM – This is the EU strategy which promotes the seamless use of digital services across EU Member States.

European Union, EU - The European Union, an economic and political union between EU Member States that together cover much of the continent of Europe.

EU Commission - The European Commission is the executive branch of the European Union, responsible for proposing legislation, implementing decisions, upholding the EU treaties, and managing the day-to-day business of the EU.

EU Members or EU Member States - On the date of publication of the State Aid Guidelines relating to broadband in 2013, the EU consisted of 28 member states, they were Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. Subsequently the United Kingdom left the EU in January 2020.

EU State Aid Guidelines, SAG - The guidelines issued by the EU Commission that summarize the principles of the State Aid rules that apply to broadband interventions.

Intervention Area – The geographical area where a State's intervention into the broadband market is intended to take place.

Intervention Contract – The contract between the State and the tenderer(s) successful in the State’s public procurement exercise to select a contractor to deploy the NGA broadband services in the Intervention Area.

Intervention Process – process undertaken by an EU Member State in seeking approval from the EU Commission to intervene in the broadband market.

Mapping Process - the process of defining an intervention area for a State intervention into the broadband market, referred to throughout the thesis as the ‘Mapping Process’.

Measure - An EU Member States’ initiative or project to intervene in the market.

Mbps – Mega bits per second, the unit of measurement used to measure broadband download and upload throughput speeds.

National Broadband Plan, NBP – The Irish State’s national broadband policy published in 2012 outlining the ambition that NGA broadband services should be available to all citizens in Ireland.

NBP Intervention – The Irish State’s project to intervene in the broadband market to ensure that NGA broadband services were made available to all citizens in Ireland.

NGA – Next Generation Access. NGA access networks are access networks which are capable of delivering very high-speed broadband services with enhanced characteristics as compared to basic broadband networks.

NRA – The National Regulatory Authority is the statutory body responsible for the regulation of the electronic communications sector within a State.

Online map – the online map on which EU Member States are required to publish their proposed Intervention Area so as to adhere to the EU State Aid Guidelines

Online map process - the process outlining the granular steps needed to produce an online map that will meet the specific and unique requirements of the EU State Aid Guidelines and the Intervention Process.

Public Procurement – the public procurement competition undertaken to select the contractor or contractors needed to deliver the State intervention.

Service Providers – Commercial operators, authorized by the NRA to provide electronic communication services, who provide retail and/or wholesale broadband services to their customers.

State Aid – forms of public funding to a State sponsored project.

State Aid Approval – The formal approval that must be granted by the EU Commission prior to any State intervention.

State intervention – A State’s plan, project, initiative, or measure to intervene in the broadband market.

30 Mbps or 100 Mbps – 30 Megabits per second or 100 Megabits per second, examples of the download throughput speeds delivered through a broadband network.

Declaration.....	2
Summary	3
Acknowledgements.....	5
Glossary and Definitions	6
Chapter 1 Introduction	17
1.1 Introduction	18
1.2 Broadband rollout progress & state intervention	19
1.3 The Intervention Process in Ireland & Motivation for the Research.....	22
1.4 Getting to the heart of the intervention process – the online map.....	25
1.5 The Research Objective and Contributions	30
1.6 Research Methodology	34
1.7 Thesis Outline.....	35
1.8 Conclusion.....	36
Chapter 2 Background and Literature Review	38
2.1 Introduction	39
2.2 A look at the State Aid Guidelines in more detail.....	39
2.2.1 Some key elements of the SAG.....	43
2.2.2 The Layers of Complexity within the SAG.....	45
2.2.3 Widely Recognized Practical Issues with the SAG	48
2.3 Existing work and research to help with unpacking SAG for practical broadband State interventions.....	49
2.3.1 EU Commission Level Related Work.....	49
2.3.2 Wider Research.....	54
2.4 A look at the Mapping Process as Portrayed in the SAG	56
2.5 Existing work and research to help with unpacking the SAG for creation of the online map	62

2.5.1 Industry & Government related work	62
2.5.2 Wider Research Fields.....	67
2.6 Conclusion.....	74
Chapter 3 The Story of the NBP Intervention	76
3.1 Introduction	77
3.2 Methodology used to create the historical record and identify the observations from the NBP intervention project	77
3.3 How the Irish NBP intervention project satisfied the SAG	79
3.3.1 How the NBP policy was created (2011 to 2012)	80
3.3.2 How an even more ambitious NBP policy was set out (2013 – 2014).....	83
3.3.3 The Development of the NBP Map (July 2013 - November 2014)	86
3.3.4 The Irish NBP Intervention Strategy (June 2014 – December 2015).....	89
3.3.5 The NBP Procurement process (December 2015 – November 2019).....	95
3.3.5.1 The Pre-Qualification Stage (2015 - 2016).....	96
3.3.5.2 The Competitive Dialogue stage (2016-2018)	98
3.3.5.3 The Final Tender Stage (2018-2019).....	111
3.3.5.4 The NBP Working Group and the Procurement Board.....	113
3.3.6 Complying with Environmental Directives and Regulations.....	114
3.3.7 The Final NBP Map Consultation	114
3.3.8 The State Aid Approval of the Irish NBP Intervention (November 2019).....	116
3.3.9 The Award of the NBP Contract (November 2019)	117
3.4 Significant Observations from the Analysis of how the Irish NBP intervention satisfied the SAG	120
3.4.1 Observation 1 - Four distinct phases of the Intervention Process can be seen	121
3.4.2 Observation 2 – Several different versions of the online map are needed ...	128

3.4.3 Observation 3 – There is a huge reliance on the Mapping Process	133
3.5 Conclusion	136
Chapter 4 Development of the Online Map	138
4.1 Introduction	139
4.2 The Creation of the Online Map in the Irish NBP Intervention	140
4.2.1 The Request for information (2013)	140
4.2.2 The Call for Input (2014)	146
4.2.3 Consultation on NBP Map (End of 2014 – Early 2015)	147
4.2.4 The Supplementary Information Request (March 2015)	150
4.2.5 Consultation on the Process to develop the Mapping Assessment Performance Criteria Assessment (July 2015)	152
4.2.6 The finalization of the NBP Mapping Assessment Framework (2015)	154
4.2.7 The NBP Mapping Assessment Framework as published	156
4.3 Making the NBP Mapping Assessment Framework more reusable	166
4.3.1 Demystifying the NBP Mapping Assessment Framework for future projects	167
4.3.1.1 The three Online Map Building Blocks	169
4.3.1.2 A reconceived and newly created framework	174
4.4 Insights from going through and reconceiving the process	187
4.4.1 Insight 1 – The complexity of the Verification Methodology is often considerably underestimated	187
4.4.2 Insight 2 – The number of Performance Criteria and sub parameters used should be minimized	188
4.4.3 Insight 3 – Verification Methodologies must be modified for each network type	190
4.4.4 Insight 4 – Determining the credibility of planned network that is yet to be deployed is a concept unique to State Aid Rules	191

4.4.5 Insight 5 – The Mapping Information Questionnaire should be designed to gather the necessary information specifically for the verification activities	193
4.4.6 Insight 6 – The quality of network information varies considerably amongst Service Providers so a degree of data validation must be applied	195
4.4.7 Insight 7 – Professional judgment and expert opinion is critical to the assessment	196
4.4.8 Insight 8 – The mapping exercise is highly onerous, expert resources are needed across a broad set of disciplines	197
4.5 Conclusions	198
Chapter 5 Corroboration of findings and Engagement with Policy Makers	200
5.1 Introduction	201
5.2 Background – Opportunities to provide input to the EU Commission	202
5.3 Testing ideas and findings with the BCO Network	203
5.4 The SAG evaluation and the revision of the SAG	209
5.4.1 The EU’s conclusions from the SAG evaluation	210
5.4.2 The EU’s targeted Mapping Consultation and bilateral engagement with the EU Commission	214
5.4.3 The updated SAG the mapping annex and the impact of this research	219
The number of Performance Criteria and sub parameters used should be minimized	222
Determining the credibility of planned network that is yet to be deployed is a concept unique to State Aid rules.	223
5.5 Conclusion	224
Chapter 6 Overall Conclusions, Reflections and Final Recommendations	226
6.1 Introduction	227
6.2 The research has met its overall objective	227
6.3 Some deeper reflections on the process and the way forward	230

6.3.1 The impact of market events, actions and reactions	230
6.3.2 The role of Politics in the Intervention Process	232
6.3.3 A robust, detailed mapping process capable of withstanding legal challenges is needed	235
6.3.4 A better, faster way to bring high speed broadband to all citizens	236
6.4 Final Conclusions and Recommendations	237
Appendix 1 – List of Basic and NGA Broadband Technologies published in 2013	239
Appendix 2 – NBP Mapping Assessment Framework.....	242
Appendix 3 – The three Online Map Building Blocks detailed description	269
A 3.1 The Irish Online Map Building Block 1 – detailed description.....	270
A 3.1.1 Stage 1 – Is the plan credible?	271
A 3.1.1.1 Stage 1 – The Technical Criteria	271
A 3.1.1.2 Stage 1 – The Deployment Criteria.....	272
A 3.1.1.3 Stage 1 – The Financial Criteria	274
A 3.1.2 Stage 2 – Agreements on Deployment.....	275
A 3.2 The Irish Online Map Building Block 2 – detailed description.....	276
A 3.2.1 The Irish development of the Mapping Verification Methodologies.....	276
A 3.2.2 The NBP Technical Criteria Verification Methodology	278
A 3.2.2.1 Introduction	278
A 3.2.2.2 Technical Criterion 1 – Is the Proposed solution NGA? - Wireless.....	279
A 3.2.2.2.1 Technical Criterion 1 – Parameter 1.1 - Wireless.....	279
A 3.2.2.2.2 Technical Criterion 1 – Parameter 1.2 - Wireless.....	280
A 3.2.2.2.2.1 Will the technology deliver a minimum of 30 Mbit/s download to each user?.....	281
A 3.2.2.2.2.2 Is the access network built using the proposed technology designed to deliver 30 Mbit/s to all users, under normal operation?	282

A 3.2.2.2.2.3 Is the maximum distance between the first point of active aggregation and the premises over which a minimum 30 Mbit/s service can be delivered established using distance modeling and/or link budgets which are supported by evidenced assumptions?	289
A 3.2.2.2.2.4 Is the proposed backhaul network designed to deliver 30 Mbit/s download to all users when they demand it?	290
A 3.2.2.2.2.5 Overall assessment of Technical Criterion 1 – Parameter 1.2	291
A 3.2.2.2.3 Technical Criterion 1 – Parameter 1.3 - Wireless	292
A 3.2.2.2.4 Technical Criterion 1 – Parameter 1.4 - Wireless	293
A 3.2.2.2.5 Technical Criterion 1 – Parameter 1.5- Wireless	293
A 3.2.2.2.6 Technical Criterion 1 – Wireless Conclusion	294
A 3.2.2.3 Technical Criterion 2 – Is the Proposed solution reliable? - Wireless ..	297
A 3.2.2.3.1 Technical Criterion 2 – Parameter 2.1 - Wireless	297
A 3.2.2.3.2 Technical Criterion 2 – Parameter 2.2 - Wireless	298
A 3.2.2.3.3 Technical Criterion 2 - Wireless Conclusion	299
A 3.2.2.3 Technical Criterion 1 – Is the Proposed solution NGA? - Wireline	301
A 3.2.2.4 Technical Criterion 2 – Is the Proposed solution reliable? - Wireline ..	304
A 3.2.2.5 Overall Technical Criteria Verification Outcome – Wireless and Wireline	306
A 3.2.4 The NBP Deployment Criteria Verification Methodology	307
A 3.2.4.1 Introduction	307
A 3.2.4.2 Deployment Criterion 1 – Is there a credible roll-out plan (“when and where”)?	308
A 3.2.4.3 Deployment Criterion 2 – Is there a credible resource plan (“how”)?	311
A 3.6.5.4 Overall Deployment Criteria Verification Outcome	312
A 3.2.5 The NBP Financial Criteria Verification Methodology	313
A 3.2.5.1 Introduction	313

A 3.2.5.2 Financial Criterion 1 – Is there a sound business plan?	314
A 3.2.5.3 Financial Criterion 2 – Is the funding available?.....	317
A 3.2.5.4 Overall Financial Criteria Verification Outcome	318
A 3.2.6 The NBP Verification Methodology – Stage 1 Summary	319
A 3.2.7 The NBP Verification Methodology – Stage 2	321
A 3.3 The Irish Online Map Building Block 3 – detailed description.....	323
A 3.3.1 The NBP Supplementary Request for Information.....	323
Appendix 4 – My submission to the EU Commission’s public consultation, in 2022	327
References	336

Chapter 1

Introduction

1.1 Introduction

Access to high quality, reliable broadband services is of significant importance for economic growth, social cohesion, and enabling innovation. It is fast becoming a basic necessity of everyday life. Next Generation Access (NGA) broadband networks, i.e., broadband networks which can deliver very high-speed broadband services, unlock the potential that digital technologies offer to the whole of society and the entire economy including all our citizens, communities, schools and industry whether they are small or large businesses. During the Covid-19 global pandemic the importance of having access to a high-quality reliable NGA broadband service could never be more evident. During periods where restrictions on the movement of people in the general community were imposed, activities such as home schooling, online education, remote working as well as online business and consumer activities were positively enabled through accessing reliable broadband services. In addition, the positive impact on mental health and social inclusion through the enablement of online communications over a vast array of digitally based platforms became very evident, touching all corners of society.

Those with poor broadband services struggled to participate in these activities; they suffered the frustration of battling the inefficiency of slow, poor, or unreliable broadband service quality. Research studies relating to the impact of digital experiences over the Covid-19 restrictions are now available, for example, a publication from the Economic and Social Research Institute of Ireland, 'Learning For All? Second-Level Education In Ireland During Covid-19' (1), highlights the difficulties faced by second level students in Ireland during the Covid-19 lockdown, particularly where they did not have access to NGA broadband services.

Given the huge importance of access to broadband, the focus of this thesis is on the provision of high-quality broadband in areas where the market does not provide such services or where there no concrete plan exists to provide such services and therefore the state must intervene. The purpose of this opening Chapter is to set the precise context for the research, clarify the research questions at the heart of this work, and provide an overview of the Chapters that follow. Section 1.2 gives a brief sense of the

progress that is being made in rolling out NGA broadband and explains the need for State intervention. Section 1.3 gives a short overview of the state intervention in Ireland, my role in the process and the subsequent motivation for the research undertaken. Section 1.4 then zones in on one aspect of the intervention, namely the creation of the online map that is used to determine the areas that require the intervention. The reason for zoning in on this aspect of the intervention process, is that this is the most hidden complexity in the process and is the area needing most attention. Section 1.5 then summaries the core contributions of the research and section 1.6 includes a high-level view of the rest of the thesis. Section 1.7 concludes the Chapter.

1.2 Broadband rollout progress & state intervention

This essential need for high-speed reliable digital connectivity is not a new phenomenon; it has been recognized across Europe for many years and has been targeted as a key priority to be addressed by successive policy makers. For example, European policies adopted by EU Member States such as ‘A Digital Agenda for Europe’ (2) (DAE), ‘The Single Market Act’ (3), ‘The Single Market Act II’ (4), ‘The Europe 2020 Strategy’ (5) (EU2020) and ‘The Digital Single Market’ (6) (DSM) are all initiatives designed to advance broadband connectivity across Europe and safeguard Europeans competitiveness in the digital age.

Europe’s DSM strategy sets out an ambition to realize a society, where citizens across Europe should be provided the opportunity to enjoy and reap the benefits of digital services seamlessly across Europe. Europe’s EU2020 underlined the importance of broadband deployment as part of the EU’s overall economic growth strategy for the following decade and set out ambitious targets for broadband development. One of the EU’s flagship initiatives, the Digital Agenda for Europe (DAE), acknowledged the socio-economic benefits of broadband and highlighted its importance for competitiveness, social inclusion, and employment. The DAE restated the objectives of the EU2020 strategy to bring basic broadband to all Europeans by 2013 and ensure that, by 2020, (i) all Europeans would have access to much higher Internet speeds of above 30 Mbps and (ii) 50% or more of European households would be subscribed to Internet connections above 100 Mbps.

The latest strategy launched by the EU Commission continues this focus on improving broadband connectivity, the 2030 Digital Compass¹ sets out the digital connectivity ambitions for 2030, that ‘All European households will be covered by a Gigabit network, with all populated areas covered by 5G’.

Despite the strong social and political intent, successive targets have not been met. The EU’s annually published index for tracking digital progress across EU Member States, the Digital Economy, and Society Index (DESI), highlights the slow progress being made in rural areas. In 2020, the DESI report on connectivity, ‘Digital Economy and Society Index (DESI) 2020 Connectivity’ (7) identified the availability of broadband in rural areas as:

‘challenging as 10% of households are not covered by any fixed network and 41% are not covered by any NGA technology.’

By 2022 the situation had only shown slight improvement, with the DESI report, ‘Digital Economy and Society Index (DESI) 2022’ (8) identifying the availability of broadband in rural areas as follows:

‘8.5% of households are not covered by any fixed network, and 32.5% are not served by any NGA technology.’

It was always envisaged that the achievement of these targets would largely be met through commercial investment, but EU Member States were encouraged to provide public funding where the targets could not be met. Hence all countries in the European Union have had to consider intervening² in their broadband market.

¹ The 2030 Digital Compass sets out the EU digital target ambitions for all EU Member States to be met by 2030, <https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade>

² Since 2003 The EU Commission has issued over 200 decisions relating to State aid for broadband and mobile.

A full list of these decisions is available on the EU’s website at https://competition-policy.ec.europa.eu/document/download/258fba43-4d06-45c0-8e4e-68db3627246f_en?filename=stateaid_broadband_decisions.pdf

The State cannot, however, intervene in any way it likes. There are specific rules which need to be followed. In using public funds, one of the key State Aid principles is that any State Aid provided is complementary and does not unduly substitute investments of market players. The principles of State Aid outlined by the EU Commission advise that any State intervention in the broadband market should limit, as much as possible, the risk of crowding out private investments, of altering commercial investment incentives and ultimately of distorting competition contrary to the common interest of the European Union. The main rationale for this is that if State Aid for broadband were to be used in areas where Service Providers, would normally choose to invest or have already invested, this could significantly undermine the incentives of commercial investors to invest in broadband in the first place. In such cases, State Aid to broadband might become counterproductive to the objective pursued. Therefore, one of the key principles in designing any State intervention is that the resulting State subsidy should target only those areas where the market fails to deliver the necessary services i.e., where market failure exists.

The EU Commission has developed EU State Aid Guidelines, 'EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks' (9), (SAG), which outline the rules that must be adhered to by EU Member States, which protect these principles. The SAG relevant to this thesis, were published in 2013.

Formal approval for an intervention must be granted by the EU Commission prior to that State intervention – in other words a rigorous process to determine that State Aid Guidelines (SAG) have been satisfied ensues. This approval (referred to herein at 'State Aid Approval') requires a typically lengthy multi-year preparatory process to be undertaken by EU Member States.

1.3 The Intervention Process in Ireland & Motivation for the Research

In Ireland the commercial market roll out of broadband did not serve all of those who needed access. Ireland due to its mainly rural nature and specific geographic spread of housing presented challenges that the commercial market could not serve. The lack of rural broadband was a particular issue in the Irish general election of 2011 and the election manifestos of political parties reflected that issue through commitments to address this infrastructure deficit. Hence in 2012 the Irish State published its 'National Broadband Plan - Delivering a Connected Society' (10) (NBP) which made it clear that a state intervention would be needed to deliver on broadband for Ireland.

In Ireland the Government Department, in 2012, with responsibility for broadband was the Department of Communications, Energy and Natural Resources. This Department was therefore tasked with figuring out how to implement what was referred to as the 'Irish NBP intervention' which of course had to be designed by adhering to the EU's State Aid Guidelines.

The process was complex and lengthy running from the publication of that plan in 2012 to 2019 when a contract for the actual delivery of the broadband project was signed. That rollout process continues to date with expected completion by 2027. Details of the process to design this State intervention are presented in Chapter 3, but for now, suffice to say it was long and complex.

The Department created an Irish NBP intervention project team in 2013 tasked with delivering this policy through designing a state-led Intervention to ensure NGA broadband was delivered to areas where commercial Service Providers would not serve. I joined the Department and the Irish NBP intervention project team in April 2014 and worked on the team up to the date that the Irish NBP Intervention received formal State Aid Approval² on 15 November 2019. I have since continued to work within the Department overseeing the implementation of the NBP contract amongst other responsibilities.

There were many different actors involved in the designing the NBP process including the Department's internal working group, the national regulator ComReg, expert advisory companies such as PwC, KPMG³ and Analysys Mason⁴, legal advisors such as Mason Hayes and Curran⁵ etc. There were steering boards and advisory panels in play and overall, there was strong governance, and a large amount of expertise was brought on board.

When first reviewing the SAG in early 2014, we all believed they would be reasonably straight forward to satisfy when tasked with designing the Irish NBP intervention. However, it quickly became apparent over the course of the Irish NBP intervention project that significant complexity is packed into those guidelines. As will be shown in detail in subsequent Chapters, the design of the Irish NBP intervention and achieving State Aid Approval for the project took almost 7 years to complete; encompassing thousands of people hours, drawing on an extensive range of specialized expertise, all of which were needed to satisfy the specific conditions set out in the SAG and ultimately achieve State Aid Approval.

While not all the 7-year duration can be solely attributed to the complexity of the SAG, undoubtedly, the lack of available details within the guidelines themselves and material to learn from was a significant contributor to the timeline. Hence, having come through the process, my over-riding motivation was to make that process easier for others who follow, and the key motivation that led to this research.

³ PwC, KPMG are consultancy firms who provide a range of advisory services to their clients, more information can be found at <https://pwc.com/> , <https://kpmg.com/> .

⁴ Analysys Mason are a firm focused on providing telecoms, media and technology advice to their clients, more information can be found at <https://www.analysysmason.com/about-us/>

⁵ Mason Hayes & Curran are a firm who offer legal advisory service, more information can be found at <https://www.mhc.ie/>.

It is common practice for work that happens in Government departments to be documented in a way that serves the process itself rather than serves those seeking to understand the process. For example, in the case of the NBP, there is written material setting out the National Broadband Plan, documents corresponding to requests for various inputs during the process, documents in response to those requests, documents describing the resulting policies, and more. These documents are all useful and all have been made public. But it is not always common practice for the story to be pieced together and presented in way that makes it easy for those wishing to emulate and learn from the whole process itself.

This does not mean that Government departments do not reflect on work done. It is indeed frequent practice to regularly reflect and develop lessons learnt so that processes can be improved, but the pace and practical pressures of the normal day-to-day work requirements typically only allow this to be done at a high level. To really piece the story together from thousands of documents, and hundreds of thousands of people-hours of work, needs time and focus.

I therefore felt in an ideal and unique position, to piece the story together and as a result be able to make improvements by putting the NBP experience in Ireland at the core of this research. I acknowledge that as an active participant in the NBP intervention process that I have a risk of certain bias towards the project in describing how and why certain activities were undertaken. As will be evident throughout this thesis, objective data sources, project documents and published documentation are referenced and used whenever possible to mitigate this risk.

In addition, the recommendations and findings have been corroborated through a series of formal engagements with the EU Commission, which is described in Chapter 5. A number of the recommendations have since been adopted in the updated State Aid Guidelines which were published in 2023 by the EU Commission.

Also, I would like to acknowledge the support the Department has offered to me in undertaking this research. From the outset, the Department has confirmed to me that they approve of my use of the material from the NBP intervention process for the purposes of this research and thesis. Without this support this research could not have been undertaken to the same extent. The Department are keen for other EU Member States to benefit from our learnings.

It is important too to acknowledge that the research in this thesis has been undertaken on a part time basis, in my own personal time. Hence the thesis is a personal expression of my work and I confirm the findings and recommendations are my own.

1.4 Getting to the heart of the intervention process – the online map

To set the more specific context for the research in this thesis and the contributions it sought to make, it is crucial to zone in on what is at the heart of the intervention process. Put in simplest terms if a state wants to intervene and help provide broadband, it needs to know where the market has succeeded and where the market has not. Hence it is all about the map.

There needs to be an agreed map that specifies what is known as the ‘Intervention Area’.

The Intervention Area is the area subject to a public procurement where eventually the State will subsidize a company to deliver broadband services to premises that are located within the Intervention Area. To adhere with the SAG, EU Member States are required to publish their proposed Intervention Area through an online map (referred to herein as the ‘online map’). The Mapping Process or NBP Mapping Process in the Irish case is the process used to create such an online map.

Before going into the complexity of what is involved in the Mapping Process, it is useful to look at an example. Figure 1.1 shows the Irish State’s online map from 2019, which was produced as part of the NBP’s Mapping Process. The Irish State’s online map was

called the 'NBP High Speed Broadband Map' or alternatively the 'NBP online map'. On the NBP High Speed Broadband Map, areas marked in 'dark blue' identified premises where NGA broadband services were already being provided or were planned to be provided by Service Providers. The areas marked in 'amber' identified premises where no NGA broadband existed or was planned to be provided in-the-near-future from any Service Provider (this concept is explained later in thesis). The locations marked as amber, when taken together, therefore identified the Intervention Area.

The NBP High Speed Broadband Map was published online on the Department's website. It allowed members of the public to view the availability of NGA broadband services in any area of Ireland at various different levels of granularity.

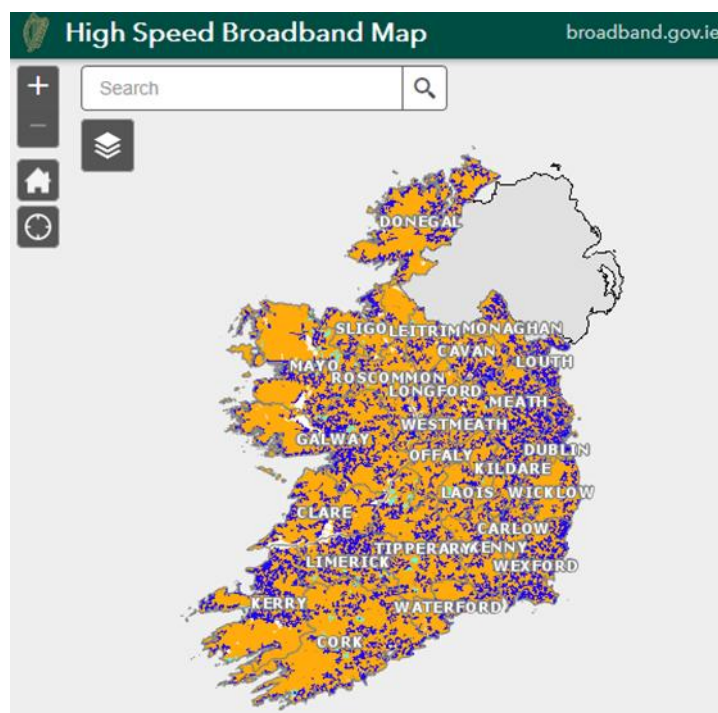


Figure 1.1 – The Irish State's NBP High Speed Broadband Map 2019

The Intervention Area, for example, could be viewed at a county level of granularity, as illustrated in Figure 1.2 below. Figure 1.2 zones in on the availability of NGA broadband services in parts of County Cork in the south of Ireland. At a county level, certain characteristics of Service Provider investment can be clearly observed. The areas in dark

blue (i.e. where Service Providers have invested or planned to invest in their networks to provide NGA broadband services) are primarily based in Cork city and its surrounding suburbs, as well as a number of satellite towns and larger villages. This concentration of broadband coverage is very typical of what can be observed in many European countries. Service Providers typically focus their investment plans on areas where there is a greater density of premises. The main rationale for this concentration is that these areas are more commercially attractive. In these areas the cost of deploying NGA broadband services when considered on a 'cost per premises' basis is lower than in more dispersed areas. Service Providers can pass⁶ many premises in these higher density areas over a short distance, thereby enabling potential revenue from each of these premises to be gained. Whereas in more dispersed locations similar levels of capital expenditure would result in a lower number of premises being passed and thus making the more dispersed locations less commercially attractive as a lower level of potential revenue can be gained. This investment pattern can be seen clearly in Figure 1.2 in County Cork where Cork City, its suburbs and other larger towns have extensive NGA coverage, whereas rural areas do not. In less densely populated areas, the capital investment needed per premises increases and hence these areas are less commercially attractive to Service Providers.

⁶ The term 'premises passed' is commonly used in the telecoms industry to describe a premises where the network has been built i.e. the premises has been 'passed' by the network. Typically this means that the premises can be connected to the network if an order is placed to get connected.

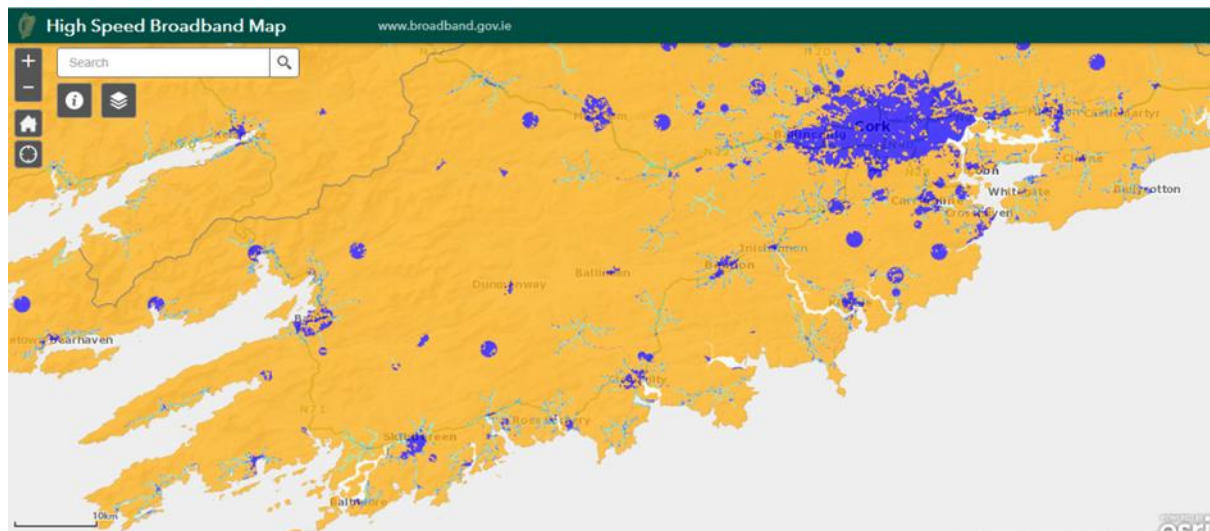


Figure 1.2 – NBP High Speed Broadband Map – Showing NGA broadband in parts of County Cork.

In Ireland, 23% of the total premises in Ireland were identified on the NBP High-Speed Broadband Map as residing in the amber area (comprising of over 560,000 premises and over 1.1million people). This represented almost 96% of the geographical land mass of Ireland.

At a lower granularity, different characteristics could be observed on the NBP High Speed Broadband Map. A feature of rural premises distribution across Ireland is that they are not typically located in villages or clustered in hamlets, they are often located in a 'ribbon type' development i.e. premises located every hundred, or so, metres apart along roadways or rural laneways rather than clustered together. This distribution increases the capital investment needed to pass each premises and makes these areas less commercially attractive to Service Providers.

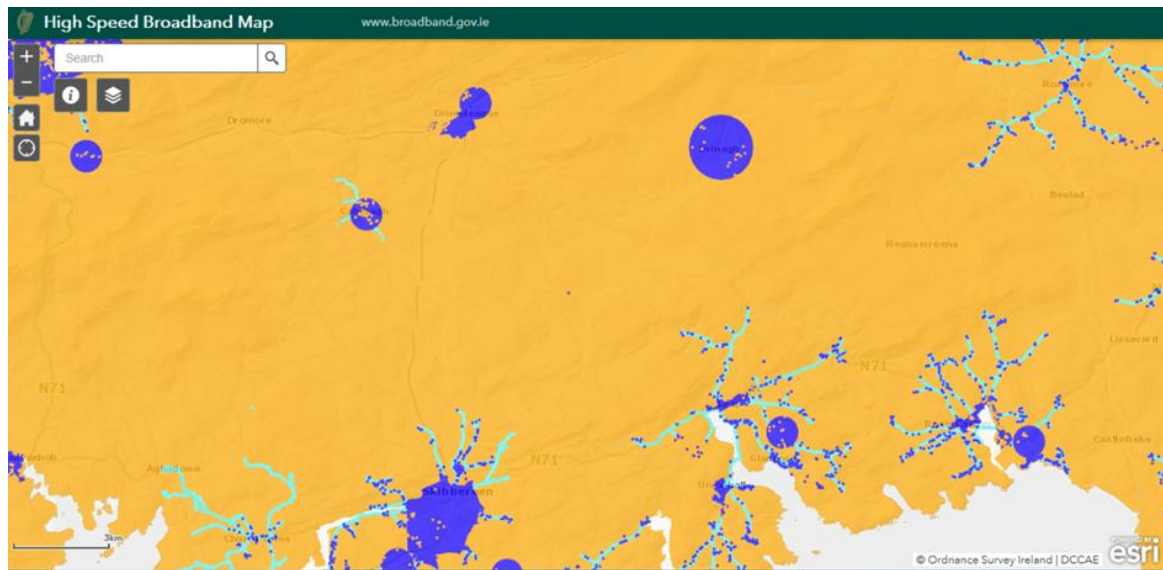


Figure 1.3 – NBP High Speed Broadband Map – Showing gaps in rural NGA coverage.

As illustrated in Figure 1.3, there were significant gaps in NGA broadband services identified on the NBP High Speed Broadband Map, over many rural areas in Ireland. Dotted along these roads are premises every 100 meters or so apart. Large numbers of premises across rural Ireland follow a similar distribution pattern. These premises were typically identified as not having any NGA broadband services and had no prospective of a commercial company deploying NGA broadband services to them in the immediate future. Businesses and communities residing in these areas often had to commute to towns or cities to conduct digitally based activities. It is in these locations that the digital divide in Ireland could clearly be seen, and its impacts felt most.



Figure 1.4 – NBP High Speed Broadband Map – Showing Cork City NGA coverage.

Figure 1.4 illustrates that gaps in NGA coverage also existed in suburban areas of cities where the density of premises is somewhat lower than in the city centre. In Cork City amber premises (i.e. premises where NGA broadband services were not available) were present in some suburban locations on the outskirts of the city, even in locations which weren't particularly far (3-5km) from the city centre. This also resulted in deep frustration from premises owners and businesses that resided very close to existing services yet still couldn't avail themselves of NGA broadband services.

To the uninitiated it may seem that the creation of an online map might be straightforward – it was not. In fact, the term 'online map' is in itself misleading; multiple versions of the NBP's online map were created before a final version was agreed. The NBP Mapping Process in Ireland took over six years to complete from 2013 to 2019, it involved eight separate various forms of consultation with industry and was the subject of intense political, media and industry scrutiny. The stakes were extremely high, and the consequences of its findings were long lasting and impactful for consumers, Service Providers, and policy makers alike.

The Mapping Process for any EU Member State has the potential to shape industry investment for many years, it can determine the fate of whether consumers receive high-speed broadband or not and can ultimately determine the success or otherwise of a State's adoption of digital services. Given that the development of the online map is a critical aspect of adhering to the SAG and gaining State Aid Approval, the research in this thesis gives a special focus to this activity, to its documentation and to finding ways to improve and streamline this process.

1.5 The Research Objective and Contributions

Gaining State Aid Approval for a broadband intervention is a complex process. This research aims to demystify the exercise and in particular focuses on demystifying the Mapping Process by leveraging the experiences gained through the Irish NBP intervention project.

As mentioned earlier, I had the honor of being a senior member of the NBP project team with responsibilities which included: the design and implementation of the end-to-end NBP Mapping Process; the management of all key decisions relating to the NBP Mapping Process; the oversight of multiple public consultations and numerous publications relating to the NBP Mapping Process; the engagement and correspondence with all industry players in Ireland (over 70 commercial Service Providers); the development of a multi-disciplined team with the appropriate skill set to implement the NBP Mapping Process including technical system matter experts, geographic information system (GIS) experts, legal and state aid experts, financial and economic experts, as well as extensive administrative and process expertise; and the engagement with the EU Commission on matters relating to the NBP Mapping Process. It is worth stating that all the work in this thesis was completely additional to my role. My role in the Department simply provided the real-life experience that fed into the subsequent research and allowed me to highlight the key issues, complexities and challenges that are faced with conducting an actual Mapping Process, rather than relying on theoretical conjecture.

The motivation to undertake this research is quite simple. Having concluded this project, I realized that there were opportunities to help others embarking on similar projects, that significant lessons could be gleaned from the Irish experience and surely a better or improved way can be found to achieve the same outcome.

Ultimately the key question in the thesis is how can the Irish experience be used to inform and improve future intervention processes?

By 'inform' I mean that other EU Member States will be able to reference and understand the experiences gained through the Irish NBP intervention project and, in particular, the NBP Mapping Process, prior to embarking on their own project to design a State intervention and seek State Aid Approval.

As referenced earlier, the DESI report on connectivity published in 2022⁷ highlighted that the urban rural divide continues to persist, with over 32% of rural premises across Europe still without access to NGA broadband services. In the EU's report on the state of the digital decade published in 2023, the EU highlighted that more than half of rural premises (55%) were without access to any fixed very high-capacity network⁸ and 9% of rural premises are without access to any fixed network at all. This is not going unnoticed; every EU Member State has or is currently developing plans to address this key economic and societal issue.

In tandem with this, the EU's targets for broadband availability continue to be expanded and evolved⁹. Therefore, many more Mapping Processes are being and will continue to be conducted. It is hoped that this research will greatly inform and aid the design and implementation of these projects. In addition, any guidance on how to conduct a Mapping Process, issued by the EU Commission themselves will be able to consider the findings outlined in this research.

By 'improve', I mean EU Member States conducting a Mapping Process will be able to leverage the findings so that their Mapping Process can be designed sufficiently robustly to underpin their decision making and give all stakeholders confidence that the intervention being proposed will deliver on their public policy objective, while being proportionate in terms of the degree to which the State is intervening in the market. Ideally the Mapping Process is conducted over a shorter period of time than would

⁷ The EU Commission didn't publish a DESI report in 2023 as they revised their reporting procedures for EU Member States to take account of the EU digital targets for 2030. A report of the state of the Digital Decade was published instead in 2023.

⁸ A very high-capacity network refers to optical fibre network or a network which is capable of delivering similar network performance to optical fibre network.

⁹ The EU's digital decade strategy targets gigabit broadband available to all by 2030, please see more details at

https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en.

otherwise be the case; is more efficiently conducted so that less resources are required to implement the process successfully; is robustly designed so as to withstand the weight of stakeholder oversight and scrutiny, to defend Service Provider challenges; and is designed to avoid other key issues and risks that are highlighted in the thesis.

To deliver this objective, multiple contributions are made in the thesis. The first contribution, which is outlined in Chapter 3, unravels the complexity of the intervention process undertaken by Irish authorities in designing a state intervention and seeking approval from the EU Commission to intervene in the Irish broadband market. This is achieved through tracing all the various activities of the Irish NBP intervention project and creating a historical record which tells the story of what was done. Although the NBP project was followed very closely by the Irish public, politicians and media, it is practically impossible for anyone to accurately create such a record, unless they were part of the NBP intervention project team and had visibility of what different activities were pursued and why.

The second contribution in Chapter 3 describes how this multi-annual, complex process can be better understood and followed, by distilling and grouping all the activities into distinct phases. The third contribution in Chapter 3 describes how and why several versions of the online map are needed throughout this multi-annual process. And the last contribution in Chapter 3 identifies the level of dependency on the Mapping Process at each phase of the intervention process, establishing the rationale for putting the Mapping Focus at the centre of this research.

The next contribution, described in Chapter 4, which is the most detailed and voluminous part of the research, identifies the key building blocks that are needed to produce an online map. While the SAG issued by the EU Commission in 2013 outlined the principles of conducting a mapping exercise at a high level, no detailed or practical guidance was provided on how to actually produce an online map. The research carefully traces how the online map was created in the NBP intervention project and defines the building blocks needed to produce an online map. The research then makes

every effort to enhance and simplify what was created for the NBP intervention project so that they can be more easily followed by other EU Member States embarking on a new Mapping Process. The building blocks themselves are described in Chapter 4. A series of newly created process flows and accompanying explanations for each are set out in Appendix 3. The information presented in Appendix 3 is a significant enhancement of what was developed by the NBP intervention project team. For the research to have the greatest impact I felt it important to create a more accessible, easier to follow process for other EU Member States. While Appendix 3 retains the level of detail required to implement a robust and thorough Mapping Process, it is enhanced by how the steps are presented in a clear and logical manner and are accompanied by explanatory notes to aid the reader through each step.

In addition to each of the above contributions, a number of key insights are outlined to aid and guide EU Member States in the production of their own online map. These insights highlight key learnings from the Irish NBP intervention project that must be considered by EU Member States if they are to succeed in creating an effective, streamlined process for their own project.

1.6 Research Methodology

The research adopted a qualitative case study methodology to investigate the Irish State's NBP Intervention and NBP Mapping Process. This methodology involved piecing together and logically grouping the activities that took place on a specific project. This tracing was informed by a thorough documentary analysis, from a wide range of sources including official papers, reports and related materials, both published and unpublished, including my own notes.

These sources were systematically examined and pieced together to reconstruct the sequence of events and decisions using a process tracing approach which identified how the policy developed over time.

Given the official record was often fragmented, incomplete and/or unclear, the analysis was necessarily interpretive, focusing on making sense of gaps, contradictions, and evolving narratives. The research was further informed by my position as a practitioner directly involved in the process. This inside perspective provided tacit knowledge and contextual understanding that enriched the analysis, while requiring reflexive awareness of potential bias.

Taken together, this combination of documentary analysis, process tracing and practitioner insight enabled a robust historical reconstruction of what actually occurred and why.

To mitigate any potential bias, triangulation of documents was pursued where possible, as well as seeking out the perspectives of key stakeholders to test the validity of the ideas and findings as they emerged. A significant exercise was undertaken directly with the EU Commission to corroborate findings with key policy makers. The process of corroboration undertaken are described in more detail in Chapter 5.

This qualitative research methodology was chosen as it provided the best opportunity to ensure the experiences from a real world project could be fully unpicked and understood. As explained above, the archive of documentation was fragmented and incomplete so further interpretation over and above a documentary analysis was needed. Fusing the documentary analysis particularly with my own practitioner insights ensured a deeper understanding of the context the National Broadband Plan project could be described. As a result, from having this deeper understanding, that a number of the key contributions were found.

1.7 Thesis Outline

The remainder of the thesis is structured in six other Chapters.

Chapter 2 in the first instance introduces the main concepts and processes that are central to the dissertation i.e., the Intervention Process and Mapping Process and terms

and concepts particularly relevant to those processes. This introduction is intended to arm the reader with the key principles and processes that are the focus of this thesis, before going on to look at what relevant literature exists and highlight the level of research that has been undertaken on this topic.

Chapter 3 and Chapter 4 both describe the main contributions of the thesis, as discussed earlier.

Chapter 5 describes the engagement undertaken with the EU Commission as part of the research. The approach describes the process undertaken to share and corroborate the research findings with these key stakeholders and disseminate the information so as to provide input to the EU Commission for the development of future EU guidance.

Lastly Chapter 6 outlines the overall conclusions and final recommendations of the thesis and highlights where further research would be of benefit.

1.8 Conclusion

The lack of availability of high-speed broadband services continues to be a significant problem for citizens across Europe, particularly for those living in rural areas. All EU Member States are focused on addressing this digital divide and have committed to ensuring gigabit broadband services will be available to all by 2030 and where the commercial market will not deliver, State intervention is needed. Under EU law, Governments must first design an intervention and seek formal approval from the EU Commission for their proposed intervention prior to any deployment. The EU Commission have published SAG which set out how an intervention should be designed and the principles they review when deciding whether to grant State Aid Approval or not.

The guidelines are just that – guidelines and do not hugely help those states implement an intervention process. Therefore, it makes sense to fully study a process that has been already undertaken, learn from it and help others engaging on the same path. The

online map is the *key* element in the design of a State's intervention and requires significant focus. The Irish NBP intervention process, combined with my personal lived experience, offers an ideal opportunity for documenting, analysis and learning.

Making the intervention process and the compliance with SAG more understandable and more accessible can be a key step in addressing the rural broadband challenge.

Chapter 2

Background and Literature Review

2.1 Introduction

In Chapter 1 the SAG, a set of EU rules that must be followed when the state intervenes in the broadband market, were introduced. Chapter 2 describes the literature survey carried out and it is presented in two parts.

To provide greater context and to aid the reader in their understanding, the first task of this Chapter, in section 2.2, is to introduce some of the main concepts that are the focus of this thesis. A general description of the SAG is provided and some of the fundamental concepts and terms used, (particularly those used in the SAG which are specific to the Mapping Process) are explained. A key insight that can be taken from this section is that the SAG contain limited information on which to build a practical State intervention. In the first part of the literature survey, Section 2.3 seeks to identify any existing research or relevant work that has taken place in relation to these SAG, and in particular work that might provide additional practical information. As can be seen in this section the EU Commission itself has initiated some limited supports, and little to no research exists to feed into the intervention process.

The online map was also introduced in Chapter 1, as the production of this online map is a key focus of the research in this thesis. However, Chapter 1 merely explained what it is and how it can be read, and hence in section 2.4 of this Chapter an overview of the how that online map process is presented within the SAG is provided. As can be seen in section 2.4 the same challenge exists as for the SAG in general – namely that there is limited detail available. In the second part of the literature survey, Section 2.5 therefore explores relevant research and publications that might shed light on the Mapping Process and highlights how little there is to use as a basis for the online map creation. Section 2.6 concludes the Chapter.

2.2 A look at the State Aid Guidelines in more detail

The EU State Aid Guidelines (9), (SAG), which are relevant to the research in this thesis were published in January 2013. The SAG's purpose is to provide EU Member States with a framework under which they can, subject to certain conditions, intervene in the

broadband market and reduce the digital divide where Service Providers have no willingness to invest.

At the same time, the SAG also aim at protecting commercial investments by ensuring that no public intervention can take place where private operators invest. They also aim to foster competition through mandating competitive selection procedures as well as mandating some specific technical requirements to ensure that any network that is subsequently built offers equal and open access to all Service Providers.

The legal basis of EU State Aid Rules is the Treaty on the Functioning of the European Union (11) (TFEU)¹⁰. State Aid is the term used to describe supports provided to undertakings from State resources, which has the potential to distort competition and affect trade between EU Member States.

EU State Aid Rules allow for a number of exemptions from State Aid Approval. These are Services of General Economic Interest, De Minimis Aid¹¹ and State Aid that qualifies under the General Block Exemption Regulation¹². These are referred to as 'Exempted' aid, all other State Aid requires State Aid Approval and is referred to as 'Notified' aid.

¹⁰ The TEFU is one of two treaties forming the constitutional basis of the EU, the other being the Treaty on European Union 12. The European Commission. Treaty on European Union 2012. (TEU).

¹¹ Details on Services of General Economic Interest and the EU Regulation relating to De Minimis Aid can be found at https://competition-policy.ec.europa.eu/state-aid/legislation/sgei_en .

¹² Details on the General Block Exemption Regulation can be found at https://competition-policy.ec.europa.eu/state-aid/legislation/regulations_en .

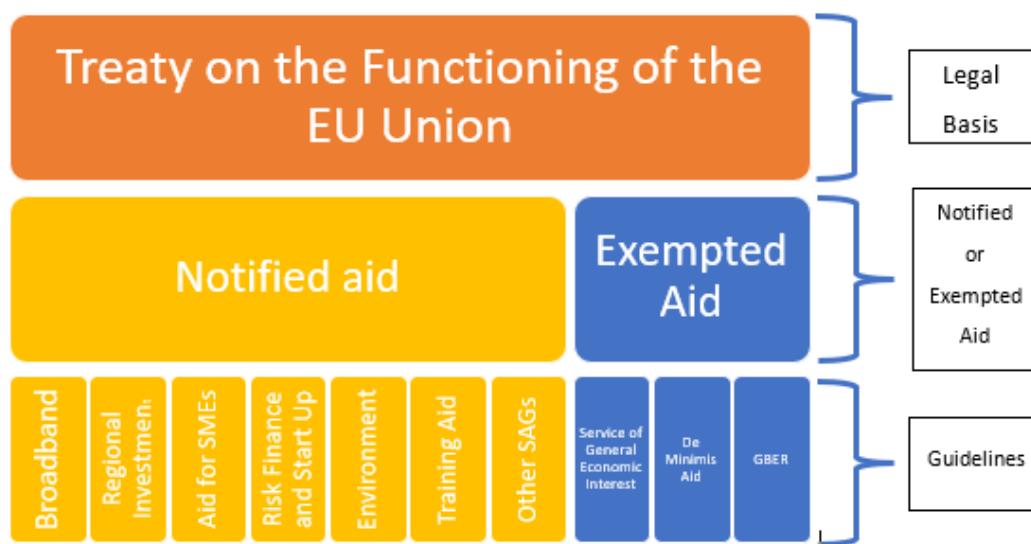


Figure 2.1 Illustration of how multiple State Aid Guidelines exist covering different sectors and how certain aid must be notified and other types of aid does not require notification to the EU Commission.

Figure 2.1 illustrates the hierarchical relationship between the Treaty and these different guidelines. The Treaty provides the legal basis of the EU State Aid rules, under which there is both Notified aid and Exempted aid. The EU Commission publishes different guidelines on how the EU's State Aid rules can be met for both Notified aid and Exempted aid.

Therefore the main motivation that the EU Commission publishes different sectoral state aid guidelines is to ensure that some consistency is applied across all EU Member States in meeting the principles of the Treaty.

The specific SAG, which are the focus of this thesis, are the EU's guidelines for EU Member State's intending to intervene in the broadband market. The SAG provide EU Member States guidance on how Articles 107 and 108 of the Treaty on the Functioning of the European Union can be met in the context of the broadband market sector. There are several other EU State Aid Guidelines which relate to other sectors e.g., Aviation, Education etc. and guidelines which relate to a specific purpose e.g., risk finance, environment etc.

Once an EU Member State establishes their national policy for broadband and identifies that an intervention in their national market is necessary to ensure this policy is delivered, they must then conduct a public procurement to select a contractor to implement this intervention. The nature of the market intervention and the contract that is awarded following the public procurement must align to EU State Aid rules. The EU Member State must determine whether their proposed market intervention is Exempted Aid or Notified Aid. If the proposed market intervention is Notified Aid, they must then satisfy the requirements set out in the SAG. An EU Member State must submit a description of their proposed intervention to the EU Commission, (this submission is referred to as a 'formal notification'). The EU Commission then assess whether EU State Aid rules set out in the SAG have, on balance, been met by the proposed market intervention or not. If they are satisfied, they provide approval for the proposed market intervention¹³. Formal State Aid Approval must be granted by the EU Commission to the EU Member State prior to the initiation of the actual network deployment or implementation of any works.

The SAG themselves are outlined in a surprisingly short document of some 26 pages. They are divided into four chapters namely, (1) Introduction, (2) The Main Principles of The Commission's Policy on State Aid for Broadband, (3) The Assessment of State Aid for Broadband, and (4) Final Provisions.

Each of the chapters in the SAG has sections covering different aspects of the rules. For example, SAG - chapter 3, section 3.3 describes the distinction between what are termed white, grey, and black areas depicting the level of NGA network services available in a given area. These concepts are unique to the SAG, and particularly the process of creating the online map. They must be carefully analysed and understood to

¹³ The full list of State Aid Broadband Decisions can be found on the EU Commission website. The below link includes decisions up to 2016

https://energy.ec.europa.eu/system/files/2016-06/opinions_SoS%2520Plans_0.pdf

ensure an EU Member State's intervention is designed correctly to meet the requirements of the SAG.

Within each section there is a number of Paragraphs which outline obligations or conditions which must be met by EU Member States, or which outline some guidance to EU Member States in how to design their State intervention. There are 91 Paragraphs in total contained within the SAG. These Paragraphs are written in a legalistic fashion but at a high level. They are open to quite a broad level of interpretation. In many cases, it is left to the EU Member State to interpret and then define more precisely what is meant by the particular condition or define the concepts with greater precision so that they can be implemented practically as part of their State intervention. In the sections that follow various elements of the SAG are highlighted.

2.2.1 Some key elements of the SAG

Paragraph 8 of the SAG describes the purpose of the guidelines as follows:

“(8) These guidelines summarise the principles of the Commission's policy in applying the State aid rules of the Treaty to measures that support the deployment of broadband networks in general (Section 2). They explain the application of these principles in the assessment of aid measures for the rapid roll-out of basic broadband and very high speed, next generation access (NGA) networks (in Section 3). The Commission will apply the guidelines in the assessment of State aid for broadband. This will increase the legal certainty and transparency of its decision-making.”

The aim of the SAG is to provide clarity to EU Member States on what the Commission will consider when assessing whether the proposed State intervention aligns to EU State Aid Rules.

Section 2 of the SAG outline the main principles of the EU's Commission policy on State aid for broadband. Section 2.1 states that in order for a State intervention (referred to as a 'Measure') to qualify as State aid, the following cumulative conditions have to be met (outlined in section 2.1 Paragraphs 10 to 15), summarized as, (a) the Measure has to be granted out of State resources, (b) it has to confer an economic advantage to

undertakings, (c) the advantage has to be selective and (d) distort or threaten to distort competition, (e) the Measure has to affect trade between Member States.

‘Compatibility’ is a term used in State Aid correspondence to describe a State intervention which is consistent with and aligns to the EU’s State Aid rules. So, if an EU Member State’s proposed Intervention is assessed by the EU Commission and deemed to be ‘Compatible’, the EU Commission will then approve the State intervention so that the EU Member State can then proceed with its implementation.

Paragraphs 33, 34 and 35 of the SAG introduce the principles of compatibility under which the EU Commission assess any proposed State intervention:

“Overview of the common principles of compatibility

(32) In the assessment under Article 107(3)(c) of the TFEU the Commission ensures that the positive impact of the aid measure in reaching an objective of common interest outweighs its potential negative side effects, such as distortions of trade and competition. This exercise is conducted in two steps.

(33) First, every aid measure has to comply with the below necessary conditions. Failure to comply with one of the following conditions will result in declaring the aid incompatible with the internal market.

- 1. contribution to the achievement of objectives of common interest*
- 2. Absence of market delivery due to market failures or important inequalities*
- 3. Appropriateness of State aid as a policy instrument*
- 4. Existence of incentive effect*
- 5. Aid limited to the minimum necessary*
- 6. Limited negative effects*
- 7. Transparency*

(34) Second, if all necessary conditions are met, the Commission balances the positive effects of the aid measure in reaching an objective of common interest against the potential negative effects.”

Essentially the SAG outline that the EU Commission will weigh up the anticipated positive impacts of the proposed State intervention against the potential negative side effects when deciding on whether the State intervention is compatible with the EU’s State Aid rules or not.

2.2.2 The Layers of Complexity within the SAG

The SAG expand on these seven conditions in chapters 2 and 3, in particular sections 3.4 and 3.5 which describe a series of principles to be met when designing a State intervention.

For example, section 3.4 of the SAG expands on how the condition ‘*limiting the distortions of competition*’ should be addressed when designing a State intervention as follows (please note that the below extract is abbreviated in part):

“Section 3.4 - Design of the measure and the need to limit distortions of competition

(78) Every State measure in support of broadband deployment should fulfil all compatibility principles described above in Section 2.5, including the common interest objective, the existence of market failure, the appropriateness and the incentive effect of the measure. As regards limiting the distortions of competition, besides the demonstration of how a ‘step change’ is achieved in all cases (in white, grey and black areas) (90), the following necessary conditions must be fulfilled to demonstrate the proportionality of the measure. Failure to meet any of these conditions would most likely require an in-depth assessment (91) which could result in a conclusion that the aid is incompatible with the internal market.

(a) Detailed mapping and analysis of coverage: Member States should clearly identify which geographic areas will be covered by the support measure in question (92), whenever possible in cooperation with the competent national bodies. The consultation of the NRA is encouraged but optional. Best practice examples suggest creation of a central database of the available infrastructure at a national level thereby increasing transparency and reducing the costs for the implementation of smaller, local projects. Member States have the freedom to define the target areas, however, they are encouraged to take into account economic conditions in the definition of relevant regions before launching the tender (93).

(b) Public consultation: Member States should give adequate publicity to the main characteristics of the measure and to the list of target areas by publishing the relevant information of the project and inviting to comment. A publication on a central web page at national level would in principle ensure that such information is made available to all interested stakeholders. By also verifying the results of the mapping in a public consultation Member States minimise distortions of competition with existing providers and with those who already have investment plans for the near future and enable these investors to plan their activities (94). A detailed mapping exercise and a thorough

consultation ensure not only a high degree of transparency but serve also as an essential tool for defining the existence of 'white', 'grey' and 'black' areas (95).

(c) Competitive selection process.....

(d) Most economically advantageous offer.....

(e) Technological neutrality.....

(f) Use of existing infrastructure.....

(g) Wholesale access.....

(h) Wholesale access pricing.....

(j) Transparency.....

(k) Reporting.....”

As can be seen from Paragraph 78 (a) the need for *detailed mapping* that allows interested parties to understand where an intervention can take place is mentioned, while several other obligations are outlined in Paragraph 78. This is the first instance in the SAG where the need for a map or for detailed mapping information is mentioned.

Section 3.5 of the SAG outlines that *‘in funding an open and neutral platform on which multiple operators will be able to compete for the provision of services to the end-users’* and outlines further conditions that must apply when designing a State intervention, for example, Paragraph 80 states the following (please note that the below extract is abbreviated in part):

“Section 3.5. Supporting the rapid deployment of NGA networks

(80) Any measure to support NGA deployment must fulfil the compatibility conditions indicated in Sections 2.5 and 3.4. In addition, the following conditions must be met, taking into account the specific situations in which the public investment in NGA networks will occur.

(a) Wholesale access.....

(b) Fair and non-discriminatory treatment.....”

As can be seen from Paragraph 80, the SAG outline obligations that the State intervention must result in any new broadband service being offered fairly to the entire broadband market and avoid favoring one Service Provider over another.

The layers of complexity introduced in sections 3.4 and 3.5 of the SAG cannot be underestimated. Each condition introduces a difficult and challenging requirement for

EU Member States to meet in designing their State intervention. By way of example, section 3.4 Paragraph 78 (f) states the following:

“Use of existing infrastructure: Since the reusability of existing infrastructure is one of the main determinants for the cost of broadband roll-out, Member States should encourage bidders to have recourse to any available existing infrastructure so as to avoid unnecessary and wasteful duplication of resources and to reduce the amount of public funding. Any operator which owns or controls infrastructure (irrespective of whether it is actually used) in the target area and which wishes to participate in the tender, should fulfil the following conditions: (i) to inform the aid granting authority and the NRA about that infrastructure during the public consultation; (ii) to provide all relevant information to other bidders at a point in time which would allow the latter to include such infrastructure in their bid. Member States should setup a national database on the availability of existing infrastructures that could be reused for broadband roll-out.”

The principle of encouraging the re-use of existing infrastructure is logical and has many obvious merits. However, introducing the associated condition that all prospective tenderers which own or control infrastructure in the target area must provide all relevant information on their assets to other tenderers is fraught with difficulty. Prospective tenderers who own infrastructure in the target area may view these assets as a competitive advantage in the tendering process and may not be willing to share these assets too readily, for example:

- they may have a reluctance to share this information without having some general regulatory obligation to do so;
- they may not even have any processes or procedures developed to allow third parties access this infrastructure;
- they may offer prohibitive prices to third parties to discourage them from accessing their infrastructure; and
- the accuracy or level of information they share may be unfit for purpose.

Therefore, the principle of encouraging re-use of infrastructure is very difficult to enforce in practice and comes with a high risk of legal challenge if prospective tenderers in a public procurement were unable to bid due to its enforcement. EU Member States must tease through these issues with prospective tenderers, they must set out the ground rules which tenderers must adhere to in a fair and balanced way and then set

out the consequences if the condition is not met. This single SAG principle was the focus of considerable discussion between tenderers and the Irish authorities, it consumed thousands of people hours during the design of the Irish NBP intervention and the public procurement that was undertaken as part of the NBP project. This is just one example of the level of complexity faced by EU Member States when attempting to meet the SAG requirements set out in sections 3.4 and 3.5, there are several other examples, in particular under Paragraphs 78 (a) to (k) and 80 (a) to (b) which result in similar levels of complexity.

2.2.3 Widely Recognized Practical Issues with the SAG

As can be clearly seen from the SAG examples quoted, they are drafted at a high level, based on principles, and presented in a legalistic fashion. The SAG do not provide guidance on how these conditions should be met. This approach is very evident throughout the SAG, particularly with respect to the Mapping Process which results in significant areas of ambiguity and room for interpretation which EU Member States must address. If we examine Paragraph 78 (a) of the SAG closely again, which identifies the requirement for a Mapping Process as follows:

'78 (a) Detailed mapping and analysis of coverage: Member States should clearly identify which geographic areas will be covered by the support measure in question (92), whenever possible in cooperation with the competent national bodies. The consultation of the NRA is encouraged but optional. Best practice examples suggest creation of a central database of the available infrastructure at a national level thereby increasing transparency and reducing the costs for the implementation of smaller, local projects. Member States have the freedom to define the target areas, however, they are encouraged to take into account economic conditions in the definition of relevant regions before launching the tender (93).'

This Paragraph explains the outcome the Mapping Process should achieve but gives no guidance on how it should be conducted. Similarly, throughout the SAG the Mapping Process requirement is referenced and the desired outcome to avoid crowding out commercial investment is clearly stated, however there is no guidance provided on how to actually conduct this process.

What is also noteworthy is that the SAG are *not* presented in any logically sequential or chronological order; they are essentially drafted as a series of conditions or obligations addressing various topics relevant to any proposed State intervention in the broadband market. The SAG do *not* provide guidance on how to structure a project to design a State intervention to meet the conditions set out. The SAG do *not* provide guidance on the different supporting activities that are needed, other than to indicate that a detailed mapping exercise and a public consultation on the proposed State intervention should be conducted in advance of applying for State Aid Approval. They do *not* make any distinction between those conditions which must be conducted by the EU Member States as part of the design of their proposed State intervention and therefore completed in advance of a formal notification to the EU Commission and those conditions which must be contracted but only delivered over the course of the actual implementation of the State intervention.

The key take away is, that despite the SAG being presented as guidelines, the SAG in fact contain limited information on which to build a practical State intervention.

2.3 Existing work and research to help with unpacking SAG for practical broadband State interventions

Given the limited detail provided within the SAG on the intervention process itself, it is worth exploring what other reference material or published work can be drawn on to bring clarity and aid in the design of a State intervention.

2.3.1 EU Commission Level Related Work

The EU Commission has taken some steps and has designed a number of initiatives, to assist EU Member States and mitigate the practical risks they face when designing a State intervention.

DG Competition assistance

Most importantly the EU Commission directly supports EU Member States by appointing a 'Case Handler' to act as a point of contact for EU Member States for the duration of

the design of their Intervention. Within the EU Commission, the Director- General (DG) for Competition¹⁴, (DG Comp), is responsible for the oversight of competition rules and State Aid Approval. A DG Comp appointed ‘Case Handler’ provides assistance and observations to the EU Member States at various times; particularly when the EU Member State seeks assistance or guidance or where they encounter a particularly challenging issue. In addition, the Case Handler will closely monitor the progression of the EU Member State’s Intervention design, they will be familiar with the local challenges faced, the key issues raised and will keep abreast of the proposed State intervention strategy as it is being developed.

Once the EU Member State has developed a national broadband policy and a State intervention Strategy is developed, an initial description of the proposed Measure may be notified¹⁵ to the EU Commission. The submission of this initial description is called a ‘pre-notification’. The Case Handler will engage all relevant parts of the EU Commission (e.g., other Director Generals such as Connect¹⁶, Agriculture and Rural Development¹⁷ as well as the EU Commission’s legal team that specialise in State Aid and competition law) so that feedback and observations on the pre-notification submission can be provided to the EU Member State. The Case Handler leads this exercise on behalf of the EU Commission and collates the feedback, questions, concerns, and observations from the

¹⁴ The EU Commission’s Director- General (DG) for Competition
https://ec.europa.eu/info/departments/competition_en .

¹⁵ A ‘notification’ is document prepared by an EU Member State which summarizes the key characteristics of
the proposed State Intervention.

¹⁶ The Directorate-General for Communications Networks, Content and Technology develops and implements
EU digital policies.
https://ec.europa.eu/info/departments/communications-networks-content-and-technology_en .

¹⁷ The Director-General for Agriculture and Rural Development, the EU Commission department is responsible
for EU policy on agriculture and rural development.
https://ec.europa.eu/info/departments/agriculture-and-rural-development_en .

different areas across the EU Commission. They will then arrange to meet with the EU Member State to assist them in interpreting this feedback. This pre-notification exercise provides EU Member States an opportunity to dry run their State Aid notification and offers them an opportunity to address the feedback prior to applying for State Aid Approval, for example, by amending the design of the Measure or updating the public procurement conditions. A pre-notification is not a mandatory step, but it is strongly advised by the EU Commission to avail of this process. It provides valuable assistance to EU Member States on what activities are needed to be completed, and highlights areas to be further considered before applying for State Aid Approval. The Case Handler will typically advise on what needs to be updated so that the requirements of the SAG can be met and how the concerns raised by any part of the EU Commission can be addressed.

Once an EU Member State is satisfied that their proposed State intervention meets the SAG, they are then required to submit a formal notification to the EU Commission and apply for State Aid Approval. There is less opportunity for EU Member States to address concerns or amend their proposed State intervention at this point. On receipt of this formal notification, DG Comp will consult with all relevant parts of the EU Commission as part of their assessment of the proposed State intervention, again this activity is led by the Case Handler. The compatibility of the proposed State intervention with the SAG is considered, as described earlier in this Chapter. The EU Commission may request clarifications on different aspects of the proposed State intervention, for example, assurances on how the proposed State intervention will be implemented or how its effectiveness will be measured. Once this assessment is completed a formal decision is then made by DG Comp on whether State Aid Approval should be granted or not and this decision is then communicated to the EU Member State. The EU Commission may grant State Aid Approval of the proposed State intervention subject to some amendments but as mentioned previously there is less opportunity for significant amendment at this stage.

The Broadband Competence Offices (BCO) Network

In addition to the provision of direct DG Comp support, the EU Commission has, more recently, established the Broadband Competence Offices (BCO) Network (this network was launched in 2017¹⁸) to promote the sharing of best practice among all EU Member States. Through this forum the EU Commission invites EU Member States to present and share learnings from their respective projects, as well as arranging regular seminars and meetings where various experts on State Aid and other subjects are presented and discussed. The BCO Network offers EU Member States a valuable opportunity to learn from the experiences of other EU Member States. In addition, DG Comp and DG Connect use this forum to present on key State Aid topics and to share updates on EU Commission initiatives. While the forum does not typically publish formal publications or papers, the BCO Network is an extremely important forum for networking and information sharing among peers across EU Member States.

Additional publications from the EU Commission

The SAG were published in January 2013, later the same year the EU Commission published a guide for decision makers 'The broadband State aid rules explained - an eGuide for Decision Makers' (13). This guide was essentially a high-level introduction to the concepts in the SAG, aimed at illuminating some of the specific requirements that might become relevant when designing a broadband project. The guide firstly considers whether a broadband project might be classified as "State aid", could have competition policy concerns, and might need approval by the European Commission. Chapter 2 of this Guide then focuses on technologies and business models that could be considered. Chapter 3 introduces some of the basic concepts in the SAG and some the terms used, such as white, grey and black areas. Chapter 4 briefly highlights the criteria applied by the European Commission to evaluate a broadband State aid case. Chapter 5 addresses

¹⁸ The European BCO Network brings together EU Member States' national and regional public authorities in charge of broadband deployment to exchange knowledge and good practices with peers, experts and European Commission representatives.

<https://digital-strategy.ec.europa.eu/en/policies/bco-network>

measures which do not constitute State Aid as well as measures that fall under various exemptions. Finally, Chapter 6 aims at providing advice on how you should proceed by suggesting a list of tasks that should be undertaken. For example, the first two tasks suggested are: 'Task 1: Gathering of reliable and sound information as to basic and NGA networks in your area' i.e. essentially a reference to the Mapping Process and 'Task 2: Carrying out a public consultation; the objective is to get suitable information in order to be able to conduct the next steps' i.e. possibly a reference to seeking industry view on the online map. This guide gave decision makers an introduction to the types of tasks were needed but unfortunately provided no detail on how to go about implementing the tasks themselves.

In 2014, the EU Commission published a handbook in the 'European Guide to High-Speed Broadband Investment' (14) which includes a number of case studies to aid EU Member States in designing their State intervention. This handbook helpfully provides information to aid EU Member State in choosing a type of infrastructure, the right investment and business models, as well as providing information on certain financing tools. This handbook attempted to assist EU Member States in planning, implementing, and monitoring broadband projects within their territories. The handbook sets out a number of questions whereby critical strategic decisions must be made, highlighting their implications. The handbook introduces the importance of defining a high-level strategy of what a public authority planning an intervention wants to achieve. The ensuing chapters present four key strategy choices that need to be made in order to achieve the goals defined in the strategy, these are the choice of the infrastructure type, the choice of the investment model, the choice of the business model and choice of the financing tools. Finally, a checklist is provided to keep track of all the steps to be taken and all the aspects to be covered during the whole process. The handbook provides some good advice on what strategic decisions need to be taken when defining an intervention strategy but unfortunately the handbook does not address how to address the requirements of the SAG and somewhat ignores the huge complexity the SAG places on EU Member States intending to intervene in the broadband market.

An update of this handbook was published in 2024, 'Broadband Investment Handbook 2024' (15), to encompass the latest technological, policy, regulatory, and financial developments as well as considering the requirements of the most recent State Aid Guidelines¹⁹ which were updated in 2023.

EU Commission Publications resulting from the evaluation of the SAG in 2020/2021/2022.

In June 2020, the EU Commission announced an initiative to evaluate the effectiveness of the SAG to determine whether a revision of the SAG was required. This evaluation and subsequent revision of the SAG that followed is discussed in detail in Chapter 5 of this thesis. However, it should be noted that through this evaluation exercise, the EU Commission published a number of documents which are of some relevance. An EU Commission Staff Working Document (16) was published 7 July 2021 including the results of the various consultation activities completed for the EU Commission's SAG evaluation. Along with the EU Commission Staff Working Document an external consultant report was also published 7 July 2021 - 'The role of State Aid for the broadband networks rapid deployment in the EU' (17). Both documents provide feedback from EU Member States and insights into the complexities that EU Member States encountered when designing a State intervention over the preceding years. While the findings are presented in an aggregated fashion, some areas that result in great complexity are highlighted e.g. the Mapping Process. While both publications identify key problem areas, they do not present the solutions on how best to address them but instead recommend that greater guidance is provided.

2.3.2 Wider Research

While the initiatives put in place by the EU Commission undoubtedly provide some assistance to EU Member States in designing a State intervention, they do not go far enough. In this section I look beyond the work of the EU Commission and explore other research.

¹⁹ The Updated State Aid Guidelines are discussed in more detail in Chapter 5 of this thesis.

The general topic of European State Aid has also been the subject of much research particularly from a legal perspective. For example, 'Legal Status and Legal Effects of the Commission's State Aid Guidelines: The Case of the Guidelines on State Aid for Environmental Protection and Energy (EEAG)(2014-2020)' (18), considers the legal status of the EU's various State Aid Guidelines and how they were viewed by the Court of Justice of the European Union in a number of cases.

In addition, a lot of research has been published on the EU's State Aid policy and how it has evolved. For example, 'The modernization of state aid for economic and social development' (19) published in 2018, examines the updating of State Aid rules undertaken in 2012 and 2013 and considers discusses the reasons for, and the goals and future implications of the modernization programme.

In the main, studies examining State Aid policy focus on whether State Aid has led to positive or negative outcomes i.e. analyzing what affect the aid has had. An example of this approach is 'Effectiveness and efficiency of state aid for new broadband networks: evidence from OECD member states' (20), although this study is not restricted to European countries but includes an analysis of 32 different countries (23 of which are EU based countries) and reviewing the effect of State Aid broadband programmes. The study concludes that State Aid significantly increases the effectiveness of new broadband networks by facilitating the deployment of new connections to 22 percentage points of households in the short term and 39.3 percentage points in the long term. In addition, the programmes are highly cost-efficient, as they break even after three years on average.

The SAG also generates some academic interest. Papers such as 'Assessing fifteen years of State Aid for broadband in the European Union: A quantitative analysis' (21) provides an overview of the implementation of broadband State Aid measures across the EU during the period 2013-2019 and focuses on the investment that has taken place and looks at the balance of public and private investment.

‘The Multilevel Governance of State Aid for Broadband Diffusion: Evidence from Three European Countries’ (22), this paper explores what is termed multilevel governance in the context of State Aid programmes for the diffusion of broadband in the European Union and looks at three countries in particular. The paper really focuses on aspects of governance.

Reports such as the CERRE Telecom²⁰ ‘State Aid for Broadband Infrastructure in Europe – Assessment and Policy Options’ (23) report focuses on the level of public funds to support broadband deployment in Europe and maintains it is insufficient compared against the targets for fibre to the home (FTTH) deployment. The report also suggests that the use of this funding is poorly coordinated, insufficiently monitored, and subject to rules which need to be simplified and updated.

What you see here is a flavor of the work – showing the genuine interest in the field, mainly tackled from governance and economics perspectives. However, from my review I could find no academic research unpacking the SAG themselves and how best to address their requirements.

2.4 A look at the Mapping Process as Portrayed in the SAG

We now turn to the specifics of the Mapping Process. As mentioned earlier, the SAG require, amongst other things, that an EU Member State carries out (i) a Mapping Process and (ii) a public consultation process. This obligation is set out in Paragraph 78 (a) and (b) of the SAG.

²⁰ CERRE is a not-for-profit organization which contributes to research in various fields including telecommunication regulation. Its membership includes independent regulators, corporations, and university research centres operating in various fields of expertise. For more information see <https://cerre.eu/about-us/>

To attempt to understand the Mapping Process the main starting point is to unpack each of the SAG references to the mapping exercise. This is not an onerous task as notably, despite the critical nature of the process, the mapping exercise is mentioned in only two places in the entire SAG, these are in Paragraph 78 (a) and 78 (b) of the SAG, which are as follows:

“Section 3.4 - Design of the measure and the need to limit distortions of competition

(78) Every State measure in support of broadband deployment should fulfil all compatibility principles described above in Section 2.5, including the common interest objective, the existence of market failure, the appropriateness and the incentive effect of the measure. As regards limiting the distortions of competition, besides the demonstration of how a ‘step change’ is achieved in all cases (in white, grey and black areas) (90), the following necessary conditions must be fulfilled to demonstrate the proportionality of the measure. Failure to meet any of these conditions would most likely require an in-depth assessment (91) which could result in a conclusion that the aid is incompatible with the internal market.

(a) Detailed mapping and analysis of coverage: Member States should clearly identify which geographic areas will be covered by the support measure in question (92), whenever possible in cooperation with the competent national bodies. The consultation of the NRA is encouraged but optional. Best practice examples suggest creation of a central database of the available infrastructure at a national level thereby increasing transparency and reducing the costs for the implementation of smaller, local projects. Member States have the freedom to define the target areas, however, they are encouraged to take into account economic conditions in the definition of relevant regions before launching the tender (93).

(b) Public consultation: Member States should give adequate publicity to the main characteristics of the measure and to the list of target areas by publishing the relevant information of the project and inviting to comment. A publication on a central web page at national level would in principle ensure that such information is made available to all interested stakeholders. By also verifying the results of the mapping in a public consultation Member States minimise distortions of competition with existing providers and with those who already have investment plans for the near future and enable these investors to plan their activities (94). A detailed mapping exercise and a thorough consultation ensure not only a high degree of transparency but serve also as an essential tool for defining the existence of ‘white’, ‘grey’ and ‘black’ areas (95).....”,

“Footnote (92): This mapping should be done on the basis of homes passed by a particular network infrastructure and not on the basis of the actual number of homes or customers connected as subscribers.”.

As can be clearly observed from Paragraphs 78 (a) and 78 (b) the nature of the ‘detailed mapping and analysis of coverage’ that is required is not specified in any way in the SAG. Paragraph 78 (b) requires that EU Member States give adequate publicity to the list of target areas through a public consultation inviting comments and that this should be done using a central web page. This is the full extent of the guidance provided in the SAG on this critical exercise.

What has emerged as custom and practice to meet this requirement from EU Member States is that the detailed mapping and analysis of coverage or a ‘Mapping Process’ is implemented, involving the production of an online map, which is published on the Government’s public website, to identify where NGA broadband services currently exist or are likely to exist in the near future in any given area. This online map is made available and can be browsed via a public website by consumers and industry.

The Mapping Process involves contacting Service Providers for details of their network and broadband services and then assessing whether these services constitute an NGA standard of broadband or not. The results of this information gathering, and subsequent assessment are then published on the online map. The findings of the Mapping Process (for example, which areas do not or will not have NGA broadband services) are then used to identify the geographical areas to be covered by the State’s Intervention; these geographical areas are referred to as the ‘Intervention Area’.

To satisfy Paragraphs 78 (b) a public consultation is required. The purpose of the public consultation process is to validate the accuracy of the online map and the Intervention Area as well as outlining the characteristics of the proposed State intervention.

The public consultation invites comments from stakeholders on the accuracy of online map. Anyone may provide comments, including members of the public, Service

Providers, other companies or agencies from industry, consumer representative groups, industry lobby groups etc. who have an interest in the project. The public consultation aims to provide transparency on how the Mapping Process and the online map itself has been developed and how the proposed Intervention Area for the State's intervention has ultimately been derived; it allows different stakeholders the opportunity to voice their opinions on the accuracy of the findings presented. Stakeholders are invited to correct any errors or omissions that they perceive exist on the online map. For example, members of the public can highlight issues where, despite coverage claims from Service Providers, they cannot access high-speed broadband services.

There are a number of unique terms and concepts that the SAG introduce specifically relating to the Mapping Process some of these are explained in the Paragraphs that follow.

White, Grey and Black NGA Areas

The Mapping Process and public consultation process together aim to ensure not only a high degree of transparency but serve as a method for defining the existence of 'white', 'grey' and 'black' areas.

The SAG uses the terms 'white', 'grey' and 'black' to describe the number of Service Providers present in any given area. For example, a 'white NGA area' is an area where no Service Provider currently provides or in the near future will provide NGA services, a 'grey NGA area' is an area where a single Service Provider currently provides or in the near future will provide NGA services and a 'black NGA area' is an area where two or more Service Providers currently provide or in the near future will provide NGA services.

White, grey and black NGA areas are described in Paragraphs 75, 76 and 77 of the SAG as follows:

“White NGA areas’

(75) Accordingly, for the purposes of assessing State aid for NGA networks, an area where NGA networks do not at present exist and where they are not likely to be built within 3 years in line

with paragraphs 63 to 65 by private investors, should be considered to be a 'white NGA' area. Such an area is eligible for State aid to NGA provided the compatibility conditions indicated in Sections 3.4 and 3.5 are fulfilled.

'Grey NGA areas'

(76) An area should be considered a 'grey NGA' area where only one NGA network (89) is in place or is being deployed in the coming 3 years and there are no plans by any operator to deploy a NGA network in the coming 3 years. In assessing whether other network investors could deploy additional NGA networks in a given area, account should be taken of any existing regulatory or legislative measures that may have lowered barriers for such network deployments (access to ducts, sharing of infrastructure, etc.). The Commission will need to carry out a more detailed analysis in order to verify whether State intervention is needed since State intervention in such areas carries a high risk of crowding out existing investors and distorting competition. In this respect, the Commission will carry out its assessment on the basis of the compatibility conditions established in these Guidelines.

'Black NGA areas'

(77) If at least two NGA networks of different operators exist in a given area or will be deployed in the coming 3 years, such an area should be considered a 'black NGA' area. The Commission will consider that State support for an additional publicly funded, equivalent NGA network in such areas is likely to seriously distort competition and is incompatible with the internal market under Article 107(3)(c) of the TFEU."

It is possible for an EU Member State to intervene in any of these areas however the threshold of justification for a State intervention, in an area where existing Service Providers are delivering NGA services i.e., in a grey NGA area or black NGA area, is higher as it carries a higher risk of crowding out existing investors and disproportionately distorting competition. An EU Member State would require a strong justification prior to intervening in a grey NGA or black NGA area, for example, having regard to whether the proposed intervention would seriously distort competition and whether the intervention was still compatible with the principles set out in the SAG.

Countries across Europe have typically designed State interventions to white NGA areas to address deficits in NGA services in locations where it is not available. However, there

have been a number of interventions in different EU Member States to ‘grey NGA areas’²¹.

Time Horizons

As is clear from the SAG, when identifying the presence of Service Providers in any given area, an EU Member State must not only look at existing networks but also (concrete and credible) plans of Service Providers to roll out NGA broadband infrastructure in those areas in the ‘near future’. The ‘time horizon’ of the Mapping Process, is the duration in time over which the future plans of Service Providers will be considered. This is an important factor to consider and introduces significant additional complexity to the Mapping Process.

Paragraph 63 of SAG states,

“(63) In order to further ensure that the public intervention does not disrupt private investments, the aid granting authorities should also verify whether private investors have concrete plans to roll out their own infrastructure in the near future. The term ‘near future’ should be understood as referring to a period of 3 years..... If the granting authority takes a longer time horizon for the deployment of the subsidized infrastructure, the same time horizon should also be used to assess the existence of commercial investment plans.”

As can be seen from Paragraph 63 of the SAG, the term ‘near future’ (i.e., the time horizon) is normally understood to refer to a period of 3 years. However, as also set out in Paragraph 63 of the SAG, if it is anticipated that the deployment of the State subsidized infrastructure will take longer than 3 years, then that longer duration should be used as the time horizon to assess the existence of Service Providers in any given area.

As with the SAG more generally, those aspects which refer to the Mapping Process specifically, lack the kind of detail needed to produce a functioning online map. As will

²¹ The EU Commission maintains a State Aid Registry, under which all State Aid decision can be found at https://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3 or by using the search bar on the <https://ec.europa.eu> website.

be seen in later Chapters based on the Irish experience, the lack of such detail has significant implications for timelines and indeed the overall intervention process, as there is such a deep dependency on the online map throughout the whole process.

2.5 Existing work and research to help with unpacking the SAG for creation of the online map

With little information to go on within the SAG in relation to the online map creation, it makes sense to look at other work in the field that can help with the work in this thesis. As in the case for section 2.3, given the nature of this work, it makes sense to start with what is available in the industry and Government domain before exploring wider research fields.

2.5.1 Industry & Government related work

EU Member States have been implementing the Mapping Process for many years since the publication of the SAG in 2013. A number of Government papers have been published and projects have been conducted relating to the Mapping Process during this time.

The first project initiated by the EU Commission ‘Mapping of Broadband and Infrastructure Study - SMART 2012/0022’²² was commissioned in June 2013. The study published ‘Study on Broadband and Infrastructure Mapping’ (24) which outlined its findings, with an aim to assist EU Member States to set up sophisticated, accurate and reliable broadband mapping systems. This study identifies four different types of mapping:

- (1) Infrastructure mapping; Mapping details of the physical telecommunications infrastructure such as ducts, poles, towers etc.

²² Summary of the Mapping of Broadband and Infrastructure Study - SMART 2012/0022 (November 2020) <https://ec.europa.eu/digital-single-market/en/news/mapping-broadband-and-infrastructure-study-smart-20120022>.

- (2) Service mapping; Mapping broadband service provision including the available bandwidths (speed), technologies, Service Providers and quality of service in specific areas.
- (3) Demand mapping; Mapping the demand for broadband services by citizens and willingness to pay.
- (4) Investment and funding mapping. Mapping information related to financing sources and instruments for broadband project funding. The Mapping Process, referred to in the SAG Paragraph 78 (a) relates mostly (but not entirely) to the concepts and challenges considered in the service mapping parts of this study.

This study provides some rich insights into the level of activity being undertaken by EU Member States with respect to mapping. It identified that at least one mapping initiative was underway in almost every EU Member State, as can be seen in the information outlined in Figure 2.2. It also identified the number of resources dedicated to mapping activities and the myriad of different approaches and processes that EU Member States were developing for mapping. Effectively the study highlighted that the mapping of broadband services was left to individual EU Member States to determine the best methodology to use for their mapping initiative and no uniform approach was apparent.



Figure 2.2 - EU Member States with broadband mapping initiatives in operation in 2014
(green: in operation, blue: no information available, yellow: planned).

(Source: The Mapping of Broadband and Infrastructure Study - SMART 2012/0022).

The study makes a number of recommendations on how to conduct the different types of mapping and outlines a proposed methodology for EU Member States to consider when developing their mapping initiatives. The study also attempts to provide guidance on the number of resources needed and costs that may be required to implement the initiative.

The recommendations in this study touch on some of the challenges of the Mapping Process, focusing primarily on the technical challenges of data collection and processing the various data formats so that an online map can be produced. The recommendations and proposed methodology would benefit greatly from deeper examination and review. A more detailed study of the mapping challenges in a real-life project, designed to satisfy the recommendation of the SAG are likely to result in identifying a much broader set of challenges and recommendations.

A second project 'Mapping of Fixed and Mobile Broadband Services in Europe (SMART 2014/0016)'²³ was initiated in January 2016 with the objective to developing the first European-wide integrated coverage map for broadband connectivity. This study attempted to consolidate the status of broadband connectivity across EU Member States and produce an interactive map from the information provided. This study was not designed to satisfy the SAG requirements, but it did encounter some similar challenges to those that a Mapping Process might encounter. For example, the challenge of attempting to consolidate multiple different mapping data sources and mapping services into a single map; and the lack of standardization of definitions around the key parameters of measurement. Some basic insights could indirectly be drawn from this

²³ The EU Broadband Map was developed from the project Mapping of Fixed and Mobile Broadband Services in Europe (SMART 2014/0016) (November 2020).

study, but these are quite limited, as the Mapping Process challenges go far beyond what was encountered in this study.

A further source of State sponsored studies relating to geographical surveys is the Body of European Regulators for Electronic Communications (BEREC) who have, more recently, been tasked with advising the EU Commission on methods for conducting geographical surveys.

BEREC have, since 2021, published three separate guidelines, namely 'BEREC Guidelines to assist NRAs on the consistent application of Geographical surveys of network deployments' (25), 'BEREC Guidelines on Geographical surveys of network deployments Article 22 (2), 22 (3) and 22 (4)' (26) and the 'BEREC Guidelines on geographical surveys of network deployments - Verification of information' (27). The aim of these document was to outline a common basis for the consistent implementation of broadband mapping activities within the purposes of Article 22 of the European Electronic Communications Code (EECC)²⁴ and other related Article 22 activities. BEREC has also published a handbook 'Handbook of BEREC Guidelines on Geographical surveys of network deployments' (28) containing all three mentioned Guidelines, for convenience and ease of reference.

The BEREC guidelines are not designed particularly to meet the SAG requirements; they are more focused on conducting regular surveillance of the telecom market for regulatory purposes. However, they do address certain aspects of mapping which would

²⁴ The EECC was a revision of the entire EU regulatory framework for the telecommunications sector published

by the EU Commission in 2018. For more information, please see

<https://digital-strategy.ec.europa.eu/en/library/proposed-directive-establishing-european-electronic-communications-code>.

Article 22 of the EECC refers to Geographical surveys of network deployments which are considered relevant to regulatory activities.

be valuable to any EU Member State designing a Mapping Process for the SAG. For example, the BEREC guidelines define some key technical terms such as ‘peak time’ and ‘premises passed’ which provides a published resource which EU Member States can reference for their own mapping projects. The BEREC guidelines describe the broadband performance thresholds (called speed classes) that should be established at each premises, but the main approach recommended is to rely on operators to submit this data rather than robustly verify or even calculate this information from operator network information.

In summary, non-academic papers relating to the Mapping Process are very limited. A number of papers, which reference initiatives somewhat akin to the Mapping Process, provide only very limited insights into how to actually conduct the Mapping Process itself. The study ‘Mapping of Broadband and Infrastructure Study - SMART 2012/0022’, conducted over 2013 and 2014, does consider some of the challenges relating to mapping broadband services and outlines a number of relevant recommendations which are primarily technical and organizational in nature. These recommendations would benefit from greater examination and review in the context of what is required specifically for the Mapping Process anticipated and required by the SAG. Similarly, whilst the BEREC guidelines go further in that they define some relevant definitions which can be referenced, they do not consider how to produce a suitable online map which could be used in the State Aid context.

In addition, further research specifically considering the Mapping Process is likely to result in identifying a much broader set of challenges and recommendations than those identified in any general study conducted to date. This additional research would be of much greater relevance and practical use to any EU Member State planning to intervene in the broadband market and address broadband market failure.

2.5.2 Wider Research Fields

It is of course also worth asking the question as to whether research material exists on the Mapping Process, beyond that which comes from Government or EU Commission initiatives.

There is a vast array of research in the area of broadband generally as broadband and the influence of digitization is a topic touched upon in nearly every sector of society and many different journals have published papers on the topic. In terms of seeking out material that might have a bearing on the Mapping Process, a broad sweep of material was explored.

The key journals where broadband research is a central focus area, where papers and where research on broadband provision are consistently published include 'Telecommunications Policy', 'Information Economics and Policy' and 'The Information Society'. Some other journals which are also of relevance are 'International Journal of Communication', 'IEE Communications', 'IEEE Wireless Communications', 'IEEE/OSA Journal of Optical and Communications Networking', 'Journal of Light wave Technology' and 'The Journal of Economic Analysis and Policy'.

The influence of broadband provision and how this is achieved, can be considered from economic, technical and regulatory perspectives. The following sections are divided under those headings and under each, the level of research available relating to the Mapping Process itself is reviewed.

Economic Perspective

There are numerous academic papers which examine the economic impacts of broadband provision. Many different aspects have been reviewed based on examining numerous economic indicators. The impacts on productivity and job creation are very common economic topics that are studied, for example 'Impact of very high-speed broadband on company creation and entrepreneurship: Empirical Evidence' (29), 'More bits – more bucks? Measuring the impact of broadband internet on firm performance' (30), 'On the regional impact of broadband on productivity: The case of Brazil' (31) and

‘Productivity, technological innovations and broadband connectivity: firm-level evidence for ten European countries’ (32). These studies represent a small sample of the numerous papers which consider the impacts of broadband on productivity and job creation. Typically, the research concludes that availability of reliable high quality broadband services is an essential enabler of productivity and efficiency, particularly in activities where there is a high reliance on digital services.

Further studies examine the link between broadband service performance and its economic impact, for example ‘Broadband internet, firm performance, and worker welfare: Evidence and mechanism’ (33) finds that high-speed internet significantly increases firm’s productivity and worker’s wages in China, and that the impacts are larger for firms in high-skill industries reliant on a higher educated work force. ‘Does state aid for broadband deployment in rural areas close the digital and economic divide?’ (34), ‘Broadband access in the EU: An assessment of future economic benefits’ (35) and ‘The impact of broadband speed on productivity: findings from Turkish firms’ (36) finds that switching from normal to high-speed broadband improves firm’s productivity among manufacturing/services firms in Turkey. Again, this is a small sample of studies which support the conclusion that availability of faster broadband speeds or very high-capacity networks, enhances the level of economic benefit experienced.

The economic context of the areas studied (the economic context considers, for example, the level of education of the work force in the area, the skill level required in the prevalent industries in the area and the level of general economic development in the area in the first instance) appears consistently to be a major influencer of the scale of economic benefit that is derived in the area and the level of positive impacts experienced. Numerous studies, including a number of the papers referenced herein, conclude that where the economic context demonstrates a reliance on a highly skilled, highly educated work force and the prevalent industries are high skill intensive, then the benefits accrued by these areas of having access to high-speed broadband services is considerably higher than areas where the economic context does not demonstrate this reliance.

Studies range from full national reviews to regional or local municipality studies. Several studies focus on the micro economic benefits experienced at a very local level. For example, many studies consider the impact on company creation and job creation at a town or municipality level, as many broadband initiatives are implemented on a municipality level.

To my knowledge, at the date of publication, no material related to the economic impact of the Mapping Process exists.

Technical Perspective

There are many technical aspects to the Mapping Process as deep engagement with the technology deployed is needed and technical definitions around what a next generation broadband service is are required. Therefore, looking at technical literature to get a sense of what might be there makes sense. Papers with technical perspectives include publications which consider the service or infrastructural cost of broadband and the different technology options available to deploy broadband services.

The IEEE Communication Society has published a list of the best reads in broadband access²⁵, (last updated in October 2019). This ‘best readings’ list attempts to compile a set of references to technical papers, survey papers, and books that cover the field of broadband access. The major areas covered are digital subscriber line (DSL), passive optical network (PON), and wireless technologies. Within the DSL topic, there are specializations on modulation and coding, dynamic spectrum management, crosstalk cancellation, multi-wire techniques and test and measurement. Within the PON topic, there are specializations on TDMA, TWDMA, WDM and OFDM techniques, as well as a review of key optoelectronic devices. The wireless topic includes WiMAX, mobile, satellite and heterogeneous networks. There are almost 200 references included in this list alone and it is acknowledged that while the list provides a wider perspective of the

²⁵ IEEE Communications Society- Best Reads in Broadband Access
<https://www.comsoc.org/publications/best-readings/broadband-access> .

field, the list is incomplete and evolving. The list demonstrates the broad range of technology options being considered and the intensive research conducted by researchers from all over the world into the different technology options in the context of broadband access.

As well as the technical solutions and techniques to enhance broadband provision, the focus of much academic research has been the consideration of the potential cost of deploying and maintaining broadband networks. This research, then in turn, provides input to the economic studies into broadband provision. Many different methods and technologies have been modeled with this context in mind. Various IEE journals (including 'IEEE Communications', 'IEEE Wireless Communications', 'IEEE/OSA Journal of Optical and Communications Networking', 'Journal of Light wave Technology') consistently examine the viability of using different technologies for broadband provision. Many publications consider the technologies which are used in the delivery of broadband, examine their characteristics, their respective merits and accompanying challenges including security, potential longevity, practical reach to remote locations etc. A sample of papers following this theme of research includes 'Comparative techno-economic evaluation of LTE fixed wireless access, FTTdp G.fast and FTTC VDSL network deployment for providing 30 Mbps broadband services in rural areas' (37), 'A cost study of fixed broadband access networks for rural areas' (38), 'A study on the deployment of high-speed broadband networks in NUTS3 regions within the framework of digital agenda for Europe' (39), 'Flexibility and broadband evolution' (40), 'A survey on emerging broadband wireless access technologies' (41), 'Evolving wireless access technologies for municipal broadband' (42), 'Fixed and mobile broadband substitution in Sweden' (43) and 'On selecting a technology evolution path for broadband access networks' (44).

In summary many researchers have examined the infrastructural cost of broadband provision, and a large body of research exists and continues to evolve under this theme. There is continual discussion and debate on which technology options are most appropriate to deliver broadband services in different circumstances and settings. This

research continues to deepen and expand as technology enhancements and developments are made and as more and more real life rather than theoretical evidence is produced from projects implemented in the field.

The evolution of technology options, how they can be deployed and what level of broadband performance can be expected, may have some relevance to those designing a Mapping Process. For example, this research may provide some relevant technical parameters or values or might describe the broadband solutions that will have to be considered as part of the Mapping Process. However, it is clear that no direct research exists that can help with designing or creating the Mapping Process itself.

Regulatory Perspective

As the Mapping Process is part of a regulatory exercise, it makes sense to explore what existing work might be of relevance.

Broadly speaking the publications that fall under this perspective consider the measurement and evaluation of broadband services, regulation strategies and other regulatory aspects relating to broadband provision. Here more useful material emerges. For example, the review of existing literature identified academic papers published focusing on different aspects of the National Broadband Map created in the United States²⁶. Figure 2.3 depicts the US National Broadband Map- an interactive map produced and maintained by the national regulatory authority for communications in the United States, the Federal Communications Commission. These publications include ‘The wireless abyss: Deconstructing the U.S. National Broadband Map’ (45), ‘The U.S. National Broadband Map: Data limitations and implications’ (46), ‘Diversity and digital divide: Using the National Broadband Map to identify the non-adopters of broadband’ (47), ‘Broadband Availability and Employment: An Analysis of County-Level Data from the National Broadband Map’ (48), and ‘How much does broadband infrastructure

²⁶ The US National Broadband Map created by the Federal Communications Commission
<https://broadbandmap.fcc.gov/#/> .

matter? Decomposing the metro–non-metro adoption gap with the help of the National Broadband Map’ (49). Similarly, some relevant studies exist based on mapping initiatives from other countries such as Canada, ‘Rural broadband: Gaps, maps and challenges’ (50).

What is relevant from these studies is that they do consider some of the challenges found when attempting to measure and represent broadband coverage on an online map at a National level and/or at a more granular level, in this case across the United States. Whilst the US National Broadband Map is not designed to meet the requirements of the SAG or the Mapping Process, some of the challenges are similar in nature to challenges that one might expect to face in implementing a Mapping Process. This includes, for example, the challenges with sourcing accurate information from Service Providers and the limitations associated with this data.

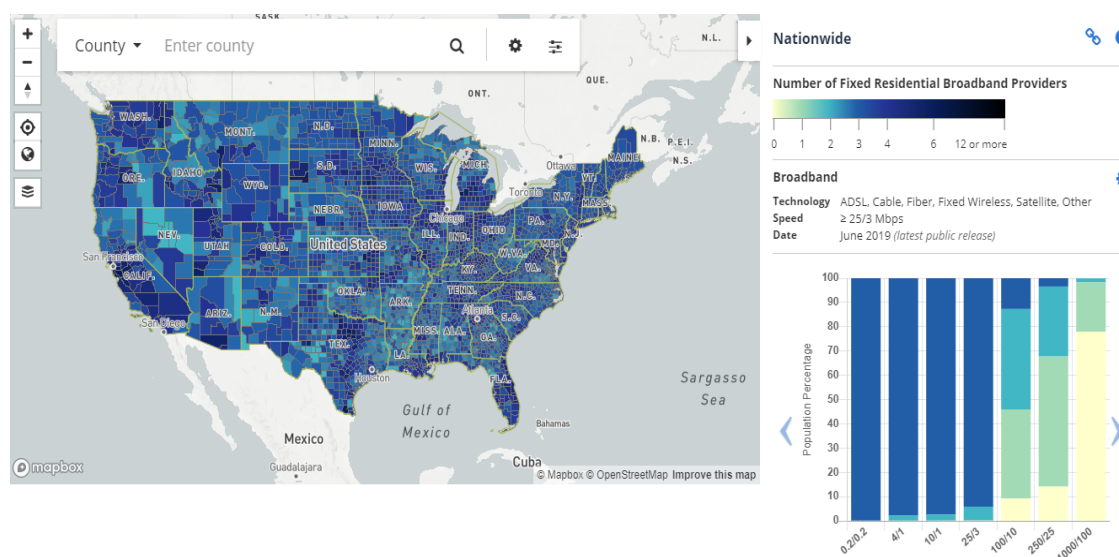


Figure 2.3 – FCC US National Broadband Map

While the Mapping Process required to satisfy the SAG involves considerably different challenges than the mapping conducted in the United States, it is noteworthy that these papers all apply robust academic analysis to the challenges of creating the US National Broadband Map and are designed to recommend improvements to the US process of mapping and inform policy makers. However, no such academic research was found relating to the Mapping Process required to satisfy the SAG.

At a national level, interestingly, Australia and New Zealand have produced a significant body of research focused on broadband provision. Both countries have implemented ambitious State sponsored initiatives to address the lack of availability of reliable high-speed broadband²⁷ and this is likely, at least in part, to explain the high level of academic research activity on the topic. Also, there is a network of researchers particularly associated with Browyn Howell from the Victoria University of Wellington and the late Professor Gary Madden from Curtin University of Technology, Perth that have a long-standing interest in researching the impacts of broadband provision. This research network has produced a steady stream of research papers focused on the economic impacts of broadband provision particularly in Australia and New Zealand. However, unlike in the United States, no academic study has been conducted examining the challenges with the geographical identification of the locations most in need of broadband provision.

European researchers appear to have focused more on industrial economic aspects, such as how to develop appropriate models for municipal partnership projects and the role of regulation in encouraging and promoting the rollout of broadband services. Examples of which include 'The EU State aid policy for broadband: An evaluation of the Italian experience with first generation networks' (51), 'The impact of infrastructure and service-based competition on the deployment of next generation access networks: Recent evidence from the European member states' (52) and 'Does regulation of basic broadband networks affect the adoption of new fiber-based broadband services?' (53).

In summary, there is considerable and continually evolving research relating to evaluation of broadband services, regulation strategies and other regulatory aspects

²⁷ NBN Co was established in 2009 to design, build and operate Australia's wholesale broadband access network. Underpinned by a purpose to connect Australia and bridge the digital divide, NBNco's key objective is to ensure all Australians have access to fast broadband as soon as possible, at affordable prices, and at least cost. Rural Broadband Initiative (RBI) is a public-private partnership (PPP), working to improve broadband access for rural New Zealanders.

relating to broadband provision. Different jurisdictions such as Australia and New Zealand have targeted research in this area. Researchers in the United States have considered the challenges with mapping in the context of the US National Broadband Map published by the FCC. However, this review was unable to find any academic research in the regulatory field of work which exists relating to the development of an online map which could then be used to identify market failure in the broadband market, such as the online map that is required to meet EU's SAG i.e. the Mapping Process.

Looking across the large body of research conducted across these three perspectives, (Economic, Technical and Regulation) this literary review could not identify any published academic research that has been conducted on the Mapping Process. Considerable academic research has been conducted and exists relating to broadband provision in general including its impacts, the costs associated, the technology options and how to regulate its provision. This research continues to evolve and develop as new evidence is identified and deeper experience is gained from real-life examples and projects. Technology enhancements continue to emerge, and each enhancement presents new opportunities for improved methods for broadband provision. However, it is clear the Mapping Process is not a topic that academic researchers have focused on at any level, if at all. Applying robust academic analysis to the challenges of conducting a Mapping Process would undoubtedly uncover critical improvements and recommendations.

2.6 Conclusion

The SAG are the most crucial aspect of designing a state broadband intervention but as shown here those guidelines are limited in detail. More specifically in the context of this thesis, the details within the guidelines that can help with one of the most important aspects of the intervention, namely the creation of the online map, are even more limited. While support material and support bodies exist, the amount of research in the

field is limited to certain aspects of the SAG. All of this points to a need for additional research.

It is the combination of my lived experiences of the design of the state intervention in Ireland and the lack of research in the field that paves the way for what follows in this thesis, namely an academic documenting of the Irish experience, an analysis and synthesis of the learnings from it, a deep dive into the Mapping Process and the feeding back of what has been learned to other EU Member States, regulators and other stakeholders.

Chapter 3 The Story of the NBP Intervention

3.1 Introduction

When I consider how I can better inform and improve future intervention processes, an obvious starting point is to examine what happened in Ireland and what activities were undertaken by the Irish authorities to gain State Aid Approval. This Chapter documents the activities undertaken in Ireland from 2012 to 2019 as part of the Irish National Broadband Plan (NBP) Intervention project and shows how Irish authorities satisfied the SAG guidelines.

Section 3.2 outlines the methodology used throughout this Chapter, what sources were used and how my own personal experience informed the development of the contributions.

Section 3.3 outlines a historical tracing of the NBP project itself. It is through this tracing that a clearer understanding of what is required and actually needed to design a State intervention and gain State Aid Approval emerges. Uniquely, this historical record provides a clear and practical reference of the approach a real-life project undertaken to satisfy the SAG and secure State Aid Approval from the EU Commission. It will therefore inform future projects and hence is considered a key contribution of this Chapter.

The compilation of this historical record enables a deeper examination and analysis of the end-to-end intervention process to be undertaken. It is through this deeper analysis that three significant observations are then made which will help improve the planning and design of future projects. Section 3.5 details these observations, each of which point to where significant, time, effort and resources will be needed in the development of any future intervention project and therefore aid EU Member States in the planning and designing their own projects.

3.2 Methodology used to create the historical record and identify the observations from the NBP intervention project

The methodology undertaken to develop the historical record in this Chapter involved piecing together and logical grouping the activities that took place, informed by the

various records that exist over the period the project was undertaken. These records include the documents published by the Department, the internal documents used by the project team, newspaper and other media clippings relating to project, my own notes and records taken at the time, combined with the real-life lived experience of leading the project itself through these activities.

As already outlined in Chapter 1, I was personally a key contributor to the Irish State's NBP Intervention and NBP Mapping Process. This historical record now provides insights into the rationale for each of the steps taken in Ireland and highlights the key issues, complexities and challenges faced during this project. Whilst the Irish NBP intervention went to great lengths to publish extensive documentation and provide transparency to the general public, as a participant in the process, the details outlined in this section provide greater detail and insights on the motivation and rationale for each of the individual steps taken, than what can be extracted from the published material.

Once the sequence of activities undertaken in Ireland to design the NBP intervention was fully traced, the next step was to reflect and examine the interdependence of each of these activities. This examination identified where certain activities are dependent on the outcomes of previous actions i.e., where they cannot either start or be completed until the outcomes of previous actions are known. It is through a close examination of this real-life project that the critical path of the project is uncovered.

The method undertaken was then to collate these critical path activities into distinct project phases so that the high-level project sequencing is clearly identified. These phases provide a high-level simplification of a multi annual, complex process so that future projects can better understand what is required from the outset.

Lastly, an examination of the key elements in each of these phases is undertaken to establish if there is central dependency and whether certain critical activities persist throughout each of the phases of the project. This deeper examination establishes how

central the mapping process is to each phase and how often the information provided by the mapping process is consulted throughout the end-to-end process.

3.3 How the Irish NBP intervention project satisfied the SAG

The NBP was not the first scheme initiated by the Irish Government aiming to address deficits in broadband service provision. Over a number of years, the Department initiated a number of regional broadband projects in advance of the NBP, namely the County and Group Broadband Scheme and the National Broadband Scheme.

County and Group Broadband Scheme.

To encourage the rollout of broadband access the Government set up the County and Group Broadband Scheme in 2004. The objective was to help establish sustainable broadband services in towns, villages, rural hinterlands and under-served areas of larger towns on the basis of local/regional authority coordination and community driven initiatives. The scheme was open to rural communities of less than 1,500 people. It enabled local communities to work with a broadband-service provider of their own choice, or to draw up and implement their own broadband plan, to launch a broadband service for local residents and SMEs.

National Broadband Scheme.

Initiated in 2007 to follow on from the County and Group Broadband Scheme, the National Broadband Scheme aimed to provide basic broadband services to the areas of Ireland that were not served and ensure that every reasonable request for broadband in these areas was met. The total value of the investment to implement the National Broadband Scheme was c. €223m, of which the Government contributed €79.8m. Following the conclusion of a public procurement process, the Department entered into a contract with "3" (a Hutchison Whampoa company trading as 3) on 23 December 2008 to implement and operate the National Broadband Scheme. The National Broadband Scheme delivered basic broadband services to certain target areas in Ireland in which broadband services was not available. Under the contract, 3 was required to provide a basic broadband service to all premises in the NBS area who sought a service.

Both the County and Group Broadband Scheme and National Broadband Scheme successfully enabled basic broadband services²⁸ to certain rural premises. However, the broadband service provided by both schemes quickly became outdated as the demand for higher and more reliable broadband services grew. Consumers quickly became frustrated with the very basic broadband service and demand grew for improved levels of service.

By 2010 and early 2011 these frustrations began to gain strong political support. Rural dwellers in particular voiced significant concern about the lack of a plans to bring broadband to their areas. Not surprisingly commercial investments were focused on urban and suburban areas. Hence a national policy was needed to address this growing digital divide.

3.3.1 How the NBP policy was created (2011 to 2012)

The origins of the Irish National Broadband Plan date back to the Irish general election held on 25th February 2011. The lack of availability of high-quality broadband across the entire country became a key topic of debate in the run up to this election. The Irish Government subsequently formed in March 2011, set out a clear ambition to tackle the issue in their Programme for Government that was then published, ‘Statement of Common Purpose’ (54). It states an ambition to:

‘... provide next generation broadband to every home and business in the state. This will be achieved by delivering fibre to the home or kerb for 90% of homes and businesses in Ireland with the remaining 10% provided with high speed mobile or satellite broadband’

This ambition statement is interesting, as it shows a level of disregard of the EU State Aid Rules which require EU Member States to maintain a technology neutral approach to any State intervention and prevent target technologies to be mandated from the outset.

²⁸ The National broadband scheme offered download speeds of up to 3Mbps, whereas there was no target download speed agreed for the County and Group Broadband Scheme.

To progress this ambition, the Irish Government convened a taskforce in 2011 creating a forum at which key industry stakeholders could highlight the legislative, policy and regulatory levers that could facilitate greater investment in high-speed broadband services across Ireland. It was also designed to identify where gaps in commercial service provision would likely occur. Membership of the taskforce included the CEOs of the six main electronic communications network operators in Ireland: these were BT, eircom, Hutchison 3G Ireland, Telefonica O2, UPC and Vodafone along with the CEOs of four other operators. It was chaired by the Minister for Communications, Pat Rabbitte TD, the Government minister responsible for the Irish State's telecommunications policy at that time.

The taskforce published its findings in 2012²⁹, the 'Report of the Next Generation Broadband Taskforce'. The report identified areas where Government and industry could work together and highlighted 42 recommendations under five headings including: Industry investment plans and likely gaps; stimulation of demand for broadband services; Planning reforms to accelerate build out of essential telecoms infrastructure; spectrum policy; and the role of state infrastructure and services. Following the publication of its findings a public consultation was initiated to seek the views of stakeholders on how best to facilitate the rollout of high-speed broadband in Ireland. The outcome of the consultation informed the Irish State policy, which was published in August 2012, the 'National Broadband Plan' (10)'.

The NBP set out the State's commitment to high-speed broadband availability across the country during the lifetime of the Government – specifically:

- 70Mbps - 100Mbps to be available to more than half of the population by 2015;

²⁹ Launch of the Report of the Next Generation Broadband Taskforce in May 2012, <https://merrionstreet.ie/en/category-index/communications/telecoms/minister-rabbitte-launches-report-of-the-next-generation-broadband-taskforce.44165.shortcut.html>

- at least 40Mbps, and in many cases much faster speeds, to be available to at least a further 20% of the population and potentially as much as 35% around smaller towns and villages; and
- a minimum of 30Mbps be available to every remaining home and business in the country – no matter how rural or remote.



Figure 3.1 Minister for Communications, Pat Rabbitte TD, at the launch of the National Broadband Plan³⁰

The NBP policy statement signaled the Irish State’s intent to invest State funds to ensure high-quality broadband was rolled out in less densely populated areas and secondly to ensure the environment was right to allow private industry to invest swiftly all over the country.

Notably the mandating of specific technologies was removed from the policy, and this better aligned to the approach recommended by the EU State Aid Rules. The download speeds of the broadband service were instead described i.e., certain broadband download speeds were set for different percentages of the premises in Ireland.

It should also be noted that those who participated in the development of the Irish policy statement did not have the benefit of having a high-level end to end view of the

³⁰ News coverage of the NBP launch can be viewed at <https://www.youtube.com/watch?v=97xIVpcMys0>

activities needed to design an intervention to meet the requirements of the SAG. They could not have appreciated the multiple phases that would follow or appreciated the extent or complexity of these activities. Therefore, the target timelines set out in this policy could not have been founded on any reliable source.

3.3.2 How an even more ambitious NBP policy was set out (2013 – 2014)

Following the publication of the NBP, Minister Rabbitte launched³¹ a public tender³² in February 2013 seeking to procure experts to assist in the design, planning and procurement of a State-led investment in high-speed broadband. Commenting on the tender announcement Minister Rabbitte said:

“... In the coming years, we expect one million homes to have access to high-speed services, in some cases with speeds as high as 150Mbps. New investments in upgrading fixed line infrastructure, and the roll out of 4G services as a consequence of the recent multi-band spectrum auction will make a considerable impact on the availability of high-speed services in many areas. However, my concern is to ensure that less densely populated areas will also receive very fast broadband so as to ensure balanced regional competitiveness and good access to on-line facilities....”.

The tender was subsequently awarded to Prisa Consulting Ltd. who then provided advice over a two-year period from 2013 to 2014. Interestingly, this two-year duration was originally thought sufficient time to design the Irish NBP intervention, plan and procure the relevant services to implement the Irish NBP intervention and satisfy the SAG. Without the availability of any relevant reference material or practical guidance, a two-

³¹ The Press release for the launch can be viewed at <https://merriestreet.ie/en/News-Room/Releases/minister-rabbitte-announces-major-step-on-the-road-to-implementation-of-the-national-broadband-plan.html>

³² The tender information can be viewed on the etenders website: <https://irl.eusupply.com/app/rfq/ojecform.asp?PID=62267&FRID=V&OJEC=2&PUB=1&PUBID=126986&PGE=/insidemain.asp>.

year duration was accepted and communicated to stakeholders as a reasonable estimate of the time needed to complete the project.

The Department developed an initial strategy to deliver the State's broadband intervention. In doing so, the key findings outlined at the time can be summarized as follows:

- Up to one third of all addresses in the State may not be served by a Next Generation Access network if left to the commercial sector;
 - Rural Ireland presents significant challenges to the State when it comes to the financing of a long-term future proofed Next Generation Access network with the cost to connect the last mile a clear barrier to commercial investment;
 - Demand for high-speed broadband was on a significant upward curve and the availability of a fit for purpose ubiquitous broadband network that is future proofed and sustainable in the long term would be critical to the Irish Economy, i.e. the aim should be that no requirement for further State intervention should remain beyond the NBP;
 - Industry investment over the preceding years had been significant, it had resulted in a tangible digital divide between rural and urban areas as industry investment targeted primarily urban areas; and
 - The evolution of technology was fast paced, and it was difficult to gauge the true extent of likely commercial investment over the short to medium term.
- Accordingly, it was concluded that any intervention must ensure that further commercial investment should not be dis-incentivized by State-led intervention plans.

Following consideration of the findings the Department concluded that:

- There was a need to pursue a more ambitious, longer term, future proofed State-led intervention than that set out in the NBP with the objective of dealing definitively with the connectivity challenge in rural areas;
- The State's intervention should involve a long-term infrastructure investment focusing on:

- an infrastructure build (likely to be primarily fibre based) to locations identified as having no current or planned enabling fibre network with a view to stimulating investment by industry in connecting end users to the network. An initial list of towns and villages had already been identified in this regard;
- supporting measures to accelerate connection to the network; and
- addressing those most remote areas where commercial investment in high-speed broadband was unlikely to happen.

Accordingly, in April 2014 the Irish Government provided approval to proceed with the detailed project planning and design of this significantly more ambitious and long-term intervention strategy. While this update to the intervention strategy did not change which locations the intervention would target, it did dramatically change the ambition level of the project, which now targeted a significant transformation of the digital connectivity in rural parts of Ireland over the longer term. This ultimately changed the cost profile of the project, the scale of investment required, the target technical solution as well as many other factors.

Following the approval of the more ambitious NBP policy the Department also developed an updated timeline. This timeline was informed by the Department's expert advisors at that time, Prisa Consulting, and demonstrated a somewhat better understanding of the steps involved. They were summarized and communicated to stakeholders as follows, in Table 3.1:

Action / Milestone	Date
Finalise mapping exercise and launch public consultation on outcome	Q4, 2014
Develop comprehensive intervention strategy for delivery of the State led intervention and launch public consultation on same	H1, 2015
Secure Government approval to the comprehensive intervention strategy	H2, 2015

EU State aid application to proposed intervention	H2, 2015
Commence Procurement Process	H2, 2015
Finalise RFT	2016
Contract negotiation and finalization	2016

Table 3.1 The NBP target Timeline set out in April 2014 (Source DCENR).

The revised duration was now estimated to be circa three years. Notably the Mapping Process was estimated at that time to take circa 6 - 9 months to complete and it was assumed that, once finalised, the Mapping Process would not be revisited. Despite the fact that the plan was informed by expert advisors, this assumption, as well as the target duration of the Mapping Process, subsequently proved to be completely inaccurate.

It was assumed that State Aid Approval could be achieved once the Irish Intervention strategy was finalised. It was not considered necessary for the public procurement process to have concluded. This assumption also proved to be inaccurate. It was also assumed that the public procurement process would take circa 18 months to complete. As will be outlined later in this Chapter, this duration also proved to be significantly underestimated.

Also noteworthy, is the fact that this plan was shared with the EU Commission at that time and no concerns were raised on the proposed approach or target timelines, despite the existence of these issues, which became more apparent as the project progressed.

3.3.3 The Development of the NBP Map (July 2013 - November 2014)

Supported by Prisa Consulting, one of the first steps taken by the Department was to engage Service Providers in July 2013, to establish the locations where the State intervention was needed. The Department issued a 'Request for Information'³³, to every

³³ As set out in the request for information, operators were requested to provide basic broadband coverage information (network infrastructure, coverage, capacity); NGA coverage information (network infrastructure,

Service Provider authorized to provide broadband services in Ireland by the Irish National Regulatory Authority, ComReg. The request sought to establish a view on the existence of any existing or planned NGA networks in Ireland. The Department conducted a technical assessment of any Service Provider submissions received and from this assessment categorized certain Service Provider network coverage as NGA. Many Services Providers submitted details of their networks and engaged in this process.

The Department made significant efforts to ensure the NBP Map was as accurate as practicably possible. All Service Providers in the State were invited to meet senior Department officials to discuss the NBP project and how they could participate in the Mapping Process as well as other aspects of the Irish NBP intervention design. Over 70 companies availed of this opportunity during 2014, the vast majority of active Service Providers across the State³⁴. In addition, the Department went to great lengths to ensure everyone had the opportunity to contribute. The Department published a series of public consultations to ensure every Service Provider in the State was provided an opportunity to share their views and have their say on how best to implement the Mapping Process fairly and equitably for all.

The development of the online map is a central theme of this thesis and Chapter 4 outlines and analyses the development of the NBP Map in detail and identifies the learnings that can be taken; therefore, it is not intended to cover this detail as part of this Chapter. However, for the purposes of understanding how the Irish NBP

coverage both current and planned, capacity); and to express their opinion on the proposed definition of NGA networks.

³⁴ ComReg maintain the Electronic Register of Authorised Undertakings (ERAU) which lists all Service Providers in the Irish State. The Register can be accessed at <https://www.comreg.ie/industry/licensing/general-authorisation/electronic-register-of-authorised-undertakings/>.

intervention satisfied the SAG we note that the NBP Map was first published in November 2014 after the considerable efforts undertaken by the Department to engage with Service Providers on their network coverage.

The NBP Map was published in 2014, showed the Department's assessment of where NGA networks were either present or planned and also where no Service Provider was either already offering an NGA broadband service or planning to by 2016. Therefore, the NBP Map was designed to identify 'white' NGA areas. This was the first opportunity for stakeholders to see the consolidated National position with respect to the availability of NGA broadband in Ireland. The NBP Map included some 747,000 premises across the State located in primarily rural areas, which comprised of almost 32% of the total premises in Ireland. The Intervention Area represented on the NBP Map covered approximately 96% of the total national land mass.

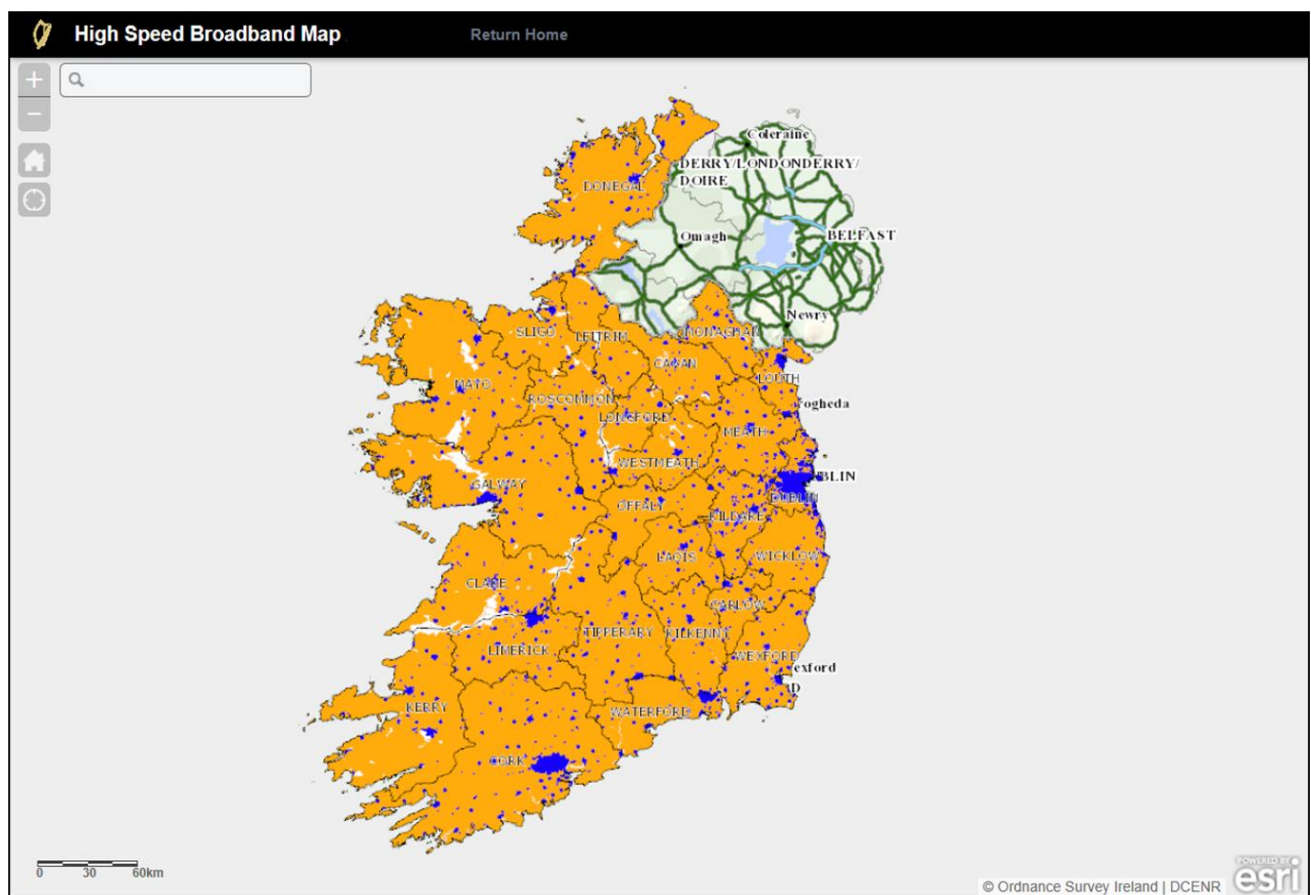


Figure 3.2 The NBP Map which was published in November 2014 (Source DCENR).

The launch of the NBP Map was a significant milestone in the Irish NBP intervention project. The Minister for Communications at the time, Minister Alex White, launched a public consultation on the NBP Map on 24th November 2014 in Doolin Co. Clare. The launch was subject to considerable public, media, political and industry interest. All major news broadcasts covered the launch, through both National and local media channels. The NBP Map received over 30,000 views on the Department's website within the first week of the launch of the public consultation. Many commentators expressed shock at the extent of the deficit of NGA broadband services in rural areas across Ireland.

From the Department's perspective, the centrality of the NBP Map to satisfying the SAG was beginning to emerge. The first publication of the NBP Map was originally intended to meet the requirements of Paragraph 78 (a) of the SAG. However, the levels of complexity involved, while still not fully clear, were beginning to become more apparent; the Mapping Process within the Irish NBP intervention project was identified as a challenging exercise which was highly contentious to a range of stakeholders, where significant support and expertise would continue to be needed, even after its first publication in 2014.

3.3.4 The Irish NBP Intervention Strategy (June 2014 – December 2015)

Over the course of 18 months the Department developed an intervention strategy 'Broadband Strategy for Ireland'³⁵ which was published as part of a public consultation launched in July 2015. This exercise was designed to meet the SAG obligation set out in Paragraph 78 (b) which requires EU Member States to give '*adequate publicity of the characteristics of the measure*' by conducting a public consultation.

³⁵ Details of this consultation can be found at

<https://www.dccae.ie/en-ie/communications/consultations/Pages/NBP-Strategy-Intervention-Public-Consultation.aspx> .



Figure 3.3 Minister for Communications, Alex White TD, speaking at the launch of the Broadband Strategy for Ireland public consultation³⁶.

Ireland's Broadband Intervention Strategy set out a series of detailed Government policy positions in respect of the proposed State intervention. Specifically, it detailed the key elements of the intervention in Ireland - what services were required and how they would be delivered. Ireland's Broadband Intervention Strategy essentially described the Irish State's Intervention in nearly every aspect and in some detail, including, setting out the ambition of the State's broadband policy both in a National and global context; describing the objective of the proposed intervention to conclusively address the digital divide over an extended period, what broadband performance (i.e., download and upload speeds, as well as reliability etc.) would be delivered to address the digital divide and how this performance would evolve over time as demand increased; setting out the principles under which the intervention strategy was drafted, targeting white NGA areas, minimizing distortions to the market, minimizing State subsidy, promoting competition, address SAG obligations etc.; and providing substantial detail on how each principle would be addressed in the State intervention.

³⁶ Minister White's interview with SiliconRepublic.com can be viewed at <https://www.youtube.com/watch?v=AeNZvC86qio> .

Ireland's Broadband Intervention Strategy was informed by seven expert reports, including:

- (1) An Ownership Report – providing recommendations on whether the assets subsidized, i.e., the subsidized broadband infrastructure, should be owned by the State or otherwise;
- (2) A Funding Report – providing recommendations on how the business model for the subsidized network should operate;
- (3) A State Aid Report – outlining how the proposed intervention meets State Aid obligations;
- (4) A Governance Report - providing recommendations on how the governance structures that need to be put in place by the State to oversee the project once it is awarded;
- (5) A Technical Report - providing recommendations on what requirements should be included in the procurement from a technical perspective;
- (6) A Benefits of High-Speed Broadband Report – an extract from the wider cost benefit analysis conducted, outlining the key benefits expected to accrue as a result of the intervention. An Annex to the Benefits Report was also published – providing further details on the quantifiable benefits expected to accrue as a result of the intervention; and
- (7) A Managing the Map Report – outlining how the NBP Map would be kept up to date during the procurement and once the procurement was finalised.

To implement this single step, considerable effort was required, including:

- Procurement of economic, technical, financial, and legal advisory services through four separate public procurement processes conducted in early 2015;
- Establishment of an advisory Steering Group³⁷ with both National and international experience to provide guidance on the delivery of the Irish NBP Intervention Strategy to the NBP working group;

³⁷ The terms of reference of the Steering Group can be found at

- Undertaking significant analysis to examine several different intervention options, this involved substantial modeling of different technologies over different topologies³⁸;
- Conducting a comprehensive costing exercise to establish the likely costs of different intervention options;
- Undertaking a series of bilateral meetings with industry, representative groups and other stakeholders to help inform the initial draft of the strategy;
- The development of a series of expert reports to support the draft intervention strategy options;
- Publication of the draft intervention strategy along with the expert reports so that a public consultation could be undertaken, inviting all stakeholders to submit their respective views on the strategy options described;
- Development of a detailed cost benefit analysis to establish the likely overall worth of the project to the State;
- Recommending the most optimum way forward to Government; and
- Seeking of approval from the Minister for Communications and full Government on the key measures in the Intervention Strategy, involving considerable cross Government engagement with senior officials and elected representatives from several different Ministries.

Figure 3.4 below represents some of the key tasks undertaken.

<https://www.dccae.ie/documents/20180205%20Steering%20Group%20terms%20of%20reference.pdf> .

³⁸ This included ‘backhaul’ only intervention or a ‘last mile intervention’ or an ‘end to end intervention’ using a number of different technologies.

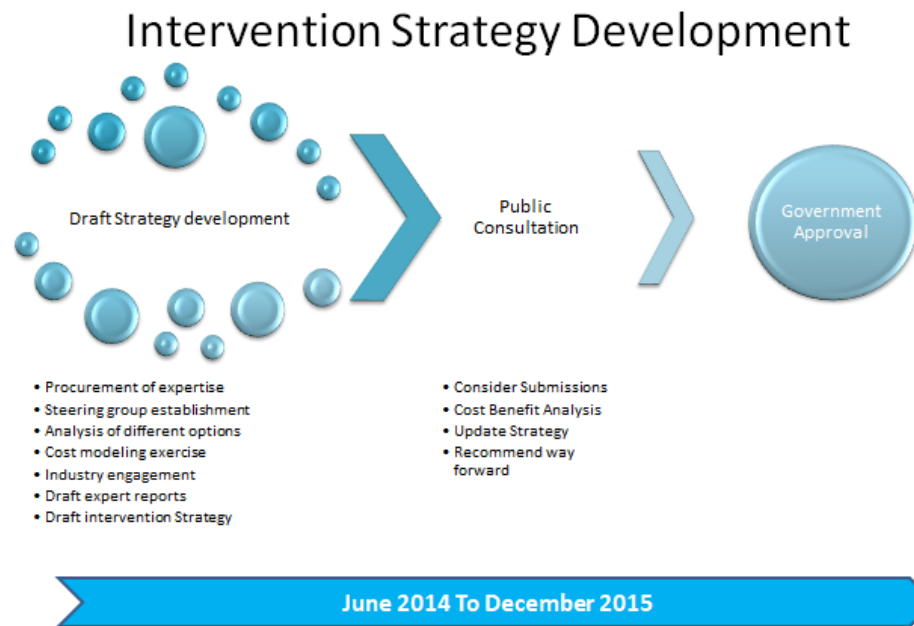


Figure 3.4 Development of the Intervention Strategy (Source DCENR).

The public consultation attracted particularly high interest from Service Providers and the communications industry; forty-one submissions were received from a range of stakeholders including Local Authorities, representative bodies, elected officials, members of the public and understandably almost every Service Provider in the communications sector in Ireland submitted a response or contributed to a group/representative body submission. This broad range of stakeholders as well as the in-depth and lengthy submissions from many stakeholders, was considered a strong response by the Department. Stakeholders expressed a wide range of views on the various aspects of Ireland's Broadband Intervention Strategy which were then considered by the Department and its expert advisors and reflected in the updated intervention strategy.

In December 2015, the Irish Government approved the strategy, and the Department published the Updated Broadband Intervention Strategy (55). Similar to the publication of the NBP Map, this represented another major political and public milestone for the Irish NBP intervention project and attracted significant media attention. A major public event was held to mark the milestone which also coincided with the initiation of the public procurement. The Minister for Communications at that time, Minister White, described the launch as:

‘a defining moment for our citizens, the telecommunications sector, and for our economy, which marked the beginning of the largest and most significant broadband intervention ever in Ireland’.

It also meant that the Irish NBP intervention project had largely met the milestones originally envisaged for the project when it was first initiated, as outlined in Table 3.2.

Action / Milestone	Original Forecast Date	Date achieved
Finalise mapping exercise and launch public consultation on outcome	Q4, 2014	The NBP Map was completed, and a public consultation launched in November 2014
Develop comprehensive intervention strategy for delivery of the State led intervention and launch public consultation on same	H1, 2015	Achieved in July 2015
Secure Government approval to the comprehensive intervention strategy	H2, 2015	Achieved in December 2015
EU State aid application to proposed intervention	H2, 2015	This was not achieved as it was not possible to seek EU State Approval without first completing the public procurement process.
Commence Procurement Process	H2, 2015	Achieved in December 2015

Table 3.2 Analysis of the original NBP target Timeline set out in April 2014 against the project status, December 2015.

The expected timelines for the completion of the remainder of the Irish NBP intervention project outlined in the NBP Intervention Strategy at that time were:

‘ 13.1. Procurement timelines

The detailed timetable for the procurement phase is as follows:

- *Procurement process commences: H2 2015;*
- *Contract Award: H2 2016.*

13.2. Proposed timeline for deployment

Based on the timeline for procurement, it is expected that the successful tenderer(s) will begin deployment of the network in the second half of 2016. In order to meet the target of the DAE of ubiquitous availability of services of at least 30Mbps by 2020, we recommend that a requirement is placed on the successful tenderer(s) to complete deployment in their relevant parts of the Intervention Area by the end of 2020.’.

The procurement process was initiated at the end of 2015 meeting the timeline forecasted. However, the forecasted timeline to award a contract i.e. during the second half of 2016, proved to be significantly underestimated, for a number of different reasons, as the contract was not awarded until November 2019. This period of the project is unpacked further in the following sections.

3.3.5 The NBP Procurement process (December 2015 – November 2019)

The SAG require that a competitive selection process is adopted, this requirement is outlined in Paragraph 78 (c):

“(c) Competitive selection process: Whenever the granting authorities select a third-party operator to deploy and operate the subsidized infrastructure (96), the selection process shall be conducted in line with spirit and the principles of the EU Public Procurement Directives (97). It ensures that there is transparency for all investors wishing to bid for the implementation and/or management of the subsidized project. Equal and non-discriminatory treatment of all bidders and objective evaluation criteria are indispensable conditions. The competitive tender is a method to reduce budgetary costs, to minimise the potential State aid involved and at the same time reduces the selective nature of the measure insofar as the choice of the beneficiary is not known in advance (98). Member States shall ensure a transparent process (99) and a competitive outcome (100) and shall use a dedicated central website at the national level to publish all on-going tender procedures on broadband State aid measures (101)”,

“Footnote (97): Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (OJ L 134, 30.4.2004, p. 114).”

The NBP Procurement process commenced on 22 December 2015. The formal procurement procedure adopted for the NBP procurement was a 'competitive dialogue procedure' which is not a procedure prescribed by the SAG but is a public procurement procedure commonly used for large and complex infrastructure projects. This process was chosen in Ireland as the most suitable procurement procedure; it is typically used where a contract cannot be awarded without prior extensive engagement with prospective bidders because of specific circumstances related to the nature and the complexity of the project. The NBP procurement fitted into this category as the specific and detailed nature of some of the SAG requirements needed to be ironed out and agreed with prospective bidders. Many of the unique requirements introduced by the SAG such as 'claw back' provisions to protect the State, requirements for equal and open access to infrastructure etc. subsequently led to extensive bidder engagement during the dialogue undertaken as part of the public procurement.

From the outset the procurement process was designed to follow a three main stages, these were: (1) A prequalification stage; (2) A competitive dialogue stage; and (3) A Final Tender stage. The procurement process was concluded in November 2019 with the award of the contract to the National Broadband Ireland. A brief summary of these three stages is outlined in the following sections.

3.3.5.1 The Pre-Qualification Stage (2015 - 2016)

On the commencement of the NBP Procurement process, both a Project Information Memorandum (PIM) and Pre-Qualification Questionnaire (PQQ) were published. The PIM set out the public procurement process that would be followed and the conditions which any bidder must adhere to if they wanted to participate in the process.

Shortly after the commencement of the NBP Procurement process, on 19 January 2016, all interested parties were invited to attend a high-level briefing with the Department. The objective was to provide an overview of the procurement process and to provide an opportunity for potential bidders to seek clarification on any section of PIM and PQQ. Over 50 companies attended the event and interest levels in the project appeared to be high from a wide range of potential bidders.

The pre-qualification stage invited interested parties to submit details of their relevant professional and technical experience in projects of a similar nature and scale to the Irish NBP intervention and to demonstrate the necessary financial standing. The different steps to be undertaken as part of the PQQ were explained in detail the PIM including specific instruction on what to bidders needed to submit and also how the submissions received would be evaluated.

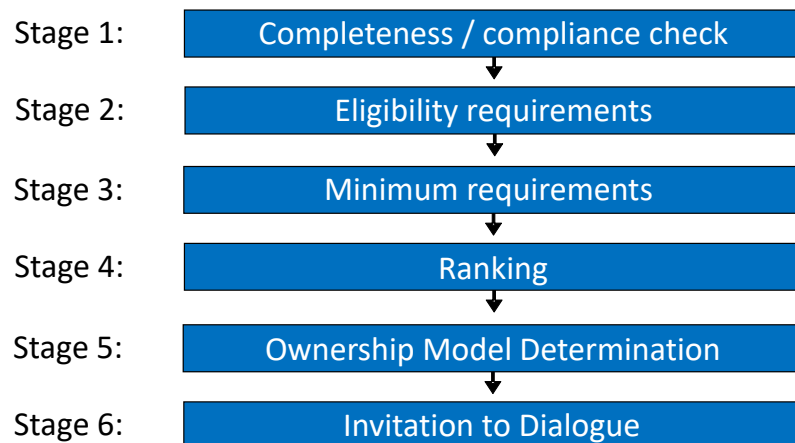


Figure 3.5 The different evaluation steps of the PQQ as set out in the PIM (Source DCENR)

Only five responses were actually received. Evaluation of the five responses concluded in July 2016, with three bidders successfully passing the pre-qualification process. These three bidders were invited to participate in the dialogue phase of the procurement process. They were SIRO, eir and a Granahan McCourt led consortium. The elimination of two potential bidders at this early stage of the process was a significant decision. Significant due diligence and scrutiny was applied to all parts of the pre-qualification stage evaluation to ensure the appropriate outcome was reached. Only bidders who demonstrated the required financial standing and necessary professional experience were invited to continue in the process. While the NBP procurement process had started with over 50 companies expressing an interest in the project, this was quickly reduced through the pre-qualification stage, as only three bidders could successfully demonstrate the financial standing and professional experience required for the project. The pre-qualification stage took over 6 months to complete. It was clear after this first stage of the procurement that, despite the best efforts of the project team, that the

target timeline of completing the procurement during 2016 was overly optimistic and would not be met.

3.3.5.2 The Competitive Dialogue stage (2016-2018)

A high-level description of the Competitive Dialogue Stage

The competitive dialogue stage of the procurement was conducted over a two-and-a-half-year period. An 'Invitation to Participate in Dialogue, (ITPD)', was issued in July 2016 to the three bidders who had successfully passed the pre-qualification stage and dialogue on the contractual requirements commenced. The key milestones and the timelines forecasted by the NBP project team at that time in 2016 were as follows, as outlined in Table 3.3.

Key milestones	Milestone date	Status
Publish Contract Notice & issue Pre-Qualification Questionnaire (PQQ) documents	22 December 2015	Complete
Deadline for submission of PQQ Responses	31 March 2016	Complete
Issue Invitation to Participate in Dialogue (ITPD) to short listed bidders (all lots)	July 2016	Complete
Receive Detailed Solutions	October 2016	
Provide feedback to Bidders on (Invitation to Submit Detailed solutions) ISDS evaluation	December 2016	
Close dialogue and issue (Invitation to Submit Final Tender) ISFT pack to short listed bidders	January 2017	
Receive Final Tenders	February 2017	
Appoint Preferred Bidder(s) & notify unsuccessful bidders	May 2017	
Contract Award	June 2017	

Table 3.3 The NBP project team's forecasted procurement timetable, drafted on 12th July 2016 (Source DCENR).

The target timelines again proved to be overly optimistic, particularly the duration required for the competitive dialogue stage, where the bidders and the Department teased through the detailed requirements of the contract. This competitive dialogue stage lasted for over a year.

An 'Invitation to Submit Detailed Solutions, (ISDS)', was subsequently issued in June 2017. Bidders submitted their 'Detailed Solutions' for assessment in September 2017. This was then followed by a final stage of dialogue which concluded when an 'Invitation to submit Final Tenders' was issued in September 2019.

Each of these invitations involved documents that were substantial in themselves, running to over a thousand pages; they outlined the specific instructions that bidders needed to follow in their response, they outlined the requirements the bidder's solution must address in their response and also outlined the process by which their submissions would be evaluated by the Department once received. In response to these invitations, substantial responses, also running to thousands of pages, were submitted by the bidders. They detailed their proposed solution outlined, with supporting evidence, how they would meet the requirements set out. Bidders also commented on the draft contract which they would be expected to sign if they were successful in the tender process.

The extended duration of the competitive dialogue stage was due in part to the scale and ambition of the plan and the necessary protections demanded by the State for such a significant public contract. In addition, a number of non-standard contractual conditions were introduced which were complex and not typical for public procurements³⁹. These were included to ensure alignment with the SAG obligations.

³⁹ One example of these obligations was the requirement set out in the SAG in Paragraph 78 (i) to have claw back provisions in the contract. A 'clawback' is a contractual protection for the State against over subsidising

These clauses significantly extended the duration of the competitive dialogue needed with each bidder.

The final NBP Contract, which has since been published⁴⁰ runs to over 3,500 pages including the contracted solution from the successful bidder which essentially outlines the output of the competitive dialogue stage. The scale of the NBP Contract that was produced provides some insight to the enormity of the task and the complexity of the dialogue stage of the process. The complexity of conducting detailed competitive dialogue with three different bidder teams, on the requirements of such a contract cannot be understated.

In September 2018, the competitive dialogue stage of the procurement was concluded. The competitive dialogue stage involved almost 400 different meetings with bidders, equating to approximately 870 hours of meetings between the Department's procurement team and teams from the three bidders over a 27-month period, giving rise to the issue of five different versions of the draft NBP Contract over that period.

Three significant events occurred in the Irish NBP intervention project between 2017 and 2018 which materially impacted the procurement process and the timeline to complete the competitive dialogue stage. These are described in the following paragraphs.

An update to the NBP Map during the NBP Procurement process

The first event related to a significant update was made to the NBP Map during the dialogue phase. The Department accepted, after a length assessment exercise, a claim

the contractor where, for example, if the contractor's actual deployment costs are lower than anticipated in their

bid, this protection allows the State to 'claw back' a proportion of the savings realised'.

⁴⁰ The NBP contract can be viewed <https://www.gov.ie/en/publication/16717-national-broadband-plan-contract/>

from eir that they would build an NGA broadband network to service 300,000 premises in the proposed Intervention Area.

In April 2017, the scope of the Intervention Area for the purposes of the procurement was revised to approximately 540K premises⁴¹. This change involved:

- Removing approximately 300,000 premises in rural locations from the Intervention Area which eir committed to address with a new commercial rollout; and
- Adding approximately 84,500 premises to the Intervention Area in primarily suburban areas which had been identified as not receiving NGA services from commercial operators.

The Minister for Communications at that time, Minister Naughten said:

‘The agreement that I have signed with Eir means one house every minute of every working day will get fibre to the door high speed broadband over the next 90 weeks. 300,000 more rural premises will have access to high-speed quality broadband – that’s an extra 500 houses every day. Over the last four years commercial operators have invested over €2.5bn upgrading telecoms networks and services. This is a clear indication that the state’s commitment to Broadband is driving investment from the commercial sector. With the finalisation of the Broadband map one of the key uncertainties in the procurement process has now been removed and will allow us to move closer to our goal of ensuring all premises in Ireland will have access to high speed broadband’.

To underpin this change eir signed a Commitment Agreement⁴² with the State, contractually committing to deliver high speed broadband to over 300,000 premises in rural Ireland.

⁴¹ The Government press release and press conference can be viewed at:

https://merrionstreet.ie/en/category-index/communications/naughten_finalizes_broadband_intervention_map_for_national_broadband_plan.124386.shortcut.html .

⁴² The eir Commitment Agreement is available at www.dccae.ie/documents/Commitment%20Agreement.pdf .



Figure 3.6 Minister for Communications, Denis Naughten TD, announcing the agreement with eir⁴³.

This change dramatically changed the scope and scale of the public procurement mid-way through the process.

The withdrawal of SIRO and eir from the NBP Procurement process

The second and third events related to the withdrawal of eir⁴⁴ and SIRO⁴⁵, two of the three remaining bidders, from the NBP Procurement process.

So why did SIRO withdraw?

SIRO, the ESB-Vodafone joint venture, formally communicated to the Department its withdrawal from the NBP Procurement process on 25 September 2017.

In its press release on the 26 September SIRO stated:

'The company shares the Government's ambition to reverse the digital divide by increasing the penetration of high speed gigabit broadband to over half a million (500,000) homes and business

⁴³ The Irish Government's full press conference can be viewed at <https://www.youtube.com/watch?v=yMBnzdbn76A&t=1379s>.

⁴⁴ eir withdraws from the NBP procurement <https://www.eir.ie/pressroom/eir-Withdraws-from-NBP/>.

⁴⁵ SIRO withdraw from the NBP procurement <https://siro.ie/news-and-insights/nbp-announcement/>.

across Ireland. Following a comprehensive review, SIRO cannot develop a competitive business case to justify continued participation in the National Broadband Plan bid process and therefore has decided to withdraw’.

Pat O’Doherty, Chief Executive of ESB, commented:

‘SIRO’s withdrawal from the National Broadband tender process was a difficult decision, it was made on the basis that SIRO was unable to make a business case for continued participation in the process’.

Anne O’Leary, Vodafone Ireland CEO, stated:

‘Naturally we are disappointed that SIRO is withdrawing from the National Broadband Plan tender..... The decision to withdraw was difficult but means the company can refocus its attention to building out the SIRO network further’.

It is clear from the statements issued at that time that SIRO and both of its parent companies were disappointed that they had to withdraw. They indicated that they couldn’t develop a competitive business case to justify continuation in the process. The direct cost that SIRO would have incurred if they continued in the NBP Procurement process would have been substantial i.e., at least 7 million euros⁴⁶. This cost would have been entirely at their own risk, with no recourse or opportunity to reclaim these costs if they were unsuccessful in the process. In addition, SIRO’s best and most experienced resources would have been required to participate in the NBP Procurement process in order to give themselves the best chance of winning the tender, making them unavailable to SIRO for other activities such as their commercial network deployment. Therefore, SIRO would have weighed up these impacts and risks against the likelihood of winning the NBP Contract.

Following the NBP Map change in April 2017, SIRO re-evaluated whether they could still develop a proposal that they would consider to be competitive against other bidders’ likely proposals. It should be noted that while the NBP Map update removed a net amount of 217k premises from the Intervention Area, these premises were not located

⁴⁶ eir later disclosed that they expended 7 million euros in their tendering activities, SIRO would have most likely matched if not exceeded this cost.

in a single location or even in a contiguous area. They were in fact scattered across the entire Intervention Area. The eir rural deployment only covered a portion of premises along any individual road and left premises near the end of the road or at the latter end of a cul-de-sac or too far back from the road (i.e., premises greater than 150m distance from the road) uncovered and without service.

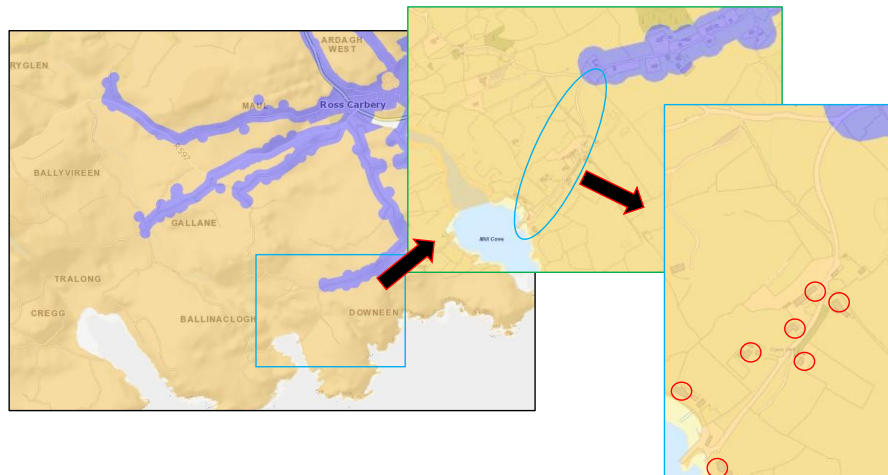


Figure 3.7 Examples of premises at the end of cul-de-sac (circled in red) which were left uncovered by the eir rural deployment near Rosscarbery, Co. Cork.

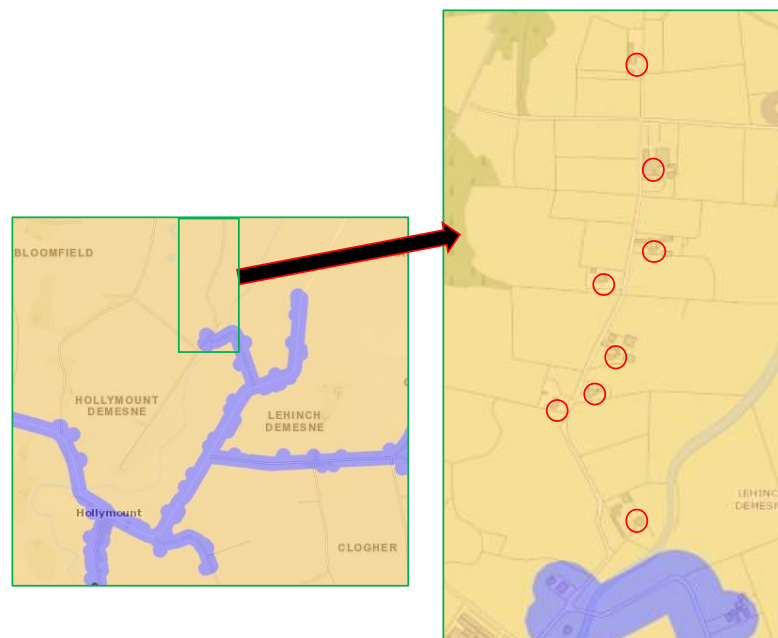


Figure 3.8 Examples of premises at the end of cul-de-sac (circled in red) which were left uncovered by the eir rural deployment near Hollymount, Co. Mayo.

As illustrated in Figures 3.7 and 3.8, the NBP Map update left premises along many roads partially covered by eir's rural deployment and partially in the Intervention Area. This resulted in SIRO having to design a network with similar network length as the network designed prior to the NBP Map update; therefore, SIRO would have modelled similar network build costs for this new design; however now they would be unable to benefit from any revenue income from the premises which were removed from the Intervention Area along these roads. This would have significantly impacted the forecasted business plan and significantly increased the level of subsidy they would require for the project if they were successful.

SIRO would have carefully weighed up and modeled this impact and ultimately, they concluded that they could not remain competitive in the NBP Procurement process.

The acceptance of eir's rural deployment to the NBP Map in April 2017 resulted in SIRO, a direct competitor to eir in the NBP Procurement process, withdrawing from the process.

The NBP Mapping Process and the decisions taken as part of this process, therefore proved pivotal to this bidder's decision on participation in the NBP Procurement process. This clearly demonstrates the level of influence the NBP Mapping Process had on the NBP Procurement process and the central and critical nature of the NBP Mapping Process to the success or otherwise of the entire Intervention Process.

So why did eir withdraw?

Eir, one of the remaining two bidders following the withdrawal of SIRO, formally communicated to the Department its withdrawal from the NBP Procurement process on 26th January 2018. Eir stated in its press release⁴⁷ on the 31st of January 2018 that

⁴⁷ eir's press release can be viewed at

https://www.eir.ie/opencms/export/sites/default/.content/pdf/IR/news/eir_withdraws_from_nbp.pdf.

“[b]ased upon the significant commercial issues and complexity within the tender process, together with growing uncertainty on a range of regulatory and pricing issues that reside outside of the NBP process, the company's board has decided that the risks are too great for its continued participation in the NBP. Therefore, eir has reluctantly taken the difficult decision to withdraw from the tender process’.

Minister Naughten subsequently published correspondence he had received from eir on 30 January 2018 confirming their withdrawal from the NBP Procurement process.



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Minister for Communications, Climate Action and Environment
Denis Naughten, TD
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30th January, 2018

Dear Minister,

Thanks to you and your staff for making the time to meet with me last week. You asked me to review our decision to exit the National Broadband Plan (NBP) tender process, and to continue dialogue on the key commercial issues. Following our meeting, I have discussed this with the Board, and for the reasons outlined below, our position remains unchanged and it is our intention not to bid for the NBP.

Our decision to exit the NBP process is driven by a range of commercial, regulatory and governance issues that have been repeatedly highlighted over the past 18 months. Additionally, as I have consistently noted in our discussion on the 30th August 2017 and in my correspondence on the 17th July 2017, the Board has had grave and growing concerns that the current regulatory environment for telecommunications in Ireland has introduced new uncertainties and greater risks which dis-incentivise future fibre infrastructure investment. Recent developments on the two topics of FTTC cost orientation and wholesale pricing of our passive infrastructure in the intervention area, as discussed below, create large economic uncertainties for eir's NBP participation.

eir entered the NBP process in good faith with the ambition of winning the entire tender. We have spent over €7m during the past 30 months and have fully engaged in the process. Notwithstanding our well-communicated 'red-line' issues, eir remained in the process and submitted our ISDS in September in the hope that these issues would be addressed in the final months of the contract negotiation.

However, despite these protracted discussions, having reviewed the final draft of the contract, significant 'red line' issues remain and more have emerged in recent iterations. We now believe that it is not possible to reach agreement within the framework of the NBP. I do not intend listing all of our commercial issues here as they have been set out by us many times. It is important to say, though, that we strongly believe that the NBP framework, as well as being incapable of

acceptance by eir, will drive very substantial additional subsidy costs and delays to the roll-out of high speed broadband to rural Ireland. We have previously communicated that eir would be confident of achieving the policy objectives of high-speed rural broadband for a fraction of the prospective subsidy, using the methodology of our 300k rollout.

The NBP framework has in our view resulted in duplication and inefficiency which will increase the ultimate cost to deliver high speed broadband to rural Ireland in those areas where it is non-commercial to provide services. Requirements such as ring-fenced funding, the creation of a wholly separate wholesale subsidiary company and the proposed restrictions on our wholesale division's ability to compete in the NBP areas are all critical factors.

In relation to access and pricing of our passive products in the NBP area, we have expressed for some time our significant concerns at the proposal by the NBP procurement team to compel eir to offer prices that are below our regulated prices. eir operates within a regulatory framework operated by Commission for Communications Regulation (ComReg) which sets these prices in accordance with our allowable regulated return. Making eir's participation in the NBP conditional upon the company offering its products at an uneconomic return is unjustifiable.

In addition, I should refer to the on-going fibre to the cabinet (FTTC) pricing review by ComReg, and its move towards cost-based pricing. This consultation will set a reference point for all future fibre broadband product pricing, including FTTH. eir continues to engage directly with ComReg and recognises the independence of the Regulator. However, as the Minister with responsibility for the sector, you are already aware that we believe that a decision to reduce wholesale fibre prices runs counter to the laudable policy objective of providing high speed broadband. This consultation has come only four years after the launch of high speed broadband on our network. No other EU jurisdiction has moved to do this in such a short timeframe. Fibre investment carries high risk and many EU regulators have recognised this by introducing a 'risk premium' which allows higher regulated returns in order to incentivise that investment. ComReg, on the other hand, has proposed to do the precise opposite by reducing the available returns of the investment through the use of cost-based pricing principles at an early stage and therefore created a clear disincentive to invest in next generations networks.

The Board was keen that I inform you of our decision as soon as possible ahead of the end of February deadline, when bidders for the NBP must agree to submit fully compliant bids. We recognise that the final draft of the contract received earlier this month addressed some of the bidders concerns. However, as you can see, many significant 'red-line' issues remain and we therefore feel it is the right time to exit the process.

As the largest investor in broadband in Ireland, eir remains committed to rolling out broadband nationally and equally committed to rural Ireland through its commercial investment of €200 million in rolling out FTTH to 300,000 rural homes and businesses. The Board is also keen to assure you that our decision to withdraw from the NBP process does not undermine our resolve to continue to support the NBP, and the successful bidder, in other ways.

eir would be happy to engage with you and your officials on your broadband policy agenda in the coming weeks to examine other proposals or opportunities to address the rollout of broadband, and to ensure we continue to deliver high speed broadband. I would suggest that we now consider when and how best to communicate our decision more widely.

Kind regards,



Richard Most
CEO eir

Cc: Mark Griffin, Secretary General, DCCAE

Directors: Carl Leaver (UK) (Chairman),
Hub Codrington (NL), Richard Most (UK),
Pam Sandhu (UK)

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Figure 3.9 Letter from eir to Minster Naughten 30 January 2018.

Eir at the time of their withdrawal referenced a number of significant commercial issues and complexities that they had identified within the tender process. A number of key principles that were set out in the NBP Intervention Strategy and included as requirement in the NBP Procurement process, so that the principles set out in the SAG could be achieved, would have been problematic for eir. These principles included the requirement for open book accounting so that the use of the public subsidy could be clearly identified and ring-fenced, a potential requirement for a separate legal entity for the company receiving the subsidy and a number of other contractual undertakings covering equality of pricing, equivalence of inputs and operational key performance indicators. While all bidders were fully aware of these principles entering the NBP Procurement process, the Competitive Dialogue stage of the procurement process provided them with an opportunity to discuss the requirements in detail and establish whether a suitable solution could be found. However, the Competitive Dialogue undertaken had failed to address these issues to eir's satisfaction.

It should be noted that the Competitive Dialogue stage did not actually complete under September 2018. Although eir were encouraged by the Department to continue to engage on these issues through the remainder of the Competitive Dialogue process, in January 2018 they declined to do so. It appears that eir left the process prematurely as they felt it was unlikely, they could agree a resolution to their issues within the tender process.

Eir also raised its concern on the regulatory regime and concerns with regard to Comreg's potential decision on wholesale fibre pricing, particularly with regard to a price reduction which could affect eir wholesale charges. This price decision was outside of the NBP Procurement process, taken by ComReg in its role as the independent regulator of the sector. While the decision would have decreased the cash generated by eir from their wholesale fibre business it is hard to reconcile how this led to their withdrawal from the NBP Procurement process.

Digging a bit deeper into the rationale behind this decision, the NBP Map update from 2017 and the consequential withdrawal of SIRO from the NBP Procurement process cannot be ignored. Eir may have considered that announcing their own withdrawal and leaving just one bidder left in the procurement process would be perceived as the 'final nail in the

coffin'. They may have expected that the NBP Procurement process would be abandoned, or a new process initiated as a result. Certain media and political commentary supported this view. The main opposition party spokesperson, Deputy Timmy Dooley, Fianna Fáil, stated:

'This represents an unmitigated failure on the part of government, and leaves over 540,000 households in serious limbo. I do not believe that the current tender process can continue with just one bidder involved.'

Indeed, the last paragraph of their letter to Minister Naughten, offers to continue to engage with the Department *'to examine other proposals or opportunities to address the rollout of broadband'*, may be a reference to an alternative process they thought would be initiated once the procurement was abandoned. Through the NBP Mapping Process and in particular the NBP Map update, eir may well have believed they had established sufficient leverage to force Government to negotiate more favorable terms for the NBP Contract. However, this was not the case, as the NBP Procurement process proceeded in any case with just a single bidder left in the process. In any case, we can only speculate on the company's motivations, and it is only the decision makers in eir at that time, who ultimately know the true rationale for their withdrawal.

The Impact of these three events

While it is difficult to quantify exactly, these three significant events added almost 15 months to the overall procurement timeline. The NBP Map Update in April 2017 revised the target Intervention Area for all bidders in the NBP Procurement process. This change represented a significant change of scope and required each bidder to fully redesign and remodel their proposed solutions.

A direct impact resulted from the NBP Map update; additional time was needed to dialogue the impact of the change in scope and to consider the technical options to address the revised Intervention Area. In particular considering the solutions to transit the area that were covered by eir's rural deployment to reach the premises in the Intervention Area. The target to receive final tenders was originally February 2017, whereas this was revised to

May 2018, a 15-month delay to the NBP Procurement process. Figure 3.10 from the NBP programme team, records the anticipated programme timeline that was forecasted in June 2017.



Draft Programme Timeline - WIP

Description	Forecast Date	Comment
Senior Dialogue Meeting with Bidders	7 th Jun 2017	Engage bidders to check readiness for formal invitation to Submit Detail Solutions
Bidders Invited to Submit Detailed Solutions	9 th June 2017	Pre-requisites: DCCAE to issue to Bidders updated Vol 1, 2 and Vol 4 incl PFMT.
Detailed Solutions received from Bidders	19 th Sep 2017	Duration of 14 weeks (which Bidders advise is required)
Detail Solutions Evaluation complete	Nov 2017	10 weeks for Technical, Commercial and Contract review and evaluation (not scoring) incl Governance/review by ERP and Procurement Board
Final Contract dialogue	Feb 2018	8 weeks after evaluation to provide Evaluation feedback to Bidders and close off remaining Contract issues (Note Contract review will start on receipt of Bidder Contract mark -ups)
Close Dialogue and Bidders Invited to Submit Final Tenders	Mar 2018	7 weeks to update Contract including approval cycle for DCCAE/Government to formally approve issue of Contract for Final Tenders
Final Tenders received from Bidders	May 2018	11 weeks from formal ISFT
Final Tender Evaluation	Aug 2018	11 weeks for Technical, Commercial and Contract review and evaluation and scoring incl Governance/review by ERP and Procurement Board.
Comparison of Lots A, B & C and Preferred Bidder Recommendation	Aug 2018	2 weeks allowing for Project sign-off of Final Evaluation reports.
Govt. approvals for Preferred Bidder appointment	Sep 2018	4 weeks approval cycle for DCCAE/Government to formally approve Preferred Bidder Recommendation
Contract award	Nov 2018	6 weeks for Financial close and due diligence



Slide 6



Figure 3.10 The NBP Procurement timeline forecasted in June 2017 (Source DCCAE).

These three events which occurred between 2017 and 2018 during the NBP public procurement, may appear very unique and localized in nature. And it is possible that other EU Member States who conduct a public procurement for a similar purpose may not face the same scale of market and Service Provider driven challenges and therefore could anticipate shorter timelines. However, in a dynamic liberalized market such as the broadband market the risk exists that actions will be taken by market players that will

disrupt the public procurement exercise. EU Member States would be well advised to anticipate such events, to regularly scan the market for signals of market actions and ensure some mitigation planning is undertaken to minimise their impact.

3.3.5.3 The Final Tender Stage (2018-2019)

As two of the three bidders, eir and SIRO, had both withdrawn from the procurement process, this resulted one bidder, a Granahan McCourt led consortium, left remaining for the final tender stage of the procurement. On 18 September 2018, they submitted their Final Tender.

The Final Tender was evaluated against the comprehensive evaluation methodology that was specifically developed for the process. The evaluation methodology set out the detailed award criteria and evaluation approach that was to be applied in the evaluation of Final Tender submissions. The evaluation methodology comprised of a combination of compliance/robustness questions (pass/fail with no scoring attached) and scored questions. Of the total score available, 65% were allocated to the technical criteria and 35% were allocated to the commercial criteria i.e., a heavier weighting was applied to the quality of the technical solution rather than the cost presented.

For the purposes of carrying out the evaluation of tenders, an extensive Evaluation Committee was established. The Committee comprised a combination of civil servants and external personnel with experience and expertise relevant to the evaluation question(s) assigned to that person.

The Evaluation Committee, on conclusion of the evaluation process, determined that the remaining bidder's Final Tender had:

- Passed the completeness, compliance and robustness checks set out in the Evaluation Methodology; and
- Achieved the scoring thresholds in respect of the Technical Criteria and Commercial Criteria the Evaluation Methodology.

As a result, the remaining bidder was deemed eligible to be classified as the preferred bidder⁴⁸.

The Resignation of the Minister for Communications

Minister Naughten announced in October 2018 that he would resign from his role as Minister for Communications following a controversy that arose over a series of meetings held with businessperson David McCourt. Mr. McCourt was the head of the Granahan McCourt consortium at the time. Subsequently, no undue influence on the procurement process was found, although the impact of this incident was to create considerable uncertainty on whether the project would go ahead or not. It therefore delayed the conclusion of the procurement process.

In addition, while detailed scrutiny from the Oireachtas was always expected as an integral part of the approval process, there is no doubt that the activities undertaken by the Government and Oireachtas to scrutinize the merits of the project greatly intensified as a result of the incident and the intense media and political attention it attracted. A series of due diligence activities were undertaken to satisfy themselves that the project represented the most prudent way forward, these included:

- An extensive scrutiny of the costs and measures within the proposed NBP contract;
- An examination of alternative models and solutions that could be pursued instead of the proposed model;
- An examination of different technologies that could be used; and
- A consultation with different industry representatives seeking their views in relation to the NBP project through a number of Oireachtas committees⁴⁹.

⁴⁸ The Government Press Release announcing the Granahan McCourt consortium as the Preferred Bidder can be viewed at

<https://www.gov.ie/en/press-release/2bbf66-preferred-bidder-appointed-to-national-broadband-plan/> .

⁴⁹ An Oireachtas committee is a group of elected representatives from the Irish parliament, chosen to consider a certain subject. For more information, please see <https://www.oireachtas.ie/en/committees/about-committees/> .

Ultimately the conclusion of the Irish NBP intervention project was delayed a further 9 months throughout 2019, before this full due diligence was concluded.

3.3.5.4 The NBP Working Group and the Procurement Board

The scale, range and depth of expertise called upon for the public procurement process was commensurate with a project of national scale. To assist the Department in delivering public procurement, a robust governance and oversight framework was put in place. This was managed by an experienced team which included both national and international experts. Departmental staff and specialists seconded to the Irish NBP intervention project team from ComReg, were supported by a range of experts in the relevant fields of commercial, legal, technical, procurement, insurance, contract, and environmental expertise including Analysys Mason, PwC, Deloitte⁵⁰, Marsh Insurance⁵¹, Mason Hayes & Curran, RPS Group⁵² and KPMG. The Department's NBP working group, including specialist advisors, comprised over 100 staff working on the project at different periods and required substantial coordination and management throughout the process to bring the procurement to a successful conclusion.

In addition, as part of the oversight arrangements, a Procurement Board was established in April 2016. The primary aim of the Procurement Board was to independently review the Department's oversight of the evaluation stages of the procurement process. The membership of the Procurement Board comprised of Ciarán Ó hÓbáin Chairperson (DCCAIE); Gerard Cahillane, (Deputy Director, NTMA⁵³); Cathal O'Donoghue (Head of Rural Economy and Development Programme, Teagasc); John Doherty (former ComReg Chairperson and

⁵⁰ Deloitte is a consultancy firm who provide a range of advisory services to their clients, more information can be found at <https://www.deloitte.com/>.

⁵¹ Marsh insurance is a firm who act as an insurance broker and risk advisor, more information can be found at <https://www.marsh.com/ie/home.html>.

⁵² RPS Group are a firm who offer advisory services relating to environmental matters, more information can be found at <https://www.rpsgroup.com/>.

⁵³ The National Treasury Management Agency (NTMA), an Irish State agency who provide a range of asset and liability management services to the Irish Government.

Commissioner); Martina Moloney (former CEO, Galway County Council); David O'Sullivan (Director, Sourcing, Procurement, Office of Government Procurement); and Brian P. Keogh (Chartered Engineer, Former Board Member, John Sisk and Son Ltd and associated Companies).

3.3.6 Complying with Environmental Directives and Regulations

In accordance with the SEA Directive 2001/42/EC, and the Habitats Directive 92/43/EEC the Department screened the draft National Broadband Intervention Strategy and confirmed the need to carry out a Strategic Environmental Assessment (SEA) and an Appropriate Assessment (AA). The Department commissioned a Natura Impact Statement (NIS) as part of the AA process to ascertain if the NBP Intervention Strategy could significantly impact on any site designated for conservation. The NIS also proposed measures to mitigate any adverse impacts. As part of the SEA the Department commissioned an environmental report to assess the likely environmental impacts the Intervention Strategy is likely to have, and to propose measures to mitigate any such impacts.

The Department published these documents, along with the National Broadband Plan Intervention Strategy as part of the SEA and AA processes. A public consultation ran from 2 January 2018 to 9 February 2018.

Of particular relevance to this thesis, was the fact that the Department also took the opportunity to consult on the NBP Map, offering Service Providers yet another opportunity to comment on the NBP Map, submit any updated information they may have and to highlight any perceived inaccuracies. The Department received 26 submissions in total as part of this public consultation.

Following the consultation, the Department updated the Intervention Strategy by way of an Addendum document to ensure that environmental concerns were integrated and addressed accordingly. No changes were made to the NBP Map as a result of this public consultation.

3.3.7 The Final NBP Map Consultation

Due to the significant delays in the procurement process experienced in 2018 and 2019, one further and final public consultation was undertaken by the Irish NBP intervention project

team so as to ensure the NBP Map reflected an up-to-date status of the availability of NGA broadband services. The EU Commission expect that the final map is informed by the most up to date industry information, received close to or within 12 months of the date that the contract is awarded.

On 26 July 2019, the Department issued its final consultation on the NBP Map and, in particular, the proposed Intervention Area, 'National Broadband Plan Conclusion of the Mapping Exercise for the Intervention Area Pre Deployment' (56). The NBP Map published for this consultation included the 542,000 premises in the Intervention Area previously published as part of the NBP Map update in 2017, as well as a further 46,000 premises where, through analysis of consumer representations received by the Department and analysis of industry data indicated that NGA services may not in fact be available. The Department sought submissions from Service Providers on any existing NGA networks or any NGA networks planned over the following 7 years. This 7-year period matched the forecasted deployment period, which had been established through the final tender submissions received from the preferred bidder (the Granahan McCourt consortium). In total 185 submissions were received including significant interest shown by Service Providers across the Irish State. Seven wire line operators and 22 Fixed Wireless Access (FWA) Service Providers made submissions and one group submission was received representing 28 FWA Service Providers. Three wire line Service Providers requested specific changes to the NBP Map while all FWA Service Providers believed changes were needed. Service providers seeking to have the Intervention Area reduced downwards referred to "existing" network build that reflected private investments made by them in recent years. No Service Provider provided any substantial detail and/or supporting evidence of their "future" planned network. The Department received 155 submissions from consumers who experienced difficulties accessing NGA broadband. The Department carried out an assessment of all submissions and concluded that NGA broadband was not available to circa 60% of these submissions and therefore these premises should be added to the Intervention Area. Having taken into account the information provided in response to the consultation, after making the adjustments considered appropriate above, the Department finalised the NBP Map in November 2019.

The findings of the consultation and the ultimate outcome of the consultation were published in January 2020, 'National Broadband Plan Consultation on the Mapping Exercise for the Intervention Area Pre Deployment – Summary of findings' (57).

The NBP Map and the Intervention Area was updated to include:

- approximately 537,000 premises⁵⁴ depicting white NGA areas in Ireland;
- 1.1 million people (23% population);
- over 54,000 farms (69% of the national total of farms);
- 44,000 non-farm businesses (mostly small and micro); and
- 695 schools.

The Intervention Area was therefore considered final for the purposes of the NBP deployment over the following seven years.

3.3.8 The State Aid Approval of the Irish NBP Intervention (November 2019)

Following extensive pre-notification engagement with the EU Commission over the full duration of the project from 2013 to 2019, in October 2019, the Irish authorities formally notified the EU Commission of the Irish NBP intervention 'National Broadband Plan' and the corresponding evaluation plan.

This formal notification described in detail the different stages of the development of the plan in accordance with the EU Commission's application process requirements. The Department was supported by State Aid experts in drafting this application and further was supported by legal, economic, technical, and financial advisors in ensuring the project was described accurately.

The formal notification included:

- The legal basis for the Intervention;
- Identification of the aid, the objective and duration of the intervention;

⁵⁴ The total number of premises in the Intervention Area was projected to grow annually as new premises were built within the Intervention Area.

- A description of its compatibility with the EU State Aid Guidelines including:
 - o Why it was needed and how it addressed a market failure;
 - o How the Intervention was appropriate;
 - o How the contractor was incentivized to deliver the objective;
 - o The proportionality of the aid granted;
 - o The possible negative effects of intervening balanced against the positive effects;
 - o The transparency of the actions that would be undertaken;
- The Aid instrument, the Aid amount, and the means of funding;
- The Evaluation plan that would be undertaken; and
- The planned reporting and monitoring regime to the Commission.

In addition, ComReg submitted their formal opinion, 'Updated State Aid Guidelines Opinion from the Commission for Communications Regulation' (58), on the Intervention in the context of the EU State Aid Guidelines, where they outlined their participation in the process and how their views had been considered. This was submitted to the EU Commission to support the Irish State's notification.

A number of clarifications and queries raised by the EU Commission were addressed following the submission of the application as the various elements of the Irish NBP intervention plan was scrutinized. Formal State Aid Approval was finally granted by DG Competition on 15th November 2019, 'State Aid Decision NBP Intervention' (59).

3.3.9 The Award of the NBP Contract (November 2019)

Once formal State Aid Approval had been granted by the EU Commission, the Department engaged the preferred bidder, the Granahan McCourt consortium.

What might be surprising are the steps that were required in advance of awarding the contract. In summary, the final tender was received and evaluated; the NBP Map was finalised; the EU Commission granted State Aid Approval; the contract was then concluded based of some revisions to the final tender to reflect changes to the map post tender; and it was at this point that the preferred bidder was asked to confirm they were still willing to

enter into a contract. These steps required careful management as the bidder, in particular, would have been aware that that NBP Map was likely to change after they have submitted their bid. Thankfully the consortium confirmed they were still willing to enter into a contract for the updated Intervention Area that was identified through the Final NBP Map consultation and honour the commitments set out in their final tender submission.

The Irish Government approved the contract award and the then Minister for Communications, Minister Bruton, entered into a contract on this basis with National Broadband Ireland in November 2019⁵⁵, the company established by the Granahan McCourt consortium to deliver the contract.



Figure 3.11 Minister for Communications Richard Bruton, An Taoiseach Leo Varadkar and David McCourt signing the NBP Contract in November 2019 at St. Kevin's National school Laragh County Wicklow.

⁵⁵ The Government Press Office Press release: Government Signs Contract for National Broadband Plan <https://www.gov.ie/en/press-release/e15062-high-speed-broadband-for-11m-people-in-homes-schools-businesses-acro/> .

This contract award marked a significant milestone in the realization of Ireland's National Broadband Plan. Speaking at the contract signing event in St Kevin's National School, Ballard in Wicklow, the then Irish Prime Minister, an Taoiseach, Leo Varadkar said:

"Some people try to divide our country - urban v rural, east coast v west coast, Dublin v the rest of the country. The Government is all about bringing Ireland closer together, ensuring that all parts of the country benefit from our prosperity. That requires investment in roads, broadband, higher education and enterprise and it's happening.

"This contract means that every home, school, farm and business in Ireland will get access to high speed broadband. No part of the country will be left behind in securing the jobs and opportunities of the future. And as we know, the future is already here in our daily lives with online access offering ever more opportunities for living and working.

Broadband will be the biggest investment in Rural Ireland ever. We can have more people working from home, a better work-life balance, fewer car journeys, and fewer greenhouse gas emissions. We can connect better with the world, with family members, with business, with new ideas and new ways of doing things. Every school in the country, like this one I'm standing in today, will be able to access digital technologies for teaching, while healthcare professionals can check in and monitor patients remotely no matter where they are based."

Signing the contract, Minister Bruton said:

"Today is a historic day for rural Ireland. By guaranteeing high speed broadband for every home, business and farm in the country, we are ensuring no one is left behind. This will have a transformative impact on rural Ireland, opening up opportunities in enterprise, health, smart farming to name a few – high speed broadband is increasingly becoming a vital utility and today the government is securing access for every person in the country.

Without high speed broadband it will be significantly more difficult to attract new jobs to rural areas and develop new enterprise opportunities and it will be more difficult to retain the jobs that currently exist in these areas. With high speed broadband, we can ensure that people in rural Ireland are able to take advantage of the opportunities that are presented by the digital economy, from health care to farming, and from education to agriculture, rural development and tourism. We will not leave rural Ireland and one quarter of our country behind. "

This signing formally contracted the deployment of high-speed broadband to over 1.1 million people living and working in the target intervention area by 2027. The scale and challenge of the Irish NBP intervention project was likened to the rural electrification project undertaken in Ireland from the 1940s to the 1970s⁵⁶.

The signing of the NBP Contract signaled the conclusion of the Irish NBP intervention project, i.e., the Irish authorities' project to satisfy the SAG guidelines and gain formal approval from the EU Commission for the intervention. This end-to-end process took over eight years to complete and bring to this milestone. Only at this point could the actual deployment of new broadband services begin.

3.4 Significant Observations from the Analysis of how the Irish NBP intervention satisfied the SAG

The detailing of the process involved in the Irish intervention serves two purposes. In the first instance it serves as a historical record of the process, and secondly affords an opportunity to stand back, reflect, and make observations.

In tracing the story, three main observations emerge. Firstly, it is possible to observe distinct phases of the process which, from a planning perspective, can be useful for those designing future interventions. Secondly, what becomes apparent is that several versions of the online map are needed in practice to successfully implement an intervention process. Again, this is extremely useful to understand from a planning and resourcing perspective. Thirdly, the level of reliance on the online map at each phase of the project can be observed.

Understanding how central the online map is to each phase of the intervention process and for what purpose can also be very useful for future projects planning. The following sections go into these observations in some detail.

⁵⁶ How the Electricity Supply Board electrified Ireland -

<https://esbarchives.ie/2020/06/09/electrifying-ireland-how-esb-connected-one-million-irish-homes-to-the-national-grid-1929-1978/> .

3.4.1 Observation 1 - Four distinct phases of the Intervention Process can be seen

Our first observation relates to the overall process for designing a State intervention i.e. the Intervention Process. Four distinct phases can be identified from analyzing the Irish process, these are (1) the development of an overall state policy, (2) the development of an Intervention Strategy, (3) the public procurement and (4) the finalization of the contract and State Aid Approval. These four phases stand out now, but they weren't as obvious or clearly defined during the Irish NBP project implementation, as the project developed so iteratively. On reflection if these phases and their outputs were known more clearly from the outset, a more realistic plan could have been designed, resources allocated more effectively and ultimately a more efficient project may have been implemented. Each of these phases is now taken in turn, to elaborate on their purpose and explain the outputs which must be achieved at each phase.

The Intervention Process Phase 1 – The Development of an Overall State Policy.

Development of an overall State Policy position, which sets out the State's ambition for broadband availability for its citizens. This is commonly referred to as a 'broadband plan' or the 'State Policy for broadband'. This phase sets out the ambition that the State is committing to achieve both through commercial investment and through State intervention where necessary.

This State Policy will consider the EU digital targets as well as the State's own specific requirements and circumstances. This State Policy will then trigger measures to encourage commercial investment where feasible and also set a mandate for the development of a State's intervention.

The key output from phase one is a policy statement or broadband plan which is endorsed by the National Government. This policy statement sets out the objectives of the State's ambition for broadband availability for its citizens, including the main characteristics that will apply. For example, the policy statement should set out:

- the **quality of broadband** and what broadband speeds should be available, e.g. whether a 30Mbps or a 100Mbps or higher broadband service should be made available;
- whether these broadband speeds should be made **available to all premises or just a percentage** of the premises in the State, for example the policy might say that NGA broadband services should be made available to 98% of premises across the State rather than 100% of premises;
- **how upgradable the broadband service** should be to meet longer-term requirements (e.g., within the next 10-20 years);
- **a date** by which the target broadband service is made available; and
- the level of **Government commitment** to intervene in the market with subsidy where necessary.

Intervention Process Phase 2 - Development of an Intervention Strategy.

This phase focuses on the development of a strategy to address those areas where commercial operators cannot or will not serve. This strategy considers many factors, for example: how the State will intervene (the proposed operating and business model, the ownership structures, the financial structures etc.), to what extent (backhaul, access, core network, performance level, future requirements etc.), the scope of the intervention (i.e. the Intervention Area), the formal process under which a public procurement will be conducted and sets out the principles under which the State subsidized entity (that is eventually awarded the contract following a public procurement) will be required to deliver and operate the State subsidized network etc.

The output from phase 2 is Government approval for a number of key strategic decisions that must be made when designing a State intervention. These strategic decisions must be approved and, in some cases, committed to by the National Government so that the next phase, the public procurement, can be initiated. The strategic decisions include defining:

- the **operating and business model** of the subsidized network. For example, whether the network will be operated as a wholesale network only or will retail services also be allowed? How will the new network's broadband services be sold to the industry

and/or directly to end users? What level of pricing should apply to these services and how should the prices be set? What obligations will apply to vertically integrated Service Providers if they were selected as the contractor to deploy the services? Whether the operation of the network should be separated from the deployment of the network? What level of commercial risk will reside with the subsidized entity versus the State in the new business? The key principles under which the subsidized entity will be required to deliver and operate the State subsidized network. Etc.;

- the **ownership structures** of the subsidized network. For example, whether the State will retain ownership of any new network infrastructure deployed, or will the ownership sit with the subsidized entity that is selected through a public procurement process? Should a public private partnership or joint venture structure be established? Etc.;
- the **financial structures** of the subsidized network. For example, the level of exchequer funding that will be granted. Whether Government-backed bank loans and bonds (guarantees) will be applied? How revenues gained from the subsidized network will be treated i.e., whether or not the connection fees and the monthly fees to access the service will be reinvested in the subsidized network to fund the deployment and operation of the network or whether they will be returned to the exchequer. What equity and debt raised on the financial markets (corporate financing), as well as equity and debt contributed by the partners in a joint venture (project finance) can be applied? Whether other forms of funding can be applied from end users or local community groups/associations? Subject to the ownership structure that is chosen whether profit share or claw back provisions should apply if the subsidized network generates higher than anticipated profits i.e., so that the State recovers some of its subsidy from these profits?;
- the **scope of the intervention**. Including the list of geographical areas that will likely be included and their location. Deciding on what parts of the network the intervention will target. For example, will the intervention target backhaul infrastructure only, local access/last mile infrastructure only, the core network infrastructure, or will active and passive infrastructure be included? Etc.; and

- the formal **public procurement procedure** that will be followed for the goods and services that are needed to deliver the State's Intervention. How the procurement process will be structured e.g., will there be multiple procurement lots suitable for smaller companies or one large lot which will be more suitable for larger companies? The term or duration of the contract(s) that will be awarded? How the selection criteria will be weighted e.g., will more points be awarded in the procurement evaluation for lower costs or higher quality? How other specific State Aid requirements will be satisfied through the procurement process e.g., how technological neutrality will apply, how the re-use of existing infrastructure will be required where appropriate in bidders' solutions, the wholesale access and pricing conditions that will apply. Etc.

This phase also determines whether the State's Intervention requires State Aid Approval or not. As mentioned in Chapter 2, and as illustrated in Figure 2.1, certain types of interventions do not need State Aid Approval and are exempted. These are as follows:

- interventions that are delivering a Service of General Economic Interest (SGEI) are not required to seek State Aid Approval. These are interventions being deployed for non-commercial purposes where no economic benefit accrues to the State Aid beneficiary. Section 2.3 of the SAG outline how these interventions should be treated, 'Section 2.3 State aid for broadband deployment as a service of general economic interest';
- interventions where the amount of subsidy being awarded is considered so low, 'de minimis', that it cannot affect competition. This is typically under €300,000 subsidy over a 3-year period. These interventions are not required to seek State Aid Approval; and
- interventions that qualify for exemption are not required to seek State Aid Approval. The General Block Exemption Regulation (60) (GBER) allows Member States to bring certain state aid schemes into place without prior notification to the EU Commission, provided that they are within the parameters set out. Amongst other requirements these are interventions where less than 100million euros aid is to be funded.

All other State interventions require State Aid Approval from the EU Commission.

The second phase also needs to fulfill any national requirements for approving the investment of public expenditure. Governments will require that the best possible value for money is obtained whenever public money is being spent or invested. An estimate of the likely cost to the State will be needed at this phase. A cost versus benefit analysis (a 'CBA') will need to be conducted to determine whether the proposed investment is likely to lead to material benefits. The level of risk being undertaken by the State will need to be assessed. Etc.

Intervention Process Phase 3 – The Public Procurement.

The public procurement exercise to select a contractor to implement the State's intervention involves the development of contractual requirements and then conducting a formal public procurement process to engage the market and to select a company(s) to deliver these requirements. The key output from the third phase is the selection of an appropriately competent entity (referred to as a 'preferred bidder(s)') to deliver the proposed State intervention i.e., a company capable of deploying and operating the new broadband service to the premises within the Intervention Area.

Once the Intervention Strategy is published and the key strategic decisions approved by the relevant competent authority, (this is typically the Government for projects of significant national scale) then the public procurement can be initiated by the State. To arrive at a preferred bidder(s) the procurement itself will typically involve:

- the development of the formal procurement procedures that will apply;
- the prequalification of suitable bidding parties i.e., usually a short list of qualified bidders;
- the development of detailed requirements from the principles and strategies set out in the intervention strategy;
- a process of dialogue with the qualified bidders to explain what is required and address any questions;
- an invitation to submit tenders at different stages. There may be several draft tenders submitted before the best and final tender proposal is submitted;

- tender evaluations at different stages of the procedure; and
- ultimately the selection of the preferred bidder(s) in the procurement process.

Substantial expert advice allied with significant procurement expertise is required throughout this third phase. The development of the procurement procedures, the intervention requirements, the dialogue with bidders, and the evaluation of tenders and selection of the preferred bidder is a complex and time-consuming exercise. The scale and potential cost of the Intervention required will significantly influence the complexity and likely duration of the public procurement. Interventions of a large-scale covering hundreds of thousands of premises will typically require very detailed and complex public procurement procedures to select a preferred bidder. The public procurement is therefore likely to take at least 12 months but more likely to take at least 2 to 3 years to conclude.

Intervention Process Phase 4 - Finalization of the contract and State Aid Approval.

The fourth phase involves finalizing the contract(s) with the company(s) who have been successfully selected through the public procurement process. It also involves seeking State Aid Approval for the intervention and then awarding the contract(s) once State Aid Approval is granted.

The output of the fourth phase is the State Aid Approval of the intervention by the EU Commission and the signing of contracts with the company(s) who have been successfully selected through the public procurement process i.e., the preferred bidder(s).

To gain State Aid Approval from the EU Commission, the full details of the intervention must be set out through a formal notification process to the EU Commission. The notification sets out the details of how the intervention adheres to the SAG including the process by which the Intervention Area was determined. Any observations or findings from the EU's review of the process conducted or the intervention proposed must be addressed by the State prior to the intervention being granted State Aid Approval. This may involve, for example, revising the terms of final contract with the preferred bidder or extending the reporting

requirements to the EU of the impacts of the Intervention once it is implemented. State Aid Approval is granted by the EU Commission if all issues are addressed to their satisfaction.

Once State Aid Approval is granted by the EU Commission, the contract award and contract finalization process can then be concluded with the preferred bidder(s). A further engagement is required with the preferred bidder(s) to establish whether they are still willing to enter a contract for the most up to date Intervention Area (as the Intervention Area may have been updated since the date of submission of their final tender) while still committing to deliver the obligations set out in their tender submission as part of the procurement process. A revised deployment plan must then be developed, to address any changes in the latest Intervention Area.

The State must also consider whether they are still willing to award the contract, examining indicators such as the updated cost benefit analysis and whether any new risks to the State have been introduced by this final update.

Taking all aspects under consideration, approval from the relevant competent authority, (again this is typically the Government for projects of significant national scale), is then needed to enter into a contract for the State intervention with the preferred bidder.

If the decision from all parties is to proceed then the contract is awarded, if not, then the State will need to reconsider its overall policy and Intervention Strategy and potentially restart the Intervention Process at an earlier phase.

The four phases of the intervention process.

In summary, through the close examination and detailed analysis of the Irish NBP intervention project we have discovered that four distinct phases were needed in Ireland to design the NBP Intervention and successfully gain State Aid Approval. Grouping the NBP intervention project activities together logically in this manner and then defining the purpose of each of these four phases results in the creation of a simple end to end view of what is required to meet the SAG obligation when designing a State intervention. Having

this simple end to end view, which is designed based on the activities and approach undertaken in Ireland as part of the Irish NBP intervention project will help others unlock the complexity of the SAG for future projects.

While intervention projects from different EU Member States are unlikely to be identical, it is likely that a similar variant of these phases will be required when designing an intervention to achieve State Aid Approval. Other EU Member States are likely of course to adopt a refined process so as to suit their local circumstance and priorities. They may find that more or less in-depth activities are needed in their particular jurisdictions, than what was implemented and needed in Ireland. However, having the intervention process undertaken in Ireland clearly defined provides EU Member States with a strong reference including a clear understanding of the end-to-end process that is required i.e., the material that was lacking when the Irish authorities initiated the Irish NBP intervention project. This will undoubtedly be of huge benefit to these future projects.

3.4.2 Observation 2 – Several different versions of the online map are needed

We now move to the second observation. Through Digging a bit deeper into the Intervention Process we can now unravel how the Mapping Process is used within each of these four phases. As shown repeatedly throughout this thesis, the Mapping Process is a hidden complexity when designing an intervention.

The Mapping Process and publication of an online map is often misconstrued as a ‘once off exercise’ which must be conducted once as part of the process to achieve State Aid Approval. This is not surprising since Paragraph 78 (a) of the SAG essentially describes this as a single activity with no hint of multiple versions of the online map being required. For convenience, please see Paragraph 78 (a) set out again below:

‘78 (a) Detailed mapping and analysis of coverage: Member States should clearly identify which geographic areas will be covered by the support measure in question (92), whenever possible in cooperation with the competent national bodies. The consultation of the NRA is encouraged but optional. Best practice examples suggest creation of a central database of the available infrastructure at a national level thereby increasing transparency and reducing the costs for the implementation of smaller, local projects. Member States have the freedom

to define the target areas, however, they are encouraged to take into account economic conditions in the definition of relevant regions before launching the tender (93). ‘

An analysis of the Irish process shows that this is not the case. Several different versions of the online map were in fact required at different phases of the Irish NBP intervention project.

A detailed examination of the NBP Mapping Process reveals that at least three versions of the online map were needed. As will be explained below, the accuracy of the online map is continuously refined and updated. This is a critical dependency that is hidden and persists throughout the design of a State intervention; this critical dependency cannot be derived from just a theoretical or desk top analysis of the SAG.

The first version of the online map - the ‘Draft Online Map’.

The research undertaken as part of this thesis reveals that the first online map that needs to be created is the ‘Draft Online Map’. This map must be published as part of a public consultation, where Service Providers and consumers must be asked to correct any inaccuracies that they can identify.

An initial market engagement is needed to develop the Draft Online Map. This involves asking Service Providers for details of their networks at a high level and then developing an approximate view of where NGA broadband services exists and where they do not.

The public consultation on the Draft Online Map must request Service Providers to submit more specific details of their networks and also to submit any plans they have to deploy new or improved broadband services in the near term; particularly where the Draft Online Map does not show NGA broadband services already in the area of their existing NGA broadband coverage or in the target area for their planned NGA broadband network. Along with their submission Service Providers are asked to outline the changes to the Draft Online Map which they believe are needed.

Submissions by Service Providers requesting a change to the Draft Online Map based on their existing or planned network are referred to as ‘claims’. These claims must be

considered in turn to ascertain whether they are true and/or whether in fact they represent credible and concrete plans to deploy an NGA network in the near future. Where validated and accepted, the appropriate changes must then be reflected on the next update to the map.

Consumers are also be invited to make submissions to the public consultation on the Draft Online Map, particularly to highlight inaccuracies on the Draft Online Map. For example, consumers may highlight locations or premises where the Draft Online Map indicates NGA services are available, but in fact, as validated through their own experience of trying to order broadband services, Service Providers are not delivering NGA services.

Submissions by all stakeholders to the public consultation must then be considered and updates must be made, where appropriate. Typically, some corrections will be needed to be made to the Draft Online Map once formal submissions are received from Service Providers and consumers as part of this first public consultation. The Draft Online Map must therefore be updated and be republished after the conclusion of this first public consultation.

The second version of the online map - the 'Procurement Online Map'.

The research reveals that the second version of the online map is the 'Procurement Online Map'. Having considered the submissions from Service Providers as part of the first public consultation, the Draft Online Map must then be updated as appropriate. This new version of the map is the 'Procurement Online Map'. This Procurement Online Map is used to define the Intervention Area throughout the State's public procurement exercise (i.e., this outlines the scope of the procurement, and it allows tenderers to identify the premises which must be addressed if they were to be awarded the contract).

The Procurement Online Map needs to rely on the most up to date information available from Service Providers at the initiation of the State's public procurement process to select a contractor to address the broadband deficit identified. Therefore, there must not be any undue delay between the conclusion of the first public consultation and the initiation of the State's public procurement process.

This Procurement Online Map is used throughout the State's public procurement process to describe the scope to tenderers of the areas where NGA broadband services are needed.

A State's public procurement process will typically require a considerable time to implement, at least 12 months, but for large scale interventions more realistically 2 to 3 years. The Mapping Process and the rules set out for the State's public procurement process must allow for updates to be incorporated to the Procurement Online Map and Intervention Area over this period. These updates may be necessary, for example, if a new commercial investment to deliver NGA broadband services was initiated while the State's public procurement process is still running.

This process of keeping the Procurement Online Map up to date may involve permitting Service Providers to submit new claims or requests for further changes to the Procurement Online Map periodically or on an on-going basis. In addition, the procurement process itself must be designed in a manner to cater for these changes i.e., allow for changes to the intervention area scope while still conducting the procurement exercise. A map can impact the procurement process to differing degrees. For example: individual and small clusters of premises being added\removed may not have any significant impact on prospective bidders or their solutions or their business plan whereas in contrast, a map change similar in scale to the one introduced in 2017 when eir's rural deployment of high speed broadband to over 300k premises was accepted, fundamentally changed the approach bidders would need to adopt for their network build and change their business plan considerably. The risk of scope change introduces a significant level of uncertainty for bidders who are incurring considerable costs as participants in the public procurement process, the process requires careful thought, must be set out up front in the procurement and then requires close management if it does occur.

The third version of the online map - the 'Final Online Map'.

The research reveals that the third version of the online map is the 'Final Online Map'. If the period since the last mapping consultation is more than 12 months, a final public

consultation must be undertaken once the State's public procurement process has been finalised and prior to applying for State Aid Approval and awarding the contract. This is highly likely for any public procurement of national scale. The output of this last public consultation is the 'Final Online Map'.

As explained earlier in this Chapter, Paragraph 63 of the SAG requires the EU Member State to establish '*whether private investors have concrete plans to roll out their own infrastructure in the near future*', whereby the term 'near future' typically means 3 years. However, where the anticipated duration of the deployment is longer than 3 years then this longer period must be used.

The forecast duration of the actual deployment for the NBP contract was 7 years. This duration only became known once bidders had confirmed their deployment proposals through the public procurement process. Therefore, the time horizon in the NBP Mapping Process had to be readjusted to match this more accurate deployment forecast. The principle of matching the time horizon of the Mapping Process with the forecasted duration of the deployment, ensures that the Mapping Process accurately assesses the existence of any Service Provider investment plans over that period and does not inadvertently lead to the intervention displacing commercial investment plans over this period.

This Final Online Map must rely on the most up to date information available from Service Providers at the time of contract award and must now assess investment plans over the forecasted duration of the deployment which has been confirmed through the public procurement process.

This Final Online Map is used to describe the scope of the Intervention Area in both the contract between the State and the tenderer(s) successful in the State's public procurement (referred to herein as the 'Intervention Contract') and the final notification of the intervention to the EU Commission when applying for State Aid Approval.

3.4.3 Observation 3 – There is a huge reliance on the Mapping Process

Finally, we move to the third observation. The reliance on the Mapping Process, how central it is to the overall Intervention Process and what is required from the Mapping Process throughout, is not identifiable from reviewing the SAG. It is a hidden dependency with a high level of complexity that typically only emerges as the Intervention Process is progressed. This thesis addresses this deficit by clearly identifying the reliance on the Mapping Process within the Intervention Process as a whole. The different versions of the online map in the Irish NBP intervention project have now been identified and the rationale for producing each of the online maps is explained. This section now considers each phase within the Intervention Process and outlines the level of dependency on the Mapping Process for each of these phases.

Producing any version of the online map is a lengthy exercise taking several months and up to 18 months to complete. For example, as there was no national mapping database already developed, the Draft Online Map for the Irish NBP intervention project took approximately 18 months to produce, whereas the Final Online Map for the Irish NBP intervention project took approximately 6 months. Therefore, it is critical when planning a State intervention to understand where and when the different versions of the online map will be used within your project so that adequate pre-planning, resources, and preparations can be put in place.

The identification that three versions of the online map are required within the Intervention Process is a significant step forward in this regard. To complement this finding, identifying how reliant each of the online maps are to each phase of the intervention process and for what purpose must also be fully understood.

Reliance of Phase 1 on the Mapping Process.

An analysis of the Irish NBP intervention project shows that during phase 1 of the Intervention Process, a broad and general understanding of the availability of broadband services is needed when considering the development of the State's broadband policy.

This policy development will not typically rely on a granular level of detail; however, it is important for the State to be cognisant of the scale of the challenge and the level of digital divide that exists at a national level. The State will seek to set target dates by which certain broadband speeds should be available; however, this cannot be done without knowledge of the level of broadband services that already exists.

The policy may also commit the Government to invest in those areas where commercial operators will not invest; again, the scale of the State's ambition will need to be informed with real information which is produced as part of the Mapping Process. Therefore, while there is no requirement to produce an online map in phase 1, the information gathered as part of the Mapping Process is clearly needed to shape the State's broadband policy.

However, policy makers would likely lose confidence in the process, if it turned out that scope of the project they had approved in principle and formed a national policy against during this phase, subsequently changed substantially at a later date. This speaks to the reliance on a broadly accurate map even in Phase 1. The research therefore concludes that even though there is no online map produced in phase 1, the reliance on the Mapping Process information during phase 1 is high.

Reliance of Phase 2 on the Mapping Process.

The Draft Online Map must be produced as part of phase 2. During phase 2 the findings of the Mapping Process is a key factor influencing the development of the intervention strategy. Phase 2 - the intervention strategy development, therefore, relies heavily on the Mapping Process as the scale and geographical spread of the Intervention Area is a critical input in determining the best intervention approach; this information is used consistently to inform key strategic decisions on the nature of the intervention and the design of the public procurement process that follows. The research therefore concludes that the reliance on the Mapping Process and in particular the Draft Online Map during phase 2 is high.

Reliance of Phase 3 on the Mapping Process.

The Mapping Process is fundamental to phase 3, as the Procurement Online Map is used to confirm the scope of the Intervention Area throughout the procurement. The Procurement

Online Map defines the Intervention Area at the start of the procurement. In addition, the Intervention Area must be maintained and updated throughout the procurement to cater for any changes to the Intervention Area that may be necessary. The research therefore concludes that the reliance on the Mapping Process and in particular the Procurement Online Map in phase 3 is high.

Reliance of Phase 4 on the Mapping Process

The Final Online Map must be produced as part of phase 4. The Mapping Process and the Final Online Map is central to the finalization of the contract where the scope is re-confirmed, and State Aid Approval is sought for the intervention from the EU Commission. The review conducted by the EU Commission examines a number of factors relevant to the intervention. The Final Online Map confirms an agreed Intervention Area which then forms part of the contract that is awarded to the winning bidder from the public procurement. The review undertaken by the EU Commission before granting approval examines the Mapping Process in detail to ensure the process complied with the SAG. The research therefore concludes that the reliance on the Mapping Process and in particular the Final Online Map in phase 4 is high.

Phase 1	Phase 2	Phase 3	Phase 4
Development of an overall State Policy on the availability of broadband for its citizens.	Development of an intervention Strategy	Conduct a Public Procurement to implement the intervention	Finalisation of the contract and State Aid Approval.
<u>Mapping Process reliance is high.</u> During this phase the Mapping Process plays a central role. A broad and general understanding of the availability of services is considered in the development of the State's policy.	<u>Mapping Process reliance is high.</u> During this phase the Mapping Process is one of a number the factors which is considered in the development of a suitable intervention strategy.	<u>Mapping Process reliance is high.</u> The Mapping Process is fundamental to the procurement phase as a confirmed scope is needed to implement the procurement. - An Intervention Area must be identified through the Mapping Process at the start of the procurement. - The Intervention Area must also be maintained and updated throughout the procurement phase	<u>Mapping Process reliance is high.</u> The Mapping Process is central to the finalization of the contract where the scope is re-confirmed, and State Aid Approval is sought for the intervention from the EU Commission. The State Aid review conducted by the EU Commission examines a number of factors relevant to the intervention measure, including an in-depth examination of the Mapping Process conducted.
No online map is used. Network information gathered as part of the Mapping Process is used.	The Draft Online Map is used as the main reference.	The Procurement Online Map is used as the main reference.	The Final Online Map is used as the main reference.

Table 3.4 Summary of the level of reliance on the Mapping Process when designing a State intervention

Table 3.4 summarises the reliance on the Mapping Process at each phase of the intervention process and confirms that the Mapping Process is a critical dependency at each phase.

3.5 Conclusion

Gaining State Aid Approval for a State intervention is conceptually straight forward i.e., that the EU Commission will weigh up the anticipated positive impacts of any proposed

intervention against the potential negative impacts when deciding on whether the Measure is compatible with the EU's State Aid rules or not. They weigh this up in the context of the impact on the competitive market for broadband or wider connectivity services or wider telecommunication services in general. However, what is not obvious is that in practice the activities required to meet the obligations set out in the SAG and ultimately design a State intervention which is compatible with EU rules, are very complex, multifaceted, and typically take several years to complete.

As discussed earlier, Chapter 3 outlines an end-to-end historical record of the Irish NBP intervention project. The value in recoding this is to inform future projects of all the steps that were undertaken in Ireland so that they may better understand what is needed and take this into account when planning their own projects.

Complementing this record are three observations; the first relating to how the intervention process can be considered as four distinct phases; the second that at least three versions of the online map are required and the third observation, which concludes that the mapping process is a central dependency running through the entire intervention process. Each of these observations can greatly inform future projects and assist them in ensuring they design their projects to effectively sequence and deliver each of the activities required.

These observations when taken together lead us to the conclusion that a deeper understanding is needed on how to create the online map. If the creation of an online map can be streamlined, then the whole process is likely to be streamlined. Therefore, in Chapter 4, I now turn my attention to this question and unraveling the complexity of creating an online map.

Chapter 4

Development of the Online Map

4.1 Introduction

As was shown at the end of Chapter 3, the online map is a critical and central dependency in the intervention process. So now this Chapter aims to bring a deeper understanding of what was done in Ireland to create an online map but to aid them in improving the process for their own projects.

Section 4.2 summarizes the steps undertaken to develop the NBP Map. I have already highlighted in section 3.3.3 that great efforts were made in the development of the NBP Map leading to its first publication in November 2014. The description in section 3.3.3 is a very simple outline, (2 pages in length), of the project milestone achieved in the Irish NBP intervention process but does not delve any deeper into how the online map was developed. Section 4.2 now traces the development of the online map in detail. Once its development has been fully traced, section 4.2.7 describes the output of this work, the NBP Mapping Assessment Framework itself that was published in October 2015. A framework which will undoubtedly inform future projects undertaking a mapping process.

Further to this, section 4.3, crucially re-examines and analyses all the material produced in the development of the NBP Mapping Assessment Framework. It considers both published and unpublished project documents and then reorganizes and recasts the NBP Mapping Assessment Framework in a format that can inform future projects more comprehensively. The recast framework, created as part of this research, is presented using logical flowcharts, accompanied by detailed explanations of each step. The recast framework is outlined in Appendix 3, as it is quite voluminous and would make the main body of the thesis difficult to read, it is, however, a main contribution of the research.

Lastly, section 4.4 outlines seven different insights which emerge from this deep analysis of the NBP Mapping Assessment Framework. These insights are written with the intent that the less technical reader can easily interpret them, without having to go through the granular detail outlined in section 4.3 and in particular Appendix 3.

4.2 The Creation of the Online Map in the Irish NBP Intervention

The online map is created through determining the areas in which next generation broadband service either exists or will come into existence through commercial investment, so that all remaining areas can be deemed as areas warranting State intervention. As might be expected the process of creating an online map therefore requires a significant amount of information from those currently providing broadband services in the country. For fairness and transparency purposes existing Service Providers and potential providers of broadband services need the opportunity to comment on the process for creating the online map. There is an onus on the Department to keep people informed. The Department uses different formal instruments to elicit relevant information and carry out consultations. Over the next number of sections, the different stages of the process for creating the online map are pieced together.

4.2.1 The Request for information (2013)

Although the full complexity and breadth of the Mapping Process was hidden at the outset of the Irish NBP intervention project, it was clear, even at the initiation of the project that a structured approach would be needed and that eliciting network information from Service Providers for the purposes of mapping would require strong engagement over some time.

The Department's NBP Steering Group, held in early 2013, records the forecasted timeline and the sequence of activities that were anticipated at that time in order to publish an online map. These are the timelines and activities set out in Figure 4.1 below. As can be seen from this figure, the expected timeline for creating the online map was approximately 7 months.

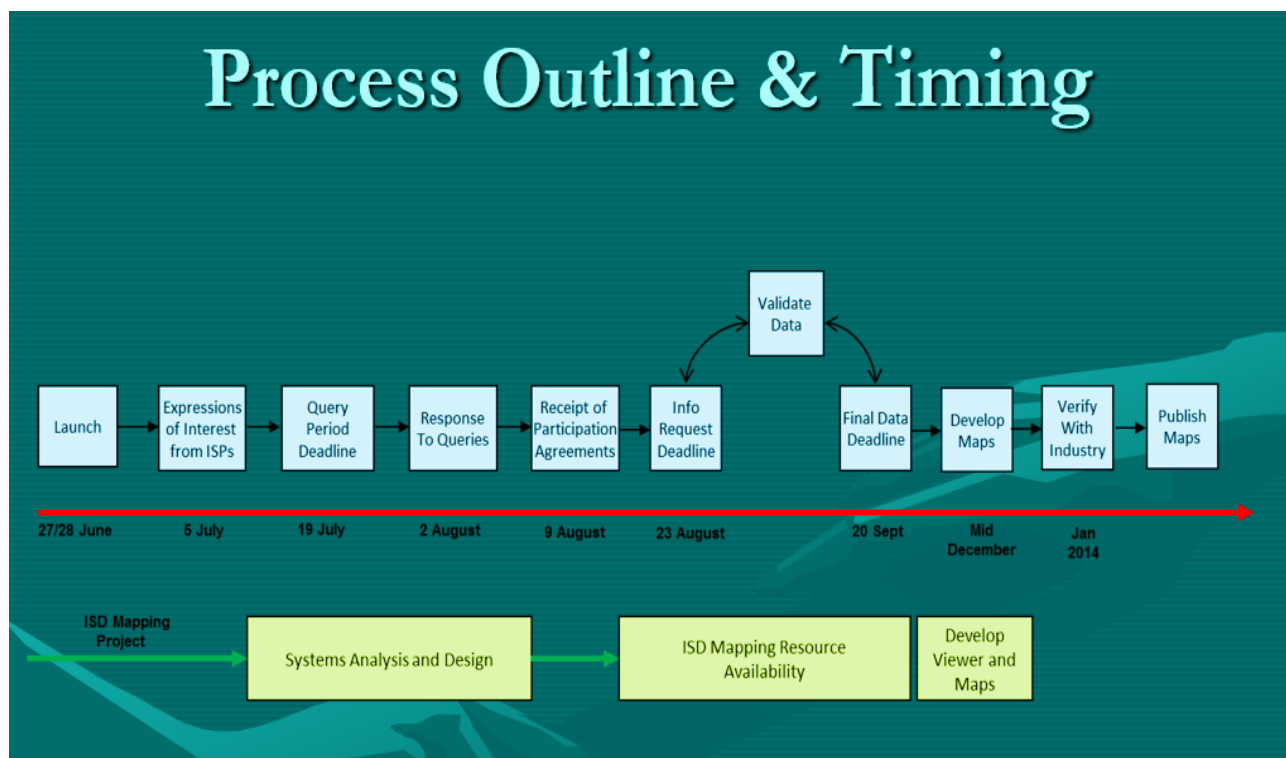


Figure 4.1 – Target timeline of 7 months and the process for the development of the NBP Map (Source DCENR).

The plan designed anticipated two main streams of work. The first stream of work envisaged a single public consultation with Service Providers⁵⁷ which would result in the publication of the online map. This engagement aimed to ensure Service Providers were well informed of the process, that they were offered every opportunity to participate and most importantly, encouraged to confirm their network coverage for the purposes of the mapping exercise.

This stream included:

- a) a proactive communications campaign and detailed engagement with Service Providers including:
 - issuing a letter to all Service Providers to inform them of the project and to encourage participation;
 - issuing a similar letter to representative industry bodies;

⁵⁷ The Request for Information consultation is referenced as an information request to Service Providers in Figure 4.1.

- publishing a notice in main newspapers accompanied by a press release by the Minister for Communications;
 - publishing a notice and copies of all documentation on the Department's website;
 - offering all Service Providers, the opportunity of bilateral meetings with Department officials; and
- b) formalizing the engagement with Service Providers, including:
- requesting Service Providers to submit a formal expression of interest;
 - requiring a formal Participation Agreement to be signed, (addressing issues such as, confidentiality, a commitment to respond to the Information Request and a commitment to meet the deadlines set out); and
- c) gathering and validating network information through the following activities:
- requesting Service Providers to respond to an 'Information Request' seeking data about their network infrastructure;
 - validating the Service Provider information;
 - Approving the information to be included in the Mapping Database.

The second stream of work involved the development of the NBP Map website, the information technology (IT) infrastructure needed to host the NBP Map, the design of the 'look' and 'feel' of the NBP Map interface for users etc. This stream included:

- securing the relevant IT and Geographic information systems (GIS) specialists for the design, development, and implementation of the NBP Map from the Department's internal IT unit;
- the development of a database to hold the relevant Service Provider information;
- the development of a map viewer interface; and
- the design of the core NBP Map functionality, for example:
 - layers to show coverage by Service Provider;
 - layers to show coverage by technology platform;
 - functionality to aggregate coverage by increments i.e., by Service Provider and technology platform; and

- Developing a “Zoomable” functionality to identify coverage at a premises level.

While the plan was approved by the NBP Steering Group, this did not lead to an immediate issuing of the ‘information request’ to Service Providers. The next issue encountered by the team was to accurately identify a full list of Service Providers operating and providing services in the State. Although Service Providers were required to register as an authorised undertaking⁵⁸ with Irish regulator, ComReg, this register proved to be quite dated and inaccurate with many companies either ceased trading altogether or who’s contact details were incorrect. A significant amount of work was undertaken by the NBP team to address this problem, for example, registered letters had to be sent to many company directors to establish whether they were still trading and to provide appropriate contact details.

Having eventually overcome this issue the Irish NBP intervention project issued an ‘Information Request’ (61)⁵⁹ ⁶⁰to all Service Providers (approximately 100 providers), in the State in June 2013 (i.e., the first mapping consultation). This required Service Providers to submit details of their fixed and wireless NGA broadband services and to outline any plans they may have to deploy NGA broadband services by 2016.

The request used the SAG as the main reference to define ‘NGA broadband’. Paragraphs 57 and 58 of the SAG in particular were quoted. Paragraph 57 of the SAG states:

⁵⁸ An authorised undertaking is the term used by ComReg to refer to companies who have registered with them, undertaking to provide an electronic communications network or an electronic communications service and which has been registered in accordance with Regulation 4 of the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011.

⁵⁹ The name chosen simply reflected the purpose of the exercise, it requested information from Service Providers.

⁶⁰ As set out in the request for information, operators were requested to provide: basic broadband coverage information (network infrastructure, coverage, capacity); NGA coverage information (network infrastructure, coverage both current and planned, capacity); and to express their opinion on the proposed definition of NGA networks.

'(57) At the current stage of market and technological development ⁽⁶⁹⁾, NGA networks are access networks which rely wholly or partly on optical elements ⁽⁷⁰⁾ and which are capable of delivering broadband access services with enhanced characteristics as compared to existing basic broadband networks ⁽⁷¹⁾ '.

Paragraph 58 of the SAG states:

'(58) NGA networks are understood to have at least the following characteristics:

- (i) deliver services reliably at a very high speed per subscriber through optical (or equivalent technology) backhaul sufficiently close to user premises to guarantee the actual delivery of the very high speed;*
- (ii) support a variety of advanced digital services including converged all-IP services; and*
- (iii) have substantially higher upload speeds (compared to basic broadband networks).*

At the current stage of market and technological development, NGA networks are:

- (1) fibre-based access networks (FTTx) ⁽⁷²⁾;*
- (2) advanced upgraded cable networks ⁽⁷³⁾; and*
- (3) certain advanced wireless access networks capable of delivering reliable high speeds per subscriber ⁽⁷⁴⁾ '.*

Accordingly, Service Providers were asked to have regard to these Paragraphs and provide supporting evidence to enable the Department to verify that they offered or planned to offer had the characteristics of NGA as set out by the Commission. In addition, appendix 1 Table A1.1 was provided to Service Providers at that time. This listed the technologies which were considered basic broadband technologies, and which were considered NGA broadband technologies. This was the full extent of the guidance provided to Service Providers as part of the information request.

In response to the information request, twenty-three Service Providers submitted details of their network coverage. This was considered a disappointing number of responses, as over ninety Service Providers had been identified as providing broadband services across the State at that time and considering the significant level of targeted effort that was expended by the Department encouraging participation from all these Service Providers.

Once submissions were received, three key issues quickly became apparent. Firstly, the description of basic and NGA broadband services referenced in the Request for Information was not sufficiently granular or precise. Different Service Providers interpreted the Paragraphs of the SAG and what constituted an NGA broadband service very differently. Greater definition of the NGA broadband service was required.

Secondly, the validation of submissions was multifaceted and complex. The validation of submissions would require significant specialist expertise supported by robust verification methods. Verification methodologies that could be applied consistently across several different technologies and different network types were needed.

Thirdly, no standard format was adopted by Service Providers when submitting their network information. Significant time and effort would be required to decipher the data received. The information itself was, in some cases, self-declared by the Service Provider as being inaccurate and incomplete. Service Providers simply did not maintain high quality, accurate network data records, nor did they always have the expertise or capacity to extract the necessary information from their networks.

This was somewhat of a wake-up call to the Department and gave them a first real insight into the scale of challenge that the Mapping Process presented. Significant engagement with Service Provider would be needed, substantially more precision would be required on nearly every aspect of process and in tandem with this, and substantial assessment processes would need to be developed. There was no guidance available or reference material available that were of any use.

It was therefore concluded that the anticipated process presented to the Steering Group (as outlined in Figure 4.1) was not realistic and could not be implemented. The Department essentially had to start again. A more iterative process involving multiple public consultations, discovery, reflection and creation would be needed.

4.2.2 The Call for Input (2014)

A totally new and more iterative approach was subsequently pursued than what was envisaged in July 2013. The next engagement with industry was undertaken through a 'Call for Input' (62)⁶¹ consultation, published in June 2014, (i.e., the second mapping consultation). By using this title, the Department signaled to the market that views were sought more broadly from stakeholders. This consultation essentially asked Service Providers for their ideas on how to best to conduct the Mapping Process. A draft set of 'Mapping Assessment Performance Criteria' were defined against which Service Providers were invited to provide suggestion on how to improve. The Mapping Assessment Performance Criteria proposed at that time were: (i) a list of qualifying technology types; (ii) reliability and quality; (iii) a minimum download speed of 30 Mbps; (iv) reliance on optical (or equivalent) technologies⁶²; and (v) the ability to support a variety of advanced digital services including converged all-IP services.

A total of thirty-one submissions were received, the respondents were mainly from industry, including mobile, fixed wireless access and wire line Service Providers. What was clear from the respondents was those Service Providers most affected by a likely intervention in rural areas were most engaged. Some submitted comprehensive responses and put significant time and effort into sharing their thoughts on how best to proceed.

Of the questions asked, there was broad agreement that a wider set of broadband characteristics such as upload speed, reliability etc. should be defined and used as the performance criteria. There was general agreement from respondents that mobile services should be considered as a separate market and not considered as compatible with the criteria or proposed intervention.

⁶¹ The name chosen for this consultation reflected that Service Providers were invited to provide their input on a range of issues. A consultation titled 'Call for Input' is often used by Public Bodies at the start of a process where open questions are posed, and general views are sought.

⁶² The term 'reliance on optical or equivalent technologies' was explained to mean fibre based or technologies which demonstrated similar levels of performance to fibre-based technologies.

The Department's 'Call For Input' was essentially a poll of views from industry stakeholder inviting all their ideas on how best to implement the mapping process. It was never intended to deliver the final position but was designed to be a steppingstone to getting closer to a final set of performance criteria. While the 'Call For Input' helped substantially to define certain technical parameters, it did throw up a number of new issues, for example questions on how future planned networks would be considered in the performance criteria. The idea that future planned networks needed to be identified so as to avoid any intervention inadvertently crowding out these investments was identified as a challenging exercise by respondents. It was not obvious to everyone that this exercise needed to be done at all. Whereas other respondents highlighted the challenges of deciphering credible investment plans from more aspirational or less credible plans.

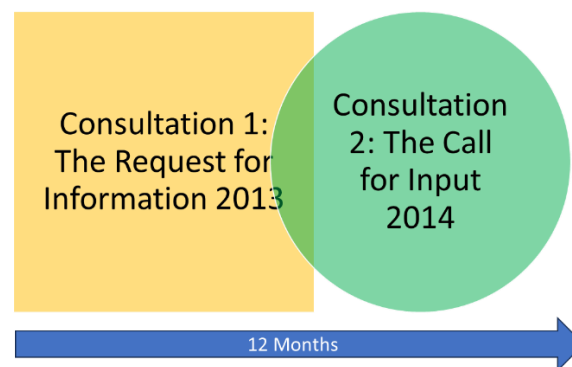


Figure 4.2. The NBP Mapping Process had a duration of 12 months by the time the 2nd Mapping Consultation was concluded.

The Department quickly realised that further consultations on these issues would be needed, and that the performance criteria, as a whole, were far from being finalised. Although, as illustrated in Figure 4.2, the Mapping Process was already running for 12 months in duration, it was unclear at that time how long this would take and how many more iterations would be needed before the Mapping Process could be finalized.

4.2.3 Consultation on NBP Map (End of 2014 – Early 2015)

Having considered the 'Call for Input' submissions the Department felt they now had sufficient information to define a more extensive set of Mapping Assessment Performance Criteria with more definitive values and parameters. They did this as part of the public

consultation published in November 2014 (i.e., the third mapping consultation), the NBP High Speed Broadband Map Consultation (63)⁶³. While this was also a public consultation, views on more specific areas were sought, as opposed to the broader ‘Call for Input’ conducted earlier. This was a logical next step for the Department to take at the time, as they attempted to narrow the focus of the consultation so that they could then finalise the process.

The Department set out several proposals. For example, to address issues raised around identifying future plans the Department proposed that new deployment and financial criteria should be met by Service Providers suggesting they have a future planned network. The consultation also proposed that Service Providers should be asked to enter binding commitments to support their claims in order that their planned coverage to be represented on the NBP online map.

For the parameters that the Department was close to finalizing, they represented these as ‘draft decisions’⁶⁴. They outlined the criteria they were likely to define and represented these as the ‘draft performance criteria’. For example, the Department proposed the technical parameters they were likely to adopt and defined them with significant granularity. Again, Service Providers were invited to submit views on whether they agreed with the Department’s draft performance criteria.

The NBP High Speed Broadband Map Consultation (the third mapping consultation) was also the first time that the Department published an online map i.e., the Draft Online Map (outlined in Figure 3.2). The ‘Draft Online Map’ showed vast areas of the State (in fact circa 95% of the geographical area of Ireland) where a State intervention would likely be needed.

⁶³ The name chosen for this consultation reflected that Service Providers were invited to provide their input on specific issues. This consultation published an actual map for the first time so views were sought on aspects of how that map was created.

⁶⁴ The term draft decision is often used by the Department to indicate their close to final position. Stakeholders responding to the consultation can interpret this as likely final position unless new or further compelling information is submitted challenging this position.

Of the 2.3million premises in the Irish State, over 700,000 premises were within the proposed intervention area and of the 50,000 Townlands in the State, 47,697 townlands were within (or partly within) the intervention Area. This online map was created by applying the draft performance criteria to any Service Provider submissions received up to November 2014. This proved a very useful exercise as internally, in advance of publishing this first online map, the Department started developing the assessment methodologies that were needed to assess Service Provider claims. This, in turn, helped the Department fine tune what information was needed from Service Provider so that their claims could be assessed. The Department realised that not only did the performance criteria need to be precisely defined but the information required from Service Providers also needed to be outlined in precise detail. Without this clarity Service Providers would inevitably omit parts of the information needed for the assessments to be conducted effectively.

The IT challenges of presenting an online map that was understandable and useable by the general public and industry should not be underestimated. Over the weeks preceding the publication of the Draft Online Map the Department undertook a series of trials with different focus groups to elicit feedback and ensure the information was accessible and the interface to the map was user friendly. As discussed in Chapter 1, the Department decided to use the colour amber to represent the areas where no NGA broadband exists and blue for those areas where it did, as opposed to matching the colours used in the SAG i.e., white and grey. These more distinctive colours were chosen so that areas could be more easily observed on the online map.

The responses to the consultation were again largely in agreement with the Department's proposals on the set of performance criteria, most importantly agreeing with the introduction of the new deployment and financial criteria for future planned networks. Some Service Providers suggested that the upload threshold should be reduced to 6 Mbps from the proposed 10Mbps upload speed, other Service Providers suggested that wireless networks using license exempt spectrum should not be automatically considered basic broadband networks.

The response to the publication of the Draft Online Map was incredible. Fifty thousand views of the map were registered in the first couple of days and the map itself was a national news story for several days after the launch of the consultation. Visually identifying the extent of the deficit of NGA broadband in rural areas illuminated the issue for all stakeholders and emphasized the need for swift action.

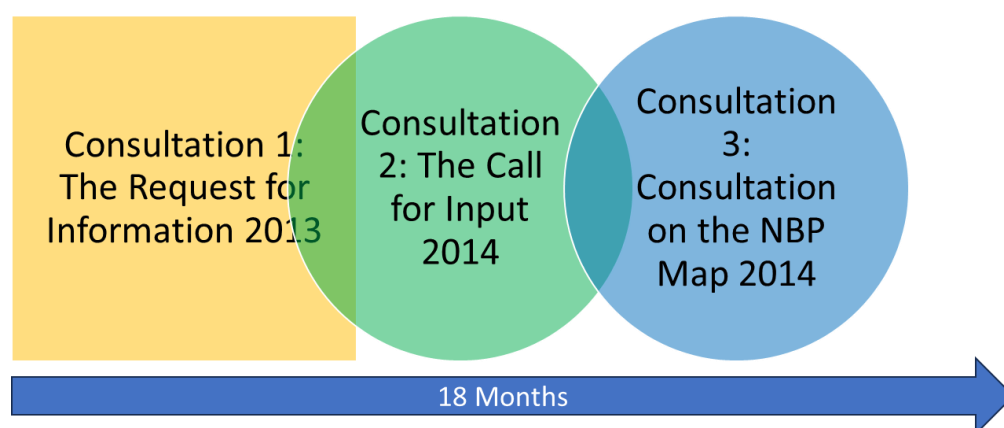


Figure 4.3, The NBP Mapping Process had a duration of 18 months by the time the 3rd Mapping Consultation was concluded.

This consultation itself was a clear effort by the Department to push the process towards conclusion. It was now more than 18 months since the first information request was issued, as highlighted in Figure 4.3. As discussed in Chapter 3, the Department now realized that the Mapping Process was firmly on the critical path and central to the entire intervention process project.

4.2.4 The Supplementary Information Request (March 2015)

In March 2015, a Request for supplementary information (64)⁶⁵ was issued (i.e., the fourth mapping consultation). The design of this new information questionnaire took into account the responses received in the second and third mapping consultations. Having largely defined the performance criteria this questionnaire could now be much more specific about

⁶⁵ The name chosen for this consultation reflected that Service Providers were invited to provide further information than had previously been requested, mindful that a previous information request had been issued in 2013.

what data was required from Service Providers if they wanted their network to be assessed by the Department. This was in stark contrast to the first 'request for information' issued in 2013 which was extremely high level and left the onus on the Service Providers to decide which information was relevant. For example, whereas in 2013 the Service Providers were requested to supply 'any evidence' they thought relevant, through the supplementary information request they were requested to provide a full set of platform specific information such as (for wireless platforms) antenna configurations, antenna gain, tilt, radiation patterns, power setting etc. etc.

The new questionnaire not only requested technical details, but to cater for claims relating to future planned networks, the questionnaire also requested deployment information for each of the five years to the end of 2020, as well as financial information about the underlying business case and funding to support any such roll out.

The request for supplementary information (the fourth mapping consultation) was the first instance in which very detailed information was requested by the Department. Substantial effort was required by the Department and their advisors in developing a standard questionnaire which outlined all the different information inputs required to be submitted by a Service Provider if they wanted their network to be assessed by the Department. The questionnaire, 'High Speed Broadband Map - Supplementary Information Request' (64) not only catered for both wire line and wireless technologies but uniquely it covered the information needed on any future investment plan that aimed to deploy NGA broadband services.

The information requested from Service Providers was specifically designed to provide all the data necessary for assessments purposes.

Surprisingly only six Service Providers responded with details of their networks. In some cases, significant information was submitted on their deployment plans with supporting financial information about the underlying business case and funding to support their

planned rollouts. The exercise offered further opportunities to create more extensive assessment methodologies, particularly those that assessed the future planned networks.

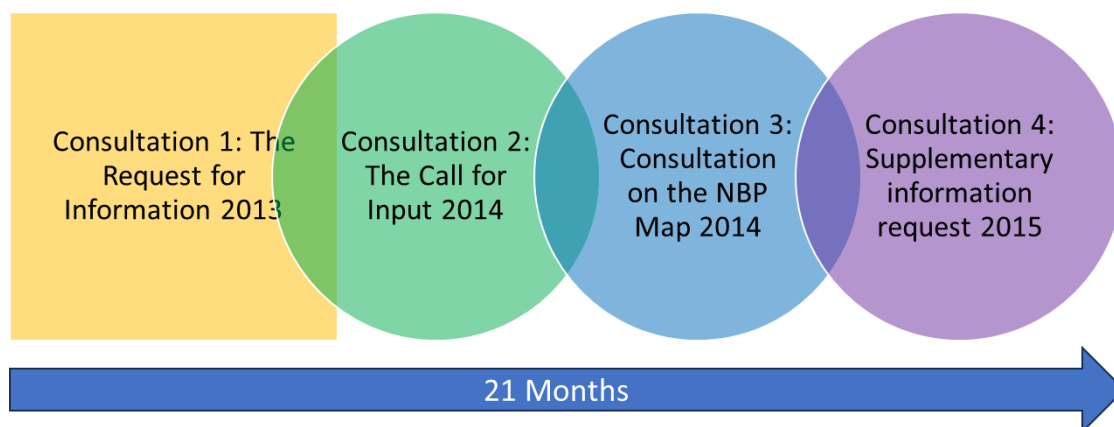


Figure 4.4. The NBP Mapping Process had a duration of 21 months by the time the 4th Mapping Consultation was concluded.

As illustrated in Figure 4.4, the NBP Mapping Process had been running for 21 months. Despite the low number of submissions received, the Department considered the information request a success, as it had reduced the need for follow-up questions and submissions and greatly shortened the period of time taken to assess the Service Provider claims. In tandem with this the assessment methodologies used were also substantially enhanced.

4.2.5 Consultation on the Process to develop the Mapping Assessment Performance Criteria Assessment (July 2015)

In July 2015, the Department published a consultation on the NBP Intervention Strategy (55)⁶⁶ (i.e., the fifth mapping consultation). While the main purpose of the consultation was not mapping related, as described in detail in section 3.3.4, it was to seek views on the draft intervention strategy.

⁶⁶ The name chosen for this consultation reflected that Service Providers were invited to provide their views on different aspects of the intervention strategy. The development of the map itself was not the main focus but the Department used the opportunity to seek views on whether more work was needed or not.

However, importantly in the context of the development of the online map, the consultation comprehensively outlined the iterative process undertaken by the Department, up to that time, to define the Mapping Assessment Performance Criteria. The Department had, at this stage, undertaken many assessments of Service Provider claims using the draft assessment criteria and through these engagements had gained a deep appreciation of level of scrutiny the mapping process would come under once finalized and applied to ultimately define the Intervention Area. The purpose of outlining each of the iterative steps in this consultation, (the fifth mapping consultation), from the Department's perspective was two-fold, firstly it highlighted to Service Providers the multiple consultations that had already been undertaken where their views were considered and secondly it offered Service Providers a last opportunity to propose whether further work on the mapping process was needed before finalizing the overall framework.

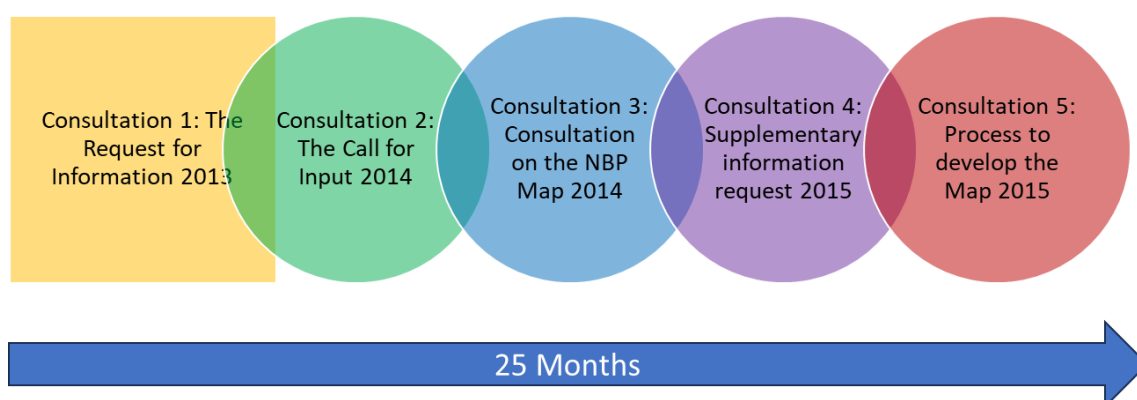


Figure 4.5. The NBP Mapping Process had a duration of 25 months by the time the 5th Mapping Consultation was concluded.

As illustrated in Figure 4.5, the NBP Mapping Process was now running for 25 months. The consultation was well supported, with a total of forty-one responses received from a range of stakeholders including Local Authorities, representative bodies, elected officials, members of the public and Service providers (fixed line, mobile and fixed wireless). A subset of these responses commented on the NBP online map and the process that was followed in its development. Following the fifth consultation, based on the responses

received relating to the mapping, the Department was confident that stakeholders all had ample opportunity to express their views. The Department considered all the latest responses before then finalizing the NBP Mapping Assessment Framework.

4.2.6 The finalization of the NBP Mapping Assessment Framework (2015)

Following the fifth mapping consultation, the full NBP Mapping Assessment Framework (65) was then finalized and published by the Department in October 2015, over two years later than originally planned timeline (outlined in Figure 4.1) and as illustrated in Figure 4.6. The NBP Mapping Assessment Framework sets out the Mapping Assessment Performance Criteria that would need to be satisfied for a Service Provider claim to be considered sufficiently credible and concrete so that the area covered by that network should be removed from the Intervention Area on the NBP online map. It also confirms the information that Service Providers should submit for their claims to be assessed. This document was then used by the Department as the basis for assessing all Service Providers' claims.

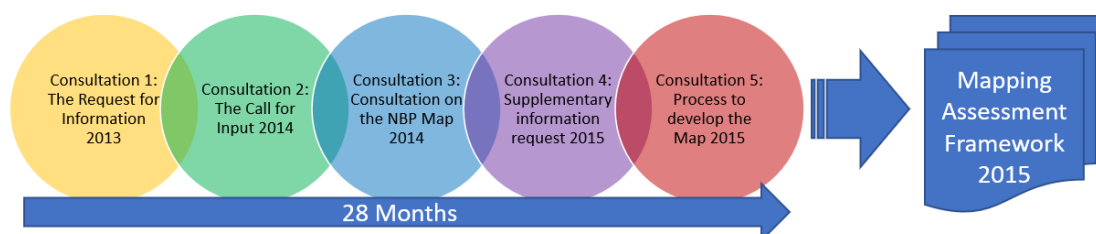


Figure 4.6 the Five Mapping Consultations leading to the NBP Mapping Assessment Framework (i.e. the framework which determines the served areas and the areas requiring intervention).

From the description provided in this Chapter, it can be seen that the development of this NBP Mapping Assessment Framework was undertaken in an iterative fashion with an intensely high level of engagement with Service Providers throughout. The outcome provided clarity and transparency to all stakeholders on what criteria was required to be met to make a change to the Intervention Area on the NBP online map.

The development of this NBP Mapping Assessment Framework took almost two and a half years to complete; included five different mapping consultations with industry; was supported by five separate public procurements for expert advisors; attracted submissions from hundreds of different stakeholders; and ultimately culminated in the publication of the NBP Mapping Assessment Framework in 2015.

Looking back now, with the benefit of hindsight the same output could well be achieved in a much shorter timeframe, for example, by starting with more predefined performance criteria and/or utilizing fewer public consultations to develop the framework, (for example the 'Request for Information' undertaken in 2013 and the Supplementary Information Request undertaken in 2015 may be completed under a single consultation). However, without the availability of any clear reference material or guidance on how to undertake the task these efficiencies were impossible to realize at the time.

The finalization of the NBP Mapping Assessment Framework was a critical milestone for the Irish NBP intervention project. It enabled the project to produce a Procurement Online Map in December 2015 and initiate a public procurement within which the potential Intervention Area was identified for bidders in the procurement. Subsequently, it enabled the Department to conduct the Final NBP Map consultation in July 2019 to identify the Intervention Area that would be included in the NBP contract and against which the project gained State Aid Approval from the EU Commission.

It should be noted that this framework was fully accepted by industry as the 'standard' required by Department. It was applied by the Irish NBP intervention project team consistently for all subsequent Service Provider claims received by the Department. Many subsequent submissions relating to both existing and future planned networks were received over the following years from 2015 up to the finalization of the NBP online map in 2019. Over this period several operators subsequently satisfied the criteria and consequently updates were made to later versions of the NBP online map prior to the finalization of the NBP online map in 2019 as already described in Chapter 3. Later in this

Chapter I describe an updated and transformed framework but before we discuss this, it is important to look at what is already available and published today.

4.2.7 The NBP Mapping Assessment Framework as published

The NBP Mapping Assessment Framework produced in 2015 as a result of the 5 mapping consultations is called “Mapping Future High Speed Broadband Networks – Criteria for assessment of investment plans”. It runs to 25 pages. For the purposes of readability of this thesis, and to make that information readily available, the resulting framework is reproduced in Appendix 2. Though 25 pages is not onerous, the material is dense and complex. The purpose of this section of this Chapter is to explain some key aspects of the content of the framework and to highlight what needs further explanation and expansion.

Firstly, the main purpose of the framework itself was to provide a set of performance criteria to help determine whether an existing or planned network could be classified as NGA by the Irish State.

On a very high level, the framework described the process to be undertaken in Figure 4.7. For a claim relating to an existing network only the technical assessment was required whereas the three types of assessment (technical, deployment and financial) were required for future planned network deployments as depicted in Figure 4.7⁶⁷. If the outcome of those assessments concluded that the criteria were satisfied, then the planned network deployment was deemed credible and capable of delivering an NGA broadband service. The process then required an agreement to be entered into between the Department and the investor where a legally binding commitment was made to deliver the planned network. Behind this simple Figure lies a huge amount of detail.

⁶⁷ Somewhat confusingly Figure 4.7 appears to refer to planned networks only, although within the framework document it explains that for existing networks the technical assessment only is applied.

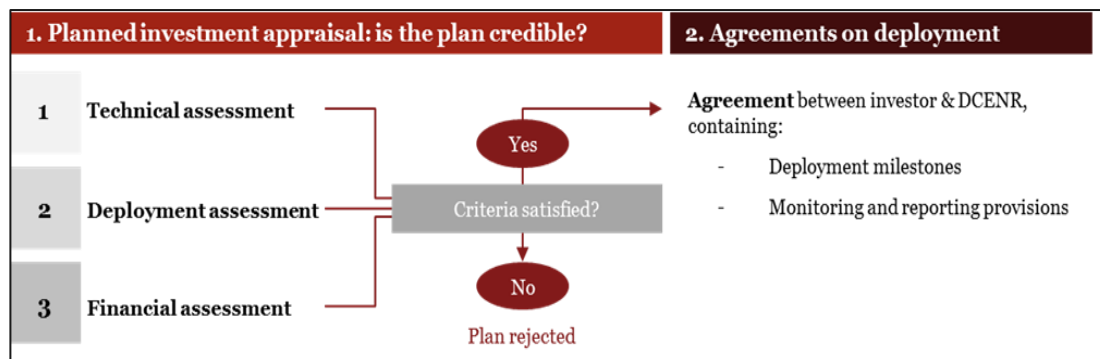


Figure 4.7 – Summary of the NBP Mapping Assessment Framework, outlined on page 6 of the framework and page 241 of this thesis (Source DCENR).

It is worth pointing out some features of the framework to give a sense of the detail.

As outlined in Figure 4.7 above, the framework involved two stages:

- Stage 1: Is the Plan credible? Within which technical, deployment and financial assessment criteria are defined; and (if all of the conditions in this stage are met, to then progress to Stage 2, if they are not the plan is rejected); and
- Stage 2: Agreements on deployment. The Service Provider is required to enter into a binding contractual agreement with the Department to meet specific deployment milestones for the planned network and to commit to certain reporting obligations.

Criteria	Parameters	Score	Credible?
1. The proposed solution is NGA	1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies)	Yes ☐ No ☐	Yes/No?
	1.2 Minimum download speed of 30 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.3 Minimum upload speed of 6 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.4 Does the solution rely on optical (or equivalent) technology?		
	1.5 Is the solution able to support a variety of advanced digital services including converged all-IP services?		
2. The proposed solution is reliable	2.1 What is interference potential in the network?		Yes/No?
	2.2 Are there concrete measures to mitigate interference?		

Figure 4.8 – A sample extract from Appendix 2 outlining the list of technical performance criteria along with the sub criteria/parameters for each criterion, on page 9 of the framework and page 244 of this thesis (Source DCENR).

As an example of the levels of detail behind the framework, if we just look at the technical assessment, we can see in Figure 4.8, which lists the technical performance criteria which had to be met (this is found on page 9 of Appendix 2), that there are only two technical criteria listed, namely ‘The proposed solution is NGA’ and ‘The proposed solution is reliable’. However, these two technical criteria are then in turn divided into multiple sub parameters which are in effect criteria which had to be met. As outlined in Figure 4.8 the first criterion has five sub parameters (parameters 1.1 to 1.15) and the second has two sub parameters (parameters 2.1 to 2.2).

Criteria	Parameters	Score	Credible?
1. Credible roll-out plan ("when and where")	1.1 Does the plan specify which premises will be passed / connected and when?		Yes/No?
	1.2 Is the rationale for the roll-out plan credible and in line with Irish roll-out practice?		
	1.3 Are the volumes of sites achievable?		
	1.4 Is the project management approach adequate to support this scale of roll-out?		
	1.5 Does the progress of the project to date match the intended planning and milestones?		
	1.6 Does the investor have a track record of timely delivery of milestones during roll-out?		
	1.7 Does the deployment plan include a credible risk analysis and risk management plan?		
2. Credible resource plan ("how")	2.1 Is the project team experienced in roll-outs of this sort?		Yes/No?
	2.2 If subcontractors are being used, is the plan to engage them advanced sufficiently to support the roll-out timeframe?		
	2.3 Are the proposed or actual subcontractors experienced in this type of roll-out?		

Figure 4.9 – A sample extract from Appendix 2 outlining the list of deployment performance criteria along with the sub criteria/parameters for each criterion, on page 11 of the framework and page 246 of this thesis (Source DCENR).

Now if we look at the deployment assessment, outlined in Figure 4.9, we can see that is also had 2 criteria, namely 'Credible roll-out plan ("when and where")' and 'Credible resource plan ("how")' and a further ten sub parameters (parameters 1.1 to 1.7 and 2.1 to 2.3). The financial assessment had two more criteria and eleven sub parameters (see page 12 of Appendix 2). The total number of criteria was six with 26 corresponding sub parameters.

Remembering that each and every criterion and sub parameter was carefully chosen and developed through the five mapping consultations it is possible to begin to appreciate the depth of complexity and time involved in creating such a framework.

Secondly, in addition to the framework outlining the performance criteria that had to be met, the framework also outlined the information which Service Provider had to provide when submitting a claim. The volume of information required is substantial and multifaceted. The full list of information needed is listed on pages 16 to 25 of Appendix 2.

Appendix A: Supplementary Request for Information

Introduction

This section contains the full supplementary information request send out to all private investors or future operators in April 2015. For information purposes, it is demonstrated how the information requested is used to assess the criteria and parameters outlined in this report.

A.1. Technical information

Table 5: Supplementary Information request and corresponding technical assessment criteria

Request	Technical assessment criteria (set out in table 1) to which the SIR requirements primarily relate (for information purposes)
1 Generic Each operator is requested to provide the following information, separately, for its existing and planned networks: 1. A description of the overall network architecture. 2. A description of the access network technology and the specification of the access equipment (including the relevant telecoms standards with which the equipment complies). 3. A description of the backhaul network technology (national¹¹ and metro¹²) and the specification of the backhaul equipment (including the relevant telecoms standards with which the equipment complies). 4. A design for the national backhaul network including any traffic and capacity assumptions. 5. The specification of all types of customer premises equipment which the operator plans to use. 6. Coverage data, as illustrated in Figure 3.1 below, in the form of a Polygonised (vector) dataset with 'DOWNLOAD SPEED' attribute attached to the polygon, delivered in one of the following formats: • ESRI Shapefile (Polygon) • ESRI PGE (polygon feature class) • Map info MID/MIF (Polygon) • KMZ (Polygon) • DXF/DGN This coverage data is requested to include:	Technical criteria 1) the proposed solution is NGA, 1.1, 1.2, 1.3, 1.4 Deployment criteria 1) Credible roll-out plan, 1.1, 1.3

¹¹ National backhaul is defined as the network which connects aggregation points to the core network and the internet
¹² Metro backhaul is defined as the network which connects access nodes to aggregation points

Figure 4.10– (a)

- NGA broadband coverage with contours corresponding to available download speed or, a map showing all premises covered, with the premises coded according to the speed they will receive. The download speed must be no less than 30 Mbps
 - Any assumptions made in relation to the contours
 - Mapping of existing and planned coverage
7. Any other relevant information that could assist the DCENR in assessing the concrete nature of submission.

2 Platform specific information

2.1 Wired platforms:

1. Please provide the following data in a spreadsheet on a per access node¹³ basis:
 - a. access node ID
 - b. access node coordinates and coordination projection system
 - c. technology (including relevant standards)
 - d. the access network frequency plan
 - e. access node status (greenfield or existing)
 - f. backhaul technology
 - g. backhaul capacity
 - h. line length distribution from cabinet to premises
2. Please provide details of the CPE and the general locations where it is proposed to install it in the premises.
3. Please describe any planned use of technological advancements to increase broadband speeds (e.g. pair-bonding, vectoring, phantom mode, channel bonding etc.).
4. Please describe the following inputs to the coverage map:
 - a. propagation model i.e. speed performance versus line length
 - b. supporting evidence including manufacturers performance data and trial results
 - c. any assumptions made in translating straight line to actual route
 - d. planning tool and associated configuration
5. Please provide a full Excel-based link budget for the downlink and uplink including all intermediary step calculations i.e. include all formula used to calculate all line items (e.g. line A + line B + line C = line D). The link budget should include at a minimum the following line items and their associated units:
 - a. transmit power
 - b. system bandwidth
 - c. required signal-to-interference-plus-noise ratio (SINR)
 - d. receiver sensitivity
 - e. maximum allowable path loss
 - f. mean propagation loss

Technical criteria 1) the proposed solution is NGA, 1.1, 1.2, 1.3, 1.4 and 2) the proposed solution is reliable, 2.1, 2.2

Deployment criteria: 1) credible roll-out plan - 1.2, 1.7

¹³ The definition of 'access node' will depend on the type of fixed access technology planned and may include FTTC cabinet, HFC node, FTTH etc

Figure 4.10 – (b)

- g. formula showing conversion of link budget into design threshold on which coverage map is based
6. Please describe the planned approach to interference management in the access network making reference to frequency plans and any issues associated with the transmission medium.
7. Regarding any existing equipment or plant which the planned network will reuse (including copper wires, coaxial cable, poles, optical fibre), please describe:
- the general state of the existing equipment or plant
 - the impact of the existing equipment or plant on the quality of service
 - the approach to mitigating the risk of equipment or plant not meeting sufficient quality standards to meet the planned quality
-
- 2.b **Wireless platforms:**
1. Please provide the following data in a spreadsheet on a per sector basis:
- sector ID
 - site ID
 - site coordinates and projection system
 - sector azimuth
 - access technology (including relevant standards)
 - carrier frequency
 - number of carriers
 - bandwidth per carrier (e.g. 20MHz).
 - structure status (greenfield or existing)
 - tower or structure height (above ground level)
 - transmit antenna height (reference base of antenna)
 - transmit power
 - antenna gain
 - antenna radiation pattern for vertical and horizontal radiation pattern (patterns should be provided in Excel or another computer readable file, loss in dB per degree)
 - MIMO scheme
 - number of transmit antennas
 - number of receive antennas
 - antenna tilt – electrical (reference positive degrees for down-tilt, negative number for up-tilt)
 - antenna tilt – mechanical (reference positive degrees for down-tilt, negative number for up-tilt)
 - spectrum licence conditions including ComReg licence reference number
2. Please describe any planned use of carrier aggregation (CA)
3. Please provide the following data in a spreadsheet on a per site basis:
- number of sectors on installation
 - any planned evolution of the number of sectors over time
 - backhaul technology
 - backhaul capacity
 - site acquisition assumptions including information regarding site ownership and statement of probability of inclusion of site
- Technical criteria 1) the proposed solution is NGA, 1.1, 1.2, 1.3, 1.4 and 2) the proposed solution is reliable, 2.1, 2.2
- Deployment criteria: 1) credible roll-out plan - 1.2, 1.7

Figure 4.10 – (c)

in rollout

4. Please provide the following data **for each proposed mode of reception** (e.g. indoor CPE, window-mounted CPE, external CPE) at the end user's premises:
 - a. describe the mode of reception
 - b. describe how service assurance for that mode of reception will be provided.
 - c. provide:
 - i. antenna height
 - ii. transmit power
 - iii. MIMO scheme
 - iv. number of transmit antennas
 - v. number of receive antennas
 - vi. antenna gain
5. Please describe the following inputs to the coverage map:
 - a. propagation model and selected parameters
 - b. planning tool and associated configuration
 - c. digital terrain map (including resolution)
 - d. clutter map (including resolution)
6. Please provide a full Excel-based link budget for the downlink and uplink including all intermediary step calculations i.e. include all formula used to calculate all line items (e.g. line A + line B + line C = line D). The link budget should include at a minimum the following line items and their associated units:
 - a. EIRP
 - b. system bandwidth
 - c. required signal-to-interference-plus-noise ratio (SINR)
 - d. receiver sensitivity
 - e. maximum allowable path loss
 - f. indoor penetration loss as applicable per clutter type or geographic type
 - g. cell edge probability
 - h. cell area probability
 - i. mean and standard deviation used to calculate slow fade margin
 - j. slow fade margin
 - k. mean propagation loss
 - l. formula showing conversion of link budget into design threshold on which coverage map is based
7. Please describe the planned approach to interference management in the access network making reference to carriers and frequency reuse plans.
8. Any other relevant information that could assist the Department in assessing the concrete nature of the technical plan.

Figure 4.10 – (d)

Figure 4.10 (a), (b), (c), (d) – A sample extract from Appendix 2 outlining the list of detailed technical information which had to be submitted by Service Providers submitting a claim, on pages 16 to 19 of the framework and pages 251 to 254 of this thesis (Source DCENR).

Figure 4.10 (a), (b), (c), (d), shows a number of pages from the NBP Mapping Assessment Framework. They are included here to give a flavour of the level of granularity and specificity developed for the information request itself and to highlight the depth of information which had to be provided for just the technical assessment. As can be seen it is divided into a generic set of information which every Service Provider had to submit and then specific platform information which had to be provided depending on whether the platform was a wired platform or a wireless platform. Service Providers were also invited to submit any other relevant information which might support their submission.

This level of granularity and specificity is replicated in the deployment and financial information sought. While Service Providers could seek clarification on what was needed, the whole idea of the questionnaire developed was to outline as clearly as possible what information is needed for each assessment, so as to avoid the need for clarification requests thereby avoiding unnecessary delays in submitting the information.

What is striking is the marked difference between this questionnaire and the original request for information issued by the Department in 2013. In 2013, the Department essentially published the NGA definitions which were set out in the SAG and asked Service Providers to submit whatever network information they deemed relevant. In contrast the NBP Mapping Assessment Framework requested specific details on equipment specifications, planning and design assumptions, network site configurations, customer premises equipment details etc. etc. all of which were required to carry out the subsequent verification of the Service Provider's claims. It was essentially through trial and error both from direct Service Provider feedback on the questionnaire and by reviewing the typical clarification requests received that the Department developed sufficient specificity in this questionnaire. As mentioned earlier, while Service Providers could still request clarification if needed, this questionnaire did reduce the need for clarifications considerably. **A future project would be well served in using this questionnaire as a starting point and reference,**

rather than repeating the same process of trial and error in the development of their own questionnaire.

Lastly, as explained throughout section 4.2, the NBP Mapping Assessment Framework and the supporting documentation used for assessments were produced iteratively over a two-and-a-half-year period before they were finalised in 2015. There was significant development of the performance criteria over this time e.g. where the Department revised the criteria, taking account of stakeholders' views submitted during the five mapping consultations undertaken. During this time, the Department expended considerable effort in developing a range of extremely detailed assessment processes for assessing claims. They continued to update these assessment processes up to 2015, as criteria were either introduced or withdrawn or as new scenarios or technologies were considered.

Due to the iterative nature of this approach, both the published and internal documentation that was produced over the period are voluminous and not easy to follow or unpack. The relationship between each step may not be obvious to those unfamiliar with the mapping process and the relationship of each to the different performance criteria is tricky to understand.

In tandem with this, the Department consistently relied on the recommendations provided by their expert advisors. While the outputs of the expert advisor's assessments were very clearly documented and explained to Service Providers, this expert advice was never published and was only available internally in the Department to the project team and to the Service Provider making a claim.

The core issue is, we are left with a substantial amount of material that is not easy to understand or follow. While much of the material is not available publicly, even if it were published, this documentation would be impractical for any future project to easily re-use or reference without first expending considerable effort in deciphering it.

It is important to address this deficit of information. Uniquely, this research now explains the full range of processes, including the verification methodologies that are required. As discussed further in section 4.3, the end-to-end processes are outlined in Appendix 3, and they are presented in a manner designed to fully inform future mapping projects.

However, it should be noted that when the EU Commission updated the SAG⁶⁸ in 2023, they encouraged EU Member States to not only publish the performance criteria but also how Service Provider claims would be assessed. This change acknowledged that this critical element of the mapping process is not typically published by EU Member States. The updated SAG was revised to encourage EU Member States to publish their assessment methodologies so that projects to learn and leverage from each other's approach.

4.3 Making the NBP Mapping Assessment Framework more reusable

The fact that the NBP Mapping Framework exists and was published in 2015 is of course very useful for other countries engaging in a similar process. It does provide some fleshing out of what is required in practice by the SAG. It is hoped through the detailing of the development of the NBP Mapping Assessment Framework in itself and in such detail as outlined in section 4.2, that others can learn from the Irish experience, avoid some of the delays that occurred and gain efficiencies in developing their own process.

However, the key question in the thesis is how can the Irish experience be used to inform and improve future intervention processes. Unfortunately, the 25 pages of the NBP Mapping Assessment Framework won't provide future projects with the full picture or a complete understanding of what is required, as this document represents a tiny proportion of the actual documentation required to successfully implement a Mapping Process. To gain a deeper understanding and demystify what is required, the full suite of documentation needs to be available, it needs to be explained comprehensively and presented in a logical manner to future projects. This is the purpose of section 4.3.

⁶⁸ The update of the SAG, published in 2023 and the influence this research has had on that update is discussed in more detail in Chapter 5.

4.3.1 Demystifying the NBP Mapping Assessment Framework for future projects

The value of re-examining the entire documentation now, (i.e., both the published and internal documentation), is that it not only allows an opportunity to look at and explain what took place from a holistic end-to-end perspective plugging any gaps that might otherwise exists in terms of understanding, it also creates the opportunity to re-organize the material into essentially a new framework that flows logically from step to step so that it can then be more easily followed, referenced and potentially re-used by a future project.

With these objectives in mind, a deep analysis of the following was undertaken:

- the NBP Mapping Assessment Framework, included herein as Appendix 2;
- the reports issued to Service Providers, from 2015 to 2019, after the framework was finalised along with any supporting information. Importantly these reports (there were over fifty reports issued by the Department) detailed the verification methods which were applied to each individual claim. These reports varied in length depending on the nature of the claim i.e. whether it an existing or future planned network, and the extent of coverage claimed i.e. was it a very localized claim to a single site or specific area or was it covering areas across the entire State. For the simplest claims, reports were less than 5 pages in length whereas for more complex claims multiple reports were issued to the Service Provider, detailed the findings against each criterion. These more complex reports ran to more than 30 pages each.
- relevant internal documentation and notes taken that explained the rationale for the approach undertaken; and
- the expert advisor reports and processes used to produce the Service Provider reports.

As a key member of the NBP Mapping team, I was uniquely qualified to conduct this analysis. Having full access to both published and internal material was essential in this part of the research. An analysis of this nature, could only have been done by someone who

worked through the process at the time and understood, through lived experience, how it knitted together recognizing the relevance of each step to the next etc.

As mentioned at the start of the thesis, I do acknowledge that as an active participant in the NBP Mapping Process I may view these documents with a certain bias, but I have restricted my analysis to explaining what was done, and to reorganizing and recasting the material in a manner that allows the entire complex web of documents to come together in a more cohesive and reusable way. At different points in time and to ensure accuracy, colleagues in the Department with strong understanding of what was implemented, have reviewed and provided observations on the historical records outlined and as explained in Chapter 5, elements of the research were shared with the EU Commission to corroborate the findings.

The deep dive analysis of this documentation was an extremely time-consuming exercise and undertaken over many months. The complexity encountered in this analysis provides clear evidence of the barrier that any future project would have encountered if they attempted to re-use the existing documentation.

There are two main outcomes to the analysis. The first outcome suggests that a lens of three building blocks should be used to look at the whole framework. In other words, I contend that the framework can be best grasped and understood by reorganizing the activities involved into three logical groupings, namely, (i) the Mapping Assessment Performance Criteria; (ii) the Mapping Verification Methodology; and (iii) the Mapping Information Questionnaire. These three groupings or blocks are depicted in Figure 4.11 and outlined in section 4.3.1.1.

The second outcome is a reworking and recasting of the framework itself through the lens of these building blocks. The purpose of this reworked and recast framework is to ensure that the material can be more easily followed by a future project. This recast framework is discussed in section 4.3.1.2 and is fully outlined in Appendix 3.

4.3.1.1 The three Online Map Building Blocks

By relooking at the entire documentation now, I quickly realised that I relied heavily on my prior experience to fully understand the interdependence between the different documents produced and their primary purpose. I stepped back from just tracing the chronological order documents were developed and sought to make sense and explain the different parts of the process at high level. I looked for ways of bringing material together in better groupings and sought out opportunities for simplification.

To allow a future project to navigate them more easily and avoid confusion, I concluded that the documentation needed to be reorganized into logical groupings or blocks. I now contend that by reorganizing the activities involved into three logical groupings, namely, (i) the Mapping Assessment Performance Criteria; (ii) the Mapping Verification Methodology; and (iii) the Mapping Information Questionnaire that future projects will more easily follow the end-to-end process.

The first building block should identify the 'Mapping Assessment Performance Criteria' which must be met for a Service Provider network, for either an existing or future planned network, to be considered an NGA broadband network.

The second building block, the 'Mapping Verification Methodology', should outline the appropriate techniques or verification methodologies needed to assess Service Provider claims to establish whether they meet the Mapping Assessment Performance Criteria or not.

The third building block, the 'Mapping Information Questionnaire', should set out the level of detail and information required to be submitted by Service Providers so that an assessment can be conducted against the Mapping Assessment Performance Criteria. This document should provide specific guidance to Service Providers on the level of information required when submitting a claim in respect of an existing or future planned network.

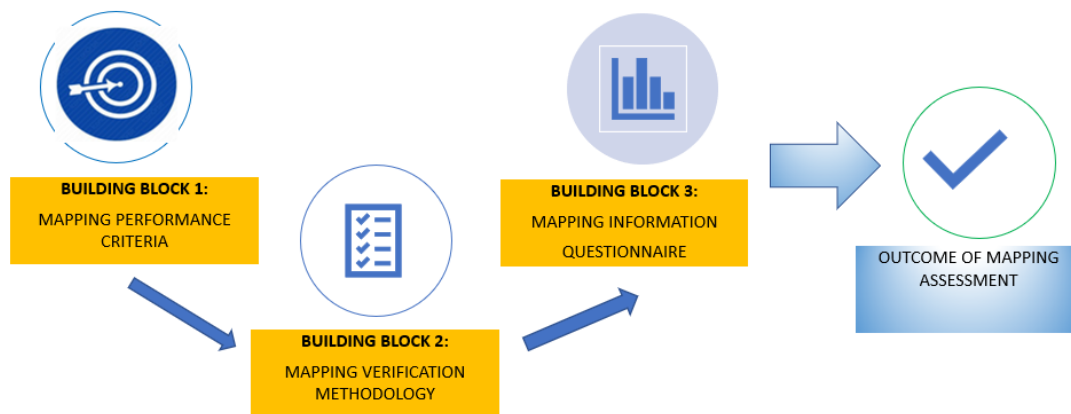


Figure 4.11 The three Online Map Building Blocks.

Online Map Building Block 1 - The Mapping Assessment Performance Criteria

The Online Map Building Block 1 should identify:

- the Mapping Assessment Performance Criteria which must be met to establish whether a Service Provider network, for either an existing or future planned network, should be considered an NGA broadband network or not.

The Online Map Building Block 1 should state the performance thresholds for different technical parameters, (for example, the minimum download speed and upload speed), which must be met for a broadband service to be considered an NGA broadband service. These criteria must not only be defined for networks that exist today, but they must also be suitable to be applied to networks that are planned but not yet deployed, so that the credibility of planned investment can be confirmed.

Put simply, the Online Map Building Block 1 should define the 'standard' that must be met for an existing broadband service to be considered an NGA broadband service or a future planned network to be considered credible and likely to deliver an NGA broadband service once it is deployed.

Service Providers already delivering basic broadband services in an area are likely to be motivated to have threshold values within the Mapping Assessment Performance Criteria reduced or diluted. This is so that they can more easily satisfy the criteria with their existing

networks. This would have the effect of preventing any State subsidized network being built in the same area; therefore, ring-fencing the area where they are already delivering services, and protecting their existing businesses and livelihoods.

The Mapping Assessment Performance Criteria is therefore very contentious. Great care must be taken in defining the set of criteria and any associated threshold values.

Online Map Building Block 2 - The Mapping Verification Methodology

The Online Map Building Block 2 should identify:

- The verification methods that are used to analyze Service Providers information to determine whether the Mapping Assessment Performance Criteria are met or not.

When determining whether a Service Provider's network meets the Mapping Assessment Performance Criteria or not, intuitively one may assume that an appropriate expert, once provided with the appropriate level of detail of a Service Provider's existing or future planned network, will be able to determine whether the criteria are met or not. This is true to some extent, experts are absolutely needed, but a detailed verification methodology must be followed by these experts in making this determination. Online Map Building Block 2 should describe the verification methodologies that are used.

Mapping Verification Methodologies must be developed for different technology types; both wire line and wireless networks. For wire line networks a range of different technologies exist including Fibre to the Home (FTTH), Fibre to the cabinet (FTTC) using Very high-speed digital subscriber line (VDSL), exchange launched VDSL (eVDSL), FTTC using Data Over Cable Service Interface Specification (DOCSIS). Similarly for wireless networks, a range of different technologies exist, including Fixed Wireless Access (FWA) using Wi-Fi, Fixed Wireless Access (FWA) using 4th Generation wireless systems (4G) or 5th Generation wireless systems (5G), Satellite services, Mobile 4G and 5G networks.

Mapping Verification Methodologies must be developed that can determine whether networks using these technologies meet the Mapping Assessment Performance Criteria or not.

Additionally, Mapping Verification Methodologies must be developed for future planned networks. This typically includes methodologies to review the credibility of the financial investment plan, of the future planned network and an examination of the deployment plan that is expected to be achieved. For future planned networks, a level of commitment may be sought to assure stakeholders that the Service Provider will in fact follow through on the planned investment. This may include a legally binding commitment to deliver specific delivery milestones, so that the plan can be monitored as it progresses.

Again, Service Providers already delivering basic broadband services in an area may be motivated to challenge the verification methodology used in reviewing the performance of their networks or seek to make the verification methodology align more favorably to their network configurations. This might allow them to meet the Mapping Assessment Performance Criteria more easily and therefore ring-fence an area where they are already delivering basic broadband services; preventing any State subsidized network being built in the same area.

The verification methodology used is therefore as contentious as the performance criteria themselves and equally great care must be taken in defining these methodologies.

Online Map Building Block 3 – The Mapping information questionnaire

Online Map Building Block 3 should address all the necessary information needed to conduct a verification of a Service Provider claim.

This building block must be made widely available to industry so that they know what information is needed for their claim to be assessed.

For an existing network this will consist of collecting detailed network information, for example information relating to the technology used in the Service Provider's network, where this technology is deployed in the network, how the different network elements are configured, what resource capacity is deployed etc.

For a future planned network details of the Service Providers deployment strategy and their deployment planning are needed, as well as details of the forecasted business plan and confirmation that the funds needed to deploy the network are available.

The three building blocks are numbered in the order they should be developed. The third Online Map Building Block can only be finalized once the first two Online Map Building Blocks are confirmed. In other words, the performance criteria must be settled, and the verification methodologies must be defined before the full extent of information needed to assess a Service Provider claim can be identified.

This order should not be confused with the order they are then implemented when conducting an assessment of a Service Provider claim. If we consider the building blocks from the perspective of a Service Provider who is submitting a claim, the order the building blocks are applied is firstly the mapping information questionnaire is responded to (Building Block 3), secondly the relevant performance criteria that apply are identified (Building Block 1) and then thirdly the verification methodology is applied (Building Block 2). It is by using this order, as illustrated in Figure 4.12, that the outcome of a mapping assessment is made.

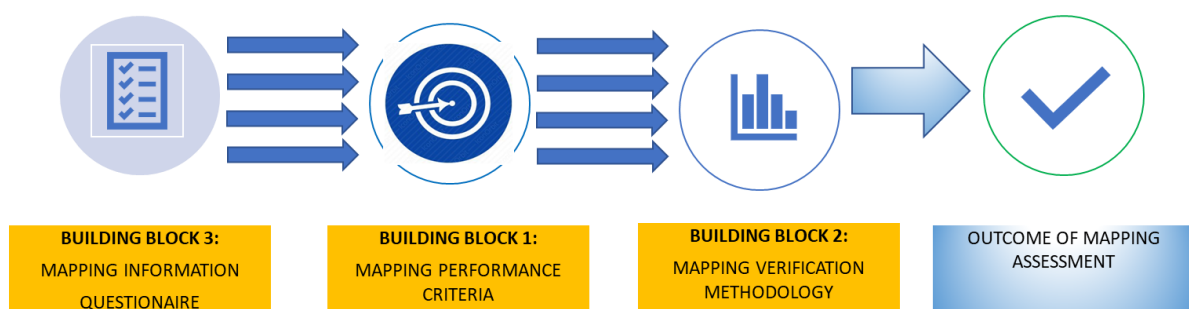


Figure 4.12 The order the three Online Map Building Blocks are implemented when conducting an assessment of a claim.

4.3.1.2 A reconceived and newly created framework

I contend that reorganizing the activities into the three Online Map Building Blocks goes some way in making the framework more understandable and reusable. Defining three logical groupings in this manner, should ensure the purpose and significance of each, can be clearly followed. However, this research goes further by creating a reconceived framework. The newly created framework can be found in Appendix 3. The decision for placing a crucial outcome of this research and essential part of the thesis in an appendix is for readability reasons. Appendix 3 runs to over 50 pages and is intended to help guide the reader through the end-to-end process like never before.

To produce Appendix 3, I firstly re-organized all available information into the categories proposed under the three Online Map Building Blocks. I then considered how best to make the information under each of the Online Map Building Blocks more understandable and reusable. What became apparent from this exercise was the fact that the first and third Online Map Building Blocks were reasonably well presented in the NBP Mapping Assessment Framework and only required some extraction from this document to make them more visible; and some additional context information to enhance their reusability. Whereas the second Online Map Building Block was not fully visible from the framework itself and needed to be augmented by the information contained with the Service Provider reports and other internal documents to form a complete picture.

To recap, the first Online Map Building Block refers to the 'Mapping Assessment Performance Criteria'. These criteria (as well as their corresponding sub parameters which are in effect sub criteria) are all contained in different sections within the published NBP Mapping Assessment Framework.

To clearly identify the first Online Map Building Block, I extracted all performance criteria and corresponding sub parameters from NBP Mapping Assessment Framework and reproduced them in a single document, now available in Appendix 3.1. To complete the explanation of the first Online Map Building Block, I then provided a short description of how binary scores and risk scores were applied to each criterion and sub parameters and

then how an outcome is determined based on these scores. Readers will note that this information is already detailed in different parts of the NBP Mapping Assessment Framework; however, the benefit of extracting the Mapping Assessment Performance Criteria into its own separate document was to make the criteria and sub parameters applicable very clear and distinct. It is not uncommon for the performance criteria to be confused with verification activities, so this simple extraction is designed to ensure they are not inadvertently conflated in any way.

The third Online Map Building Block is also contained within the NBP Mapping Assessment Framework as an appendix to the framework (please see pages 16 to 25 of framework and pages 251 to 260 of this thesis). The third Online Map Building Block is the 'Mapping Information Questionnaire' i.e. the information which Service Providers should submit when they were submitting a claim. As discussed later in this Chapter, under section 4.4.5 insight 5, this questionnaire must be customized to garner the specific information necessary to conduct the verification of Service Provider claims. Rather than just reproduce what is already included in the framework, instead I provide guidance to future projects in how to develop this building block. I describe how the NBP's Mapping Information Questionnaire was structured and how each section of the questionnaire was designed to provide the necessary information for the technical, deployment and financial assessments undertaken.

Lastly for the second Online Map Building Block a much more fundamental recasting of material was required than was required for the first and third. As the key information is contained within the Service Provider reports issued to various different Service Providers over the course of the NBP Mapping Process and in internal documents within the Department, a deep analysis of this material was required, and significant effort was needed to present the material in an understandable and reusable format.

I carefully examined each of the Service Provider reports that were issued and sought opportunities to explain the verification methodologies undertaken more comprehensively and then present them logically and in a reusable manner.

From the material reviewed combined with my personal experience of implementing the project, I identified that two separate verification methodologies had been developed for the technical assessment, one for wireline networks and one for wireless networks, while the same verification methodology was applied for the deployment and financial assessments irrespective of the network type. This insight is discussed further in section 4.4.3 'insight 3'. These two different wireline and wireless verification methodologies along with the deployment and financial methodologies are now fully documented, albeit in a recast format, in Appendix 3.2.

To explain what was undertaken more comprehensively, for each criterion, I took each sub parameter and documented how each were assessed. I provided detailed step by step guidance of each part of the assessment and provided context and explanation for the different characteristics reviewed as part of the assessment. I then summarized the assessment of each criterion, by developing a concise summary of the verification methodologies undertaken for each criterion in a single table. These tables list the items considered and the evidence sought against each sub parameter for each criterion.

For example, Table 4.1 (which is included in Appendix 3 as Table A 3.2) summarises the verification methodology applied for wireless networks against criterion 1.

Technical Criterion 1 - Is the proposed solution NGA?		
Parameter	Items considered	Examples of supporting evidence.
1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies)	The technology used in the proposed solution e.g. LTE, LTE-Advanced, 5G, Wi-Fi 5.	The specifications of the technology used in the proposed network.
1.2 Minimum download speed of 30 Mbit/s to all users when they demand it.	The theoretical download speed capability of the technology being used in the proposed solution. ----- The radio access equipment configuration and design with respect to download speed: 1. the radio access equipment configurations; and 2. the engineering design for coverage and capacity.	The manufacturers performance specifications of the technology used in the proposed network. ----- Details of the radio configurations deployed to each site. Details of the designs used to determine coverage. Details of the capacity calculations and assumptions used in the design. Details of the configuration of customer premises equipment.
1.2 continued....	The link budget modelled to demonstrate the likely radio access download speed performance of the solution. ----- The backhaul network capacity and configuration.	Details of the link budget outputs, the assumptions used and evidence on the validity of the assumption used for the area targeted by the network. ----- Details of the backhaul equipment configurations deployed from each site to the

1.2 Minimum download speed of 30 Mbit/s to all users when they demand it.	The theoretical download speed capability of the technology being used in the proposed solution. The radio access equipment configuration and design with respect to download speed: 1. the radio access equipment configurations; and 2. the engineering design for coverage and capacity.	The manufacturers performance specifications of the technology used in the proposed network. Details of the radio configurations deployed to each site. Details of the designs used to determine coverage. Details of the capacity calculations and assumptions used in the design. Details of the configuration of customer premises equipment.
1.2 continued....	The link budget modelled to demonstrate the likely radio access download speed performance of the solution. The backhaul network capacity and configuration.	Details of the link budget outputs, the assumptions used and evidence on the validity of the assumption used for the area targeted by the network. Details of the backhaul equipment configurations deployed from each site to the handover to the core network. Details of the capacity calculations and assumptions used in the design of the backhaul network.
1.3 Minimum download speed of 6 Mbit/s to all users when they demand it.	The same items are considered for parameter 1.3 as for parameter 1.2 except upload speed performance is reviewed instead of download	Same evidence is required as for parameter 1.2 except details relating to upload speed are needed.

Table 4.1 The concise summary of the NBP Technical Criteria Verification Methodology applied for wireless networks against technical criterion 1 which is further explained in Appendix 3 – Table A 3.2.

While the step-by-step description of the verification methodology used for a wireless network against criterion 1 is detailed over 15 pages in section A 3.2.2.2, Table A 3.2

conveniently provides a summary of the verification methodology used. As can be seen from this example in Table 4.1, listing all the sub parameters in a single table alongside the items considered for each and the types of evidence sought provides concise guide of what was undertaken. A similar table was developed for each criterion.

I then developed a series of flow charts which identified the logical interaction of each step of the verification. For such a detailed and complex process, recasting the framework by using flow charts so that the user is guided from one step to the next, with clear hierarchies outlined as well as providing clarity on the interdependence of each step.

It is not intended that the tables when viewed within the flow charts themselves are fully legible as they contain detailed granular information. Instead, the legible version of the tables are outlined separately throughout Appendix 3 (for example please see Table A 3.2, Table A 3.3, Table A 3.4, Table A 3.5 which refer to the technical verification methodology, similar tables exist for the deployment and commercial verification methodologies); they are merely included in the flow charts to illustrate how the end-to-end process including the entire verification methodology of the framework operated. The interdependencies are clearly signposted and how each step fitted into the overall framework is explained. This provides significant simplification on the one hand, while on the other hand, not losing any of the complexity needed to implement a robust and comprehensive process.

For example, If we follow the flow chart for the technical assessment which is outlined in Figure 4.13 (and in Figure A 3.14 in Appendix 3). The two technical criteria are clearly outlined at the start of the process flowchart. Then the verification activities are applied, these are represented as tables (in the case of the technical assessment Tables 4.2 and 4.3 are applied for wireless networks, whereas Tables 4.4 and 4.5 are applied for wireline networks). If both assessments are met, then the technical criteria are met.

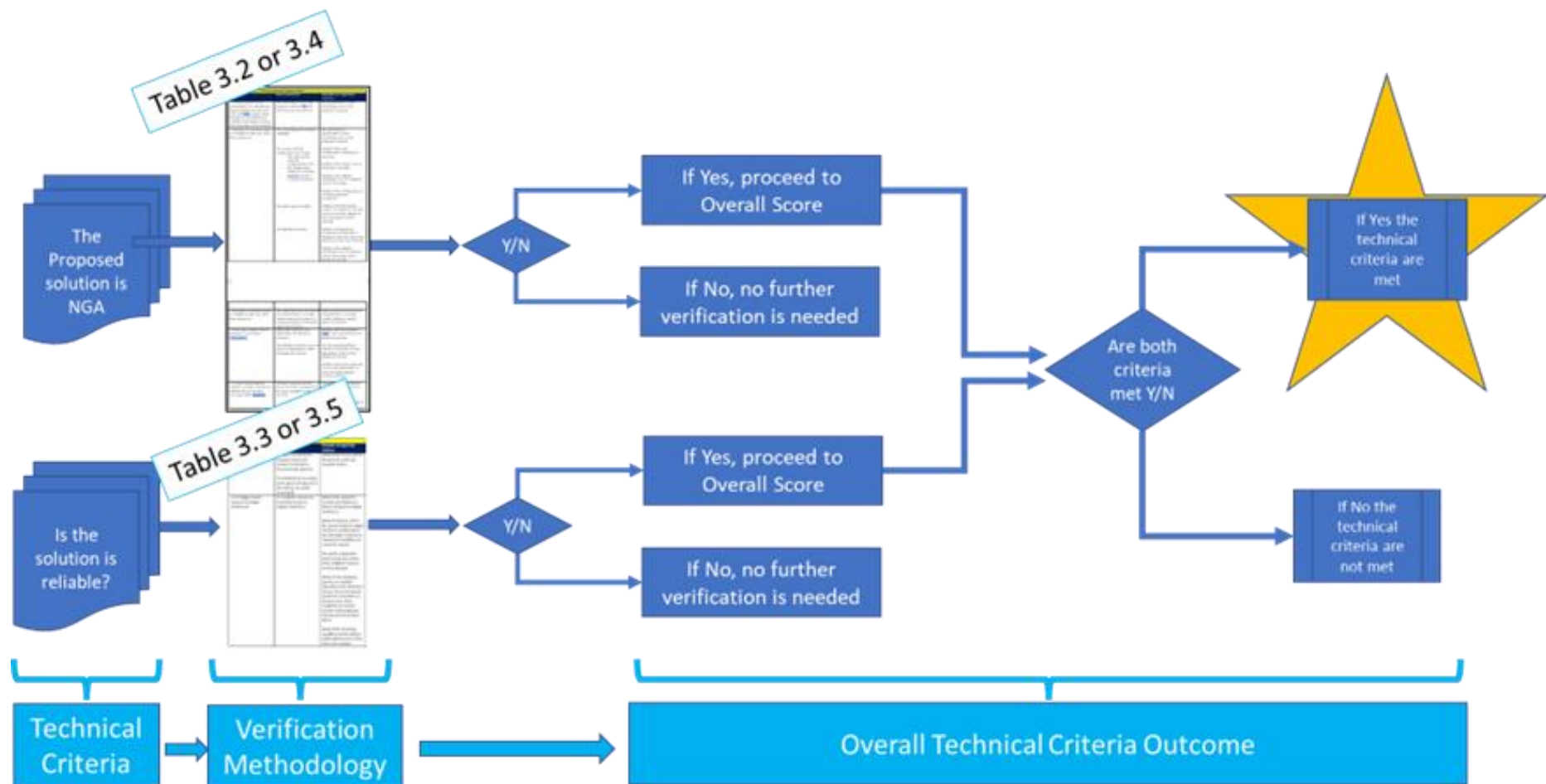


Figure 4.13 The flowchart that was created and which is further explained in Appendix 3 - A 3.14. It summarizes the Technical Verification Methodology.

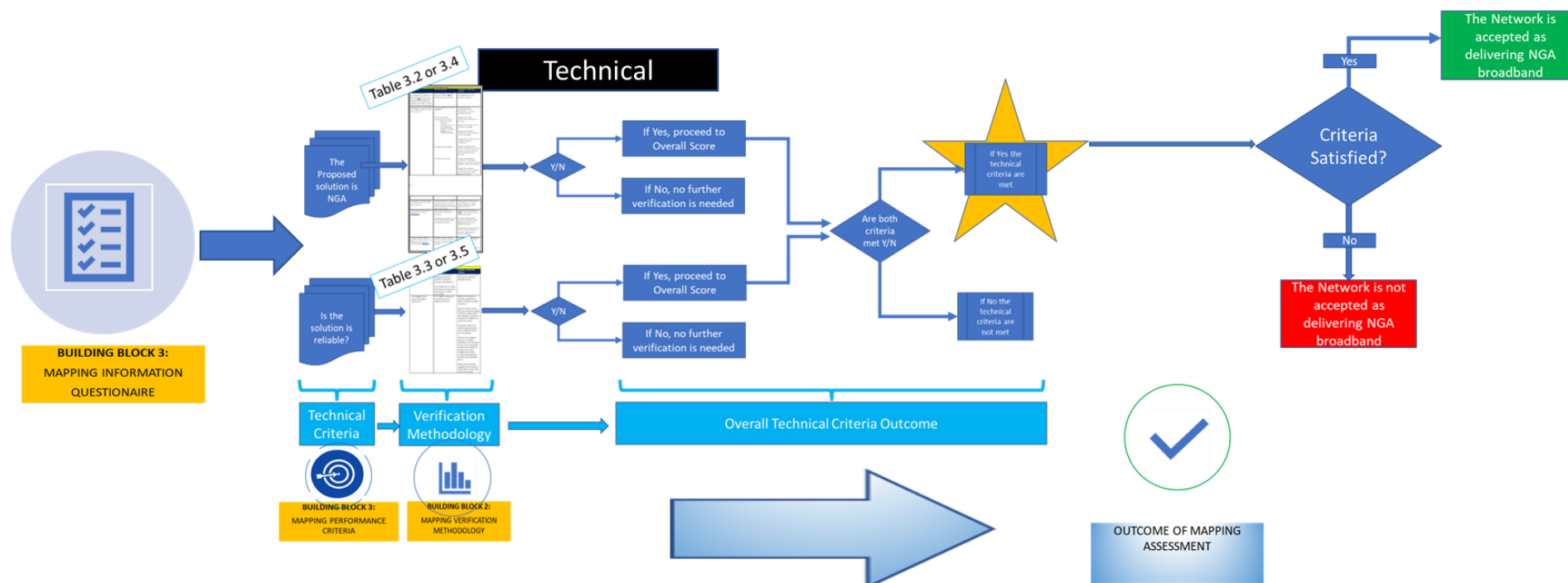


Figure 4.14 The end-to-end process for the assessment of a Service Provider claim relating to an existing network.

Figure 4.14 illustrates how the three Online Map Building Blocks are applied against an existing network claim to determine the outcome of the mapping assessment. For a future planned network, verification methodologies for deployment and financial must also be developed. The summaries of these verification methodologies are outlined in Figures 4.15 and 4.16.

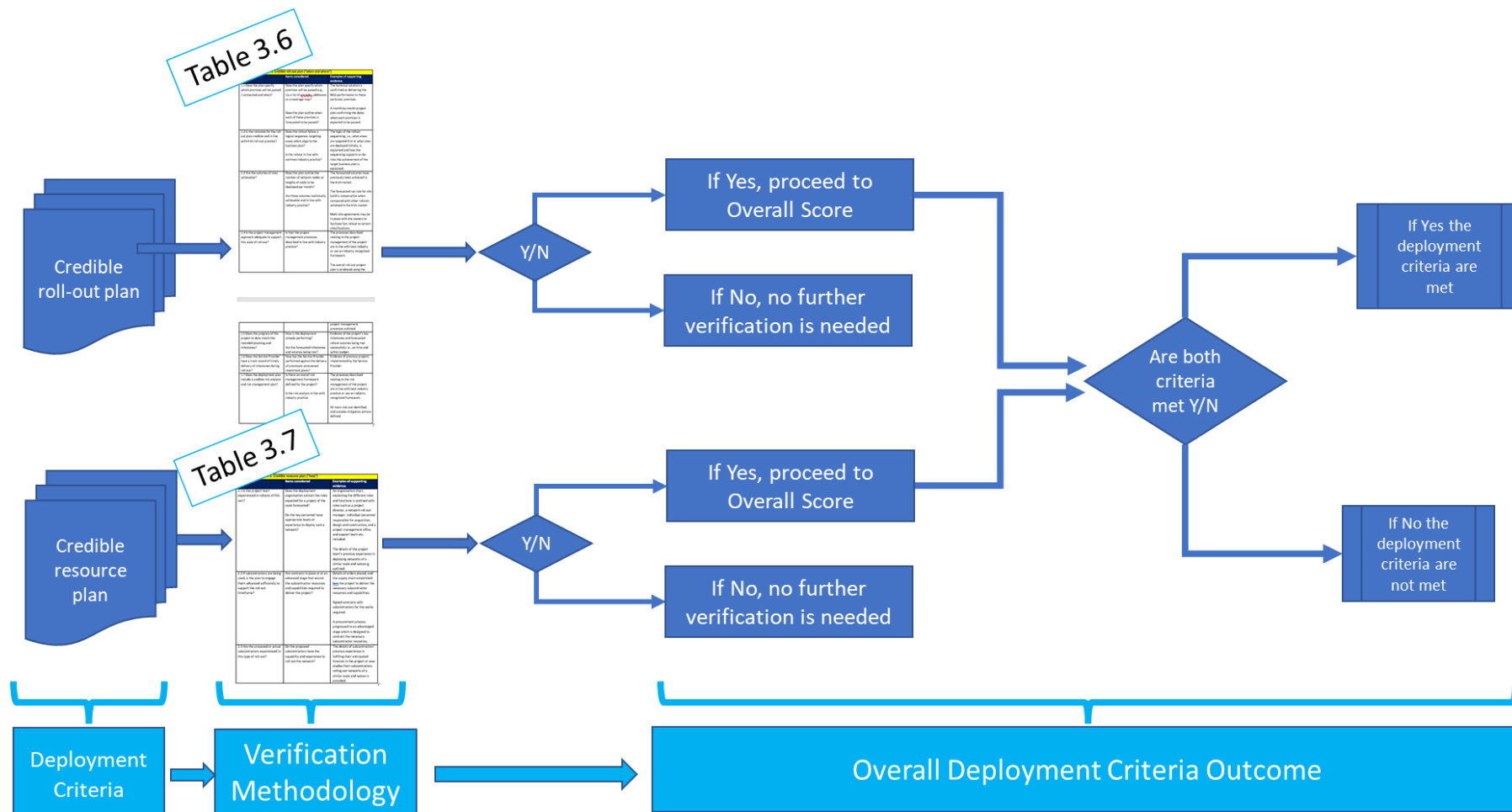


Figure 4.15. Summary of the NBP Deployment Criteria Verification Methodology (outlined in Figure A 3.17 of Appendix 3).

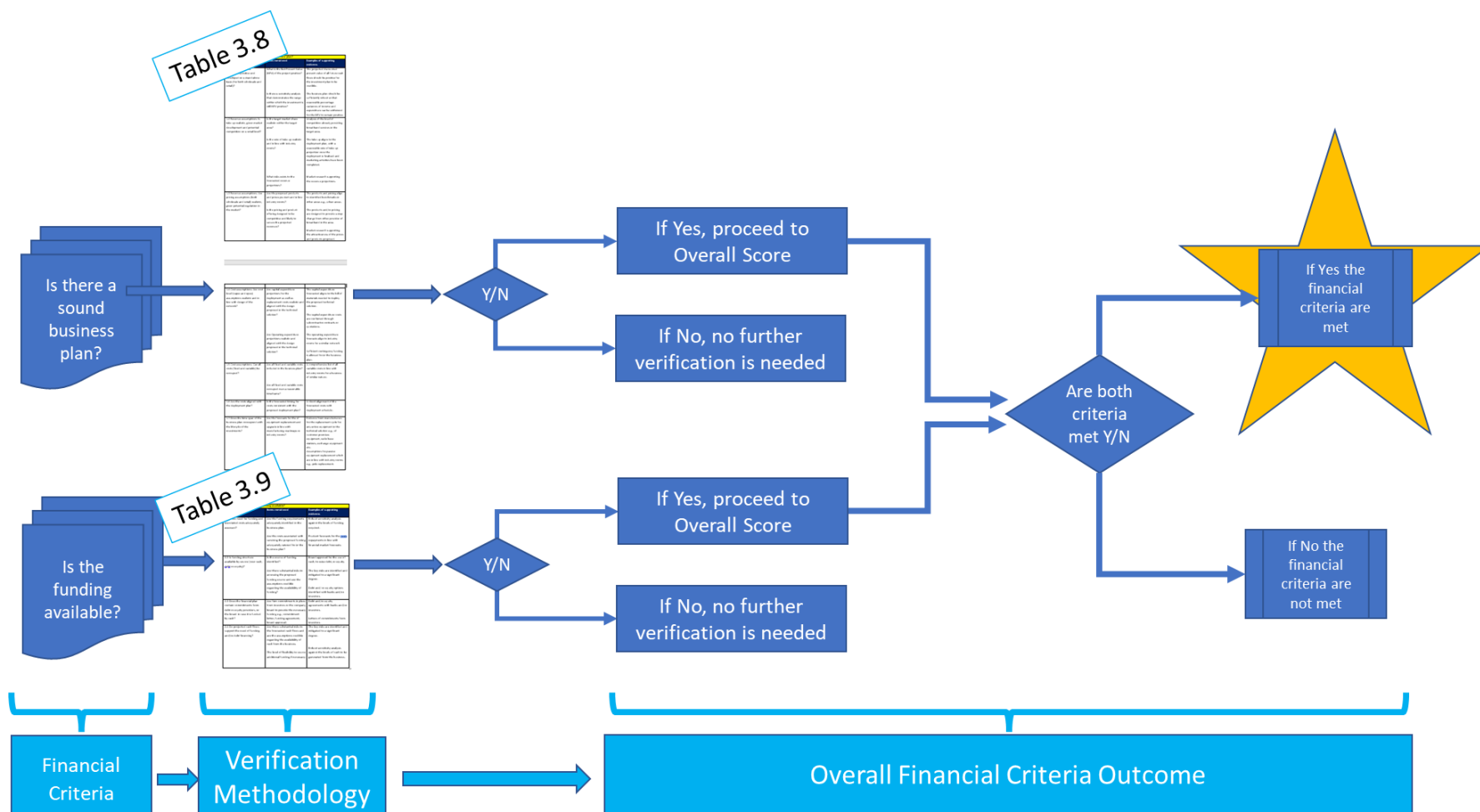


Figure 4.16. Summary of the NBP Financial Criteria Verification Methodology (outlined in Figure A 3.20 of Appendix 3).

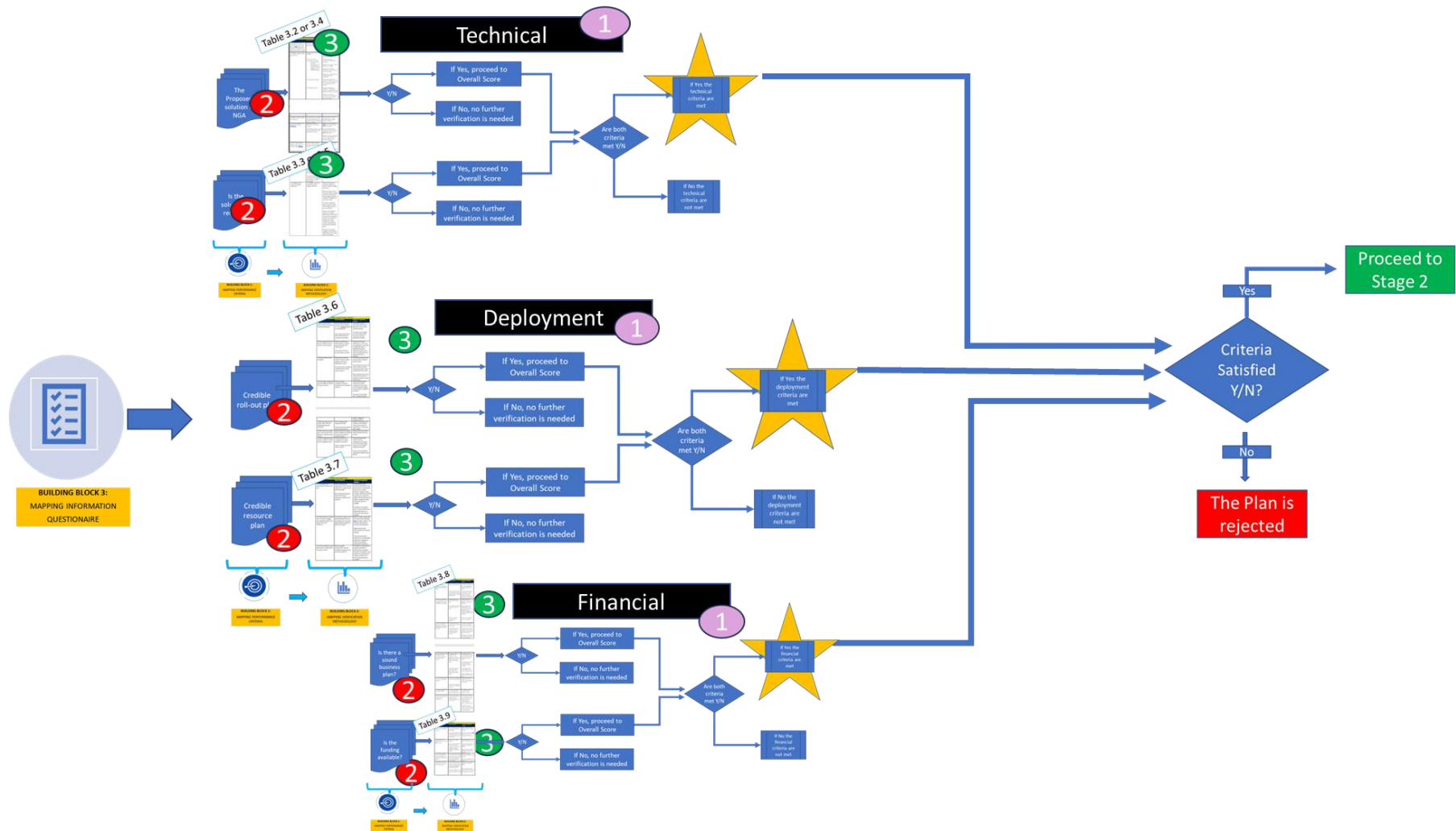


Figure 4.17. The primary flowchart that was created and which is further explained in Appendix 3 - A 3.21. It illustrates the Stage 1 activities of the framework for a future planned network claim.

This annotated flowchart, as outlined in Figure 4.17, includes, for example:

- ✓  The Technical, Deployment and Financial criteria and their verification is brought together in a single flow chart.
- ✓  The performance criteria for Technical, Deployment and Financial criteria are each included.
- ✓  The verification methods (which are newly created tables described in detail in Appendix 3) are linked directly to each Technical, Deployment and Financial criteria.
- ✓  The flow of decision making is clearly identified in the diagram and how each verification method eventually converges to a final outcome decision point.

This new flowchart was deliberately developed iteratively over the course of Appendix 3 so that the reader can follow and understand its meaning. As mentioned earlier, a summary table concludes how each criterion is assessed; now as each criterion is individually described and discussed, the flow chart is then augmented by that individual step until eventually we conclude with the primary flowchart in Appendix 3 - A 3.21.

The final additional enhancement is provided throughout Appendix 3 but in particular throughout Appendix 3.2, (which runs to almost 30 pages), through the provision of explanatory notes, which outline how each step of the verification methodology is conducted. This includes what calculations are used; what static values for different parameters are used and why; how the different Service Provider information submitted feeds into the calculations and each of the assessments. Each step of the verification process is described and discussed in detail so that a deep understanding can be gained and even replicated if this were appropriate.

For example, for *'Technical Criterion 1 – Is the Proposed solution NGA? – Wireless'*, Appendix 3.2.2.2 explains in detail how each parameter relevant to this criterion is assessed (please note this criterion has four parameters). The verification methodology for the first technical

parameter '*Will the technology deliver a minimum of 30 Mbit/s download to each user?*' is extremely complex and examines multiple characteristics of the Service Provider's network. The explanatory notes for just this parameter run to over 11 pages and can be found in Appendix 3.2.2.2.2.

These detailed explanatory descriptions provided in this research are not documented in a similar fashion anywhere else and could only have been derived from the insights and understanding from an active participant in the project. The lived experience of creating and then implementing the NBP Mapping Assessment Framework is an essential contributing factor to the research itself. Again, these detailed explanatory notes took a considerable amount of time to derive and draft but form a critical component of the outputs achieved.

This thesis asserts that if a new project were provided with this newly created framework, which:

- introduces the concept of three online map building blocks;
- reorganizes the information in a significantly more simplified fashion;
- documents what needs to be considered;
- clarifies the key steps through clear process flow charts and tables; and
- is accompanied by detailed explanatory notes;

then this would significantly aid the project. It would considerably demystify what needs to be done, it would provide a clear reference of how to do it and it would ultimately shorten the period of time needed for the development of processes required for future online maps.

To develop the three Online Map Building Block used in the NBP Mapping Process, five separate mapping consultations were undertaken over a 28-month period. Armed with the material that is now documented in this thesis, a future project could gain significant efficiencies by taking the NBP material as a strong starting and then consider what tweaks and updates would be needed in the context of their own market and policy objectives. They could then revise the three Online Map Building Blocks documented herein and

customize them to meet their own State's requirements. **I contend that a future project could then fast track this whole process by targeting a single mapping consultation rather than the five undertaken in the Irish State's NBP project.** Through this single mapping consultation, they could then seek views from stakeholders on draft performance criteria, draft verification methodologies and a draft information questionnaire informed by this research and therefore significantly well-developed and nearly finalised. Inevitably this would greatly shorten the period needed to develop the building blocks for their Mapping Process.

4.4 Insights from going through and reconceiving the process

Arising from the experience of personally implementing the NBP Mapping Process; standing back and reflecting on what was implemented and why; and subsequently recasting the framework in a more reuseable manner. post implementation, has afforded the opportunity to glean further insights and observations that can potentially be of further use to those planning broadband State interventions. These insights and observations are outlined below.

It is intended that EU Member States and other interested parties should be able to read this section of the Chapter and make sense of these key insights without having to read the detailed descriptions of the online map building blocks provided in Appendix 3 which might be of more interest to someone designing the more detailed processes or definitions, for example, defining the performance criteria or developing the verification methodologies.

4.4.1 Insight 1 – **The complexity of the Verification Methodology is often considerably underestimated**

While the performance criteria set the 'target performance levels' needed to be achieved for a Service Providers' network to be considered capable of delivering high speed broadband and thus removed from the State's target intervention area on the online map, separate and distinct verification methodologies are also needed to determine whether these performance criteria are in fact met or not.

A performance criterion might be, for example, that the Service Provider network consistently delivers a 30Mbps download service, whereas the verification methodology will determine whether this is the case or not; it will involve a deep analysis of the network, its technology, how the network is designed, configured, and managed particularly during the busiest periods of the day, how many customers it is serving etc. EU Member States, who have yet to conduct a mapping exercise, may not always recognize the detail and scale of effort required to undertake the verification activities until the process is well underway. It is often misconceived that checking whether a performance criterion is met or not is a binary exercise, where the outcome is an obvious ‘yes’ or ‘no’ and where little or no verification is required. As demonstrated by the scale and complexity of the Mapping Verification Methodologies outlined in Appendix 3.2, this is very far from a simple binary exercise and many factors must be considered.

The assessment of the first technical criterion ‘is the proposed solution NGA?’ as outlined in table A 3.2 of Appendix 3, five different parameters are examined as part of the assessment and within these parameters, and multiple different network characteristics are examined. It is not a matter of just reading the results of a speed test on the network for example. The reality is that considerable time, effort, and expertise must be expended on the development of these verification methodologies.

The EU Commission SAG does not provide any guidance on verification methodologies or give any indication of the scale of challenge that these methodologies present to EU Member States progressing a robust mapping exercise. Typically, it is only through iterative discovery that this complexity is revealed.

4.4.2 Insight 2 – The number of Performance Criteria and sub parameters used should be minimized

The number of performance criteria and sub parameters used should be kept to a minimum so as to keep the end-to-end process as efficient and lean as possible. Figure 4.8 outlined the list of technical performance criteria along with the sub criteria/parameters for each criterion used in the Irish NBP intervention project and section 4.3.1 expands on the performance criteria and parameters used in Ireland a bit further. Each performance

criterion leads to the development of a corresponding verification methodology and as illustrated by Appendix 3.2, verification methodologies must be very precise and developed to a granular level. Consequently, they are lengthy, complex and time consuming, both to develop and then implement. For example, as described in section 4.2.7 there were a total of six performance criteria with 26 corresponding sub parameters defined for the NBP Mapping Assessment Framework; and each of these 26 sub parameters have several individual characteristics which needed to be considered carefully as part of the assessment. This led to a significant amount of work, both up front in the development of the verification methodologies and then subsequently in the implementation of the assessments against Service Provider claims.

Therefore, it is important to make every effort to minimize this work, by balancing the desire to define a significant number of different performance criteria and sub parameters (with corresponding characteristics), so that the target performance is adequately described with the complexity that each criterion or sub parameter will inevitably introduce to the verification methodologies.

Defining too many performance criteria and sub parameters will likely lead to the verification methodologies either becoming too unwieldy and unworkable or perhaps unnecessarily time consuming.

Having conducted the NBP Mapping Assessment Framework it is possible to identify sub parameters that can be deemed superfluous. For example, the NBP Mapping Assessment Performance Criteria used for Technical (please see Appendix 3.1.1.1 for the full details) identified the parameter 'whether the solution is able to support a variety of advanced digital services including converged all-IP services?' This parameter required a corresponding verification methodology which was subsequently applied to every Service Provider claim submitted to the Department. However, the assessment against this parameter offered little benefit to the verification exercise as practically all modern telecommunication technologies could reasonably attest to meeting the criterion.

4.4.3 Insight 3 – **Verification Methodologies must be modified for each network type**

Whilst the performance criteria must be the same for all network types, the verification methodologies must differ and be adapted depending on the network type and in some cases, the technology used in the network.

As part of the NBP Mapping Process, initially a uniform verification methodology was envisaged but it was quickly realized that this approach was not realistic, once the diverse range of network types and technologies that were being used to deliver broadband services across the State were identified.

For the NBP Mapping Process, the NBP project team concluded at the time that two different verification methods were needed, one for the technical verification of wire line networks and a second for the technical verifications of wireless networks.

A wire line technical verification methodology was developed which assessed multiple wire line network types (Appendix 3 - A 3.2.2.3 outlines the verification methodologies used in the NBP Mapping Process for wire line networks). These network types included:

- Fibre To the Home networks using Gigabit Passive Optical Network (GPON) based technologies;
- Fibre to the Cabinet network types using Very high-speed Digital Subscriber Line (VDSL);
- and Data Over Cable Service Interface Specification (DOCSIS) technologies.

The corresponding verification method included, tracing the physical routes of cables that were deployed; measuring the actual cable lengths from the target premises to the local exchange or cabinet in the network; identifying the theoretical broadband performance at different distances from the exchange or cabinet through a review of the link budget use in the design of the network, i.e. this review would include a review of the inputs assumed in the link budget calculations such as the level signal loss assumed at splitter or junction points; and comparing the actual deployed cable length to the theoretical distances indicated by the link budget so as to determine whether an NGA broadband performance

could be maintained to every target premises. This tracing of the physical routes cable lengths from the target premises and verifying whether the service could still be delivered simply would not be applicable to a wireless network.

A wireless technical verification methodology was also developed, (Appendix 3 - A 3.2.2.2 outlines the verification methodologies used in the NBP Mapping Process for wireless networks) which assessed wireless network types including:

- Fixed wireless networks using 4G LTE or 5G; and
- Wi-Fi based networks.

This verification method included, for example, examining the theoretical total capacity of each sector of cell and comparing this calculation to the actual configurations of equipment actually deployed on each cell site; identifying the number of premises within the coverage area of that site; reviewing the level of take up assumed from the premises that reside within the cell's coverage area; reviewing the level of capacity assumed for each premises within the coverage area; so as to determine whether each site has sufficient capacity to serve the target premises within the cell.

This verification approach simply would not be applicable to a wireline network. Therefore, different technical verification approaches were needed and applied depending on the technology type used in the network.

4.4.4 Insight 4 – Determining the credibility of planned network that is yet to be deployed is a concept unique to State Aid Rules

For State Aid Approval, both existing networks and networks that are not yet deployed but will be deployed in the near future⁶⁹ must be considered. This is a unique requirement that emanates from the EU's core State Aid principle of minimizing the distortion to the market. Forecasting whether a plan is credible and concluding whether it will likely happen or not, is

⁶⁹ The phrase 'near future' refers to within 3 years or within the same timeline as the proposed market intervention.

a matter of assessing the preparedness of the plan and the level of risk involved. This is more akin to an assessment a financial investor might undertake as part of a due diligence exercise rather than a technical network assessment.

Therefore, the performance criteria that must be defined have to include not only the required technical performance criteria but also criteria that define the level of deployment readiness required and define the level of financial readiness required for the projects to be deemed credible.

As described in section 4.2.7, the NBP Mapping Assessment Framework defined performance criteria for both deployment and financial; and corresponding verification methodologies were developed against, (a recast version of these are outlined in Appendix 3.2). The NBP Mapping Assessment Framework also required a formal legal agreement to be signed by any Service Provider committing to their future deployment for that deployment to be deemed credible (as outlined in Appendix 3.2.7).

As can be imagined, the whole exercise of assessing a future planned network comes with significant risk both for the State and the Service Provider themselves. If, for example, the plan is deemed 'credible' through the verification exercise and therefore the areas covered by the future network are excluded from the State's intervention area; but the future planned network is (for whatever reason) not subsequently deployed; then these areas will likely be left outside of the State's intervention plan with little prospect of their broadband service deficits being resolved. Similarly, if a future planned network is deemed 'not credible', this could result in a prospective investment not proceeding as planned.

Therefore, great care is needed in the development of the verification methodologies for future planned networks; the implementation of the assessments of future planned networks; and if deemed 'credible' and accepted as a future planned network, their anticipated progress should be closely monitored to ensure they are actually deployed.

4.4.5 Insight 5 – The Mapping Information Questionnaire should be designed to gather the necessary information specifically for the verification activities

The mapping information questionnaire is not just a generic questionnaire to Service Providers asking for information on their network or future investment plans. The questionnaire must be specifically designed to feed the necessary information required to conduct the verification of each performance criteria and parameter. There needs to be a direct correlation between the information requested and the verification methodology that will be applied to Service Provider claims so that the verification can be fully implemented without having to ask for further information and so that the Service Provider is clear on what information is needed to submit a claim and therefore doesn't expend time and effort collecting information that will not be needed.

Appendix.1 of the NBP Framework	Generic questions which Service Provider information requested to provide	The NBP Mapping Assessment Framework parameter which required this information
1	A description of the overall network architecture.	1. Section 3.2 parameter 1.1 2. Section 3.2 parameter 1.2 and 1.3 i. Section 3.2.1 - 1st bullet ii. Section 3.2.1 – 2nd bullet iii. Section 3.2.1 – 4th bullet iv. Section 3.2.1 – 3rd bullet 3. Section 3.2 parameter 1.4 4. Section 3.2 parameter 1.5 5. Section 3.2 parameter 2.1 6. Section 3.2 parameter 2.2
2	A description of the access network technology and the specification of the access equipment (including the relevant telecoms standards with which the equipment complies).	1. Section 3.2 parameter 1.1 2. Section 3.2 parameter 1.2 and 1.3 i. Section 3.2.1 - 1st bullet ii. Section 3.2.1 – 2nd bullet iii. Section 3.2.1 – 4th bullet 3. Section 3.2 parameter 1.5 4. Section 3.2 parameter 2.1 5. Section 3.2 parameter 2.2
3	A description of the backhaul network technology (national ¹¹ and metro ¹²) and the specification of the backhaul equipment (including the relevant	1. Section 3.2 parameter 1.1 2. Section 3.2 parameter 1.2 and 1.3 i. Section 3.2.1 – 3rd bullet 3. Section 3.2 parameter 1.4

	telecoms standards with which the equipment complies).	4. Section 3.2 parameter 1.5 5. Section 3.2 parameter 2.1 6. Section 3.2 parameter 2.2
4	A design for the national backhaul network including any traffic and capacity assumptions.	1. Section 3.2 parameter 1.2 and 1.3 i. Section 3.2.1 – 2nd bullet ii. Section 3.2.1 – 3rd bullet 3. Section 3.2 parameter 1.4 4. Section 3.2 parameter 2.1 5. Section 3.2 parameter 2.2
5	The specification of all types of customer premises equipment which the operator plans to use.	1. Section 3.2 parameter 1.2 and 1.3 i. Section 3.2.1 - 1st bullet 2. Section 3.2 parameter 1.5 3. Section 3.2 parameter 2.1 4. Section 3.2 parameter 2.2
6	Coverage data in the form of a Polygonised (vector) dataset with 'DOWNLOAD SPEED' attribute attached to the polygon, delivered in one of the following formats, ESRO Shapefile (Polygon); ESRI PGB (polygon feature class); Map info MID/MIF (Polygon); KMZ (Polygon); DXF/DGN. This coverage data is requested to include: - NGA broadband coverage with contours corresponding to available download speed or, a map showing all premises covered, with the premises coded according to the speed they will receive. The download speed must be no less than 30 Mbps: - Any assumptions made in relation to the contours; - Mapping of existing and planned coverage.	1. Section 3.2 parameter 1.2 and 1.3 i. Section 3.2.1 – 4th bullet
7	Any other relevant information that could assist the DCENR in assessing the concrete nature of submission.	

Table 4.1 What information was sought from Service Providers as input to the verification methodology.

Table 4.1 shows how specific information sought in the NBP questionnaire provided the necessary input to conduct verification against specific parameters in the NBP Mapping Assessment Framework.

Therefore, ideally, the performance criteria should first be set, and then the verification methodology must be designed before lastly the full set of the questions in the information questionnaire can be finalized.

4.4.6 Insight 6 – The quality of network information varies considerably amongst Service Providers so a degree of data validation must be applied

It may be expected that Service Providers have clear and precise information on where their own networks are deployed, the equipment they have deployed, the configurations of this equipment, which customers they are serving and of the level of service they are providing to their customers. Unfortunately, this is not the case. The quality and accuracy of the information provided by Service Providers will vary considerably.

Not all Service Providers maintain precise and accurate inventory records and as a result they cannot confirm where their network infrastructure is actually located or what has been deployed. For example, the Irish incumbent Service Provider, eir, has the largest volume of passive network infrastructure in the State (including substantial volumes of poles and ducting infrastructure), some of which was deployed over 30 years ago, e.g. the useful life expectancy of a wooden telegraph pole can be up to 30 years in duration. Unfortunately, eir's record keeping does not always record the geographical coordinates of every pole or duct accurately. In eir's case, despite best efforts, the information received on some poles incorrectly located them in the middle of fields or in the Irish Sea. Despite considerable efforts from Service Providers, grossly inaccurate information was received as part of the NBP Mapping Process.

A level of interpretation and validation of the information received is needed. Checks on the accuracy of the information need to be included in the verification exercise.

4.4.7 Insight 7 – **Professional judgment and expert opinion is critical to the assessment**

The implementation of the verification methodologies and the determination of scores for each parameter is not always a purely mechanical exercise; a subject matter expert's view is required to opine on whether the proposed solution fully meets the criteria or not.

Technical assessments of broadband networks are often misconceived as akin to a mathematical formula that will produce a binary output. However, this is not the case and the process of verifying the performance of broadband networks is more nuanced and requires an element of professional judgment to be applied.

For example, Technical criterion 2 parameter 2.2 states the following:

'2.2 Are there concrete measures to mitigate interference?'

The verification of this parameter involved a review of the mitigation measures or protections put in place by the Service Provider to mitigate the impact of interference to the network. The ability of the technology to mitigate interference is highly dependent on the network design used and the specific configuration of equipment that were actually deployed in the network. For example, some equipment providers have inherent features which support the management of interference in general (e.g., beam forming, transmit frame synchronization), the review considered whether these features had been activated and deployed consistently in the network. The network design was reviewed to verify whether any of the technology's interference management capabilities were used and whether the installation practices were modified depending on the interference risk (e.g., practices such as the use of separate channels for transmitters on the same mast, robust installations at customer premises utilizing high gain antennas and narrow beam filters). These measures were considered likely to mitigate the impact of potential interference. The monitoring capabilities and the ability to quickly address issues as they arise were also reviewed.

Ultimately all the different mitigation measures the Service Provider had in place to mitigate the impact of interference to the network had to be considered in aggregate and a risk score had to then be applied of 'Low', 'Medium' or 'High'.

The verification methodologies and the determination of scores for each parameter relied on expert opinion and their professional judgement. These decisions are likely to be the subject of significant scrutiny from Service Providers who might not agree with the scores assigned to the different aspects of their network. Therefore, it is important to ensure the appropriately qualified resources with a sufficiently deep level of expertise are available to conduct the verification exercise and assign the score for each parameter.

4.4.8 Insight 8 – The mapping exercise is highly onerous, expert resources are needed across a broad set of disciplines

It is only when the full set of tasks and activities are set out clearly, as they are now in Appendix 3, does the scale of the activities become fully apparent. An extensive team of multi-disciplined system matter experts are needed to conduct assessments of this nature. For the technical verification activities alone, several different disciplines are needed.

For example, for a wire line network submission deploying a fibre to the home technology:

- a Geographic information systems expert may be needed to calculate the actual fibre route lengths;
- a fibre design expert may be needed to review the link budget assumptions; and
- a fibre technical solution architect may be needed to determine the capability and theoretical capacity of the equipment used.

For a wireless network submission deploying a Fixed Wireless Access solution:

- a Geographic information systems expert may be needed to calculate the distance from the mast to the target premises;
- a radio access design expert may be needed to review the link budget assumptions; and
- a radio technical solution architect may be needed to determine the capability and theoretical capacity of the equipment used.

Similarly for the deployment and financial verifications activities several different disciplines are needed. It should be remembered that the findings are highly contentious and likely to be challenged by Service Providers who do not agree with the conclusion on their claims so the level of expertise used is important so that the findings can be relied upon.

For the NBP Mapping Process, the necessary technical and deployment expertise was provided by Analysys Mason and the financial expertise was provided by KPMG.

It should also be noted that the Department also realized technical, financial and economic expertise was essential to the project steering, guidance and implementation. They recruited strategic competence to lead roles in each of these areas within the NBP project team, so that the internal project team could be managed effectively without relying solely on the external advisory services. This strategic recruitment is strongly advised to be complemented by extensive advisory services.

4.5 Conclusions

The insights and contributions outlined in this Chapter come from a desire to make the creation of an online map, a process that becomes well understood by other EU Member States wishing to roll out a broadband intervention scheme. They emanate from a deep analysis of the Irish NBP intervention project. Significant work was required to take the NBP Mapping Assessment Framework and recast and reorganize the activities into the three Online Map Building Blocks. To further demystify the Mapping Process, a comprehensive step by step guide of the verification methodology is now documented, complimented by a series of summary tables. Flowcharts were also developed to help guide the reader through this complex framework in a logical manner. In addition, as part of the analysis eight key insights were garnered. It is intended that EU Member States and other interested parties can make sense of these key insights even before reading the detailed descriptions of the Online Map Building Blocks provided in Appendix 3.

The contributions set out in this Chapter have the potential to greatly benefit those who are now designing interventions in other EU Member States. A future project can now reference

material from a real-life project which has successfully implemented a Mapping Process. Rather than developing their own building blocks in an iterative fashion over multiple public consultations (as explained, five were needed in the Irish State's project), I contend that a future project could significantly shorten this process by leveraging the material that is outlined in this thesis. A future project could update the NBP Online Map Building Blocks, taking into account their own market and policy objectives, and jump straight to the final mapping consultation. This would inevitably shorten the time needed to develop their own building blocks.

What follows now in Chapter 5 is a description of the series of engagements that were undertaken with external policy makers over the course of the research. These engagements sought to test and corroborate the findings described throughout Chapter 3 and Chapter 4, as well as influence any future guidance provided by the EU Commission to EU Member States relating to the Mapping Process.

Chapter 5

Corroboration of findings and Engagement with Policy Makers

5.1 Introduction

The ultimate aim of this research is to inform and improve future mapping projects for EU Member States carrying out State interventions in the broadband market. The work described thus far has had at its core the objective to create accessible material that built on the Irish experience and that through this thesis is made available to interested parties.

However, as mentioned already, I was an active participant in the NBP process and very conscious that while undertaking research based on my work that the risk of bias was possible. A deliberate strategy undertaken to mitigate this risk was to regularly seek outside perspectives from key stakeholders to test the validity of the ideas and findings as they emerged.

This Chapter focuses on the activities undertaken, as the research progressed, in bringing the ideas uncovered by the research to others to verify whether they could in fact inform future projects.

In addition, in doing so, I also took opportunities to inform EU policy. An additional way in which future mapping projects can be informed and improved is through changing the rules and guidelines at an EU level. It is the EU Commission itself who provides guidance to all EU Member States on how to adhere to EU State Aid rules. While this research, once published, will be available for use to any EU Member State, any formal guidance published by the EU Commission, specifically on the Mapping Process, would clearly serve as the primary reference for future projects. Therefore, for this research to have the greatest possible impact, sharing my findings directly with the EU Commission and thus influencing and shaping the EU Commission's future guidance on the Mapping Process was desirable. Informing any EU guidelines is challenging and of course updates typically come from a multitude of inputs and are not based on the work of any single individual. However, my specific contributions to the process which resulted in the updated SAG (published in 2023) are outlined on this Chapter.

This Chapter revolves around the key engagements undertaken between 2019 and 2023, namely the engagement with other EU Member States through the EU's Broadband Competence Office (BCO) Network (the network established by the EU Commission to facilitate information sharing across EU Member States, described in section 2.3.1) which is outlined in section 5.3, an evaluation of the SAG undertaken by the EU Commission which can be found in section 5.4 and their targeted mapping consultation which can be found in section 5.5. Section 5.2 serves as a general introduction.

5.2 Background – Opportunities to provide input to the EU Commission

To test the validity of the ideas and use the evidence uncovered through this research to aid with the development of future guidelines, it was important to first identify the appropriate channels or fora.

A number of approaches were considered; this included the formal publication of the research findings, direct unsolicited submissions to key stakeholders in the EU Commission, presentations to other EU Member States, dissemination of the information at the EU's Broadband Competence Office (BCO) Network meetings and responding formally to any relevant public consultations that arose over the course of the research. All the above approaches were considered useful and likely to be effective to some degree.

Naturally, as the EU Commission had already established the BCO network with the main purpose to promote the sharing of best practice among all EU Member States, it made most sense to leverage this existing structure in the first instance. The BCO Network had considerable reach, with members from every EU Member State typically present at each meeting and strongly supported by the EU Commission. Section 5.3 describes the engagement which was undertaken towards the EU Commission and other EU Member States as part of a BCO Network meeting held in October 2019.

Another significant opportunity for engagement was leveraged between 2020 to 2023, when the EU launched an initiative to evaluate the effectiveness of the entire SAG. They

then subsequently updated the SAG where they felt it was appropriate. The EU Commission considered all aspects of the SAG, however with this research in mind, I focused the evidence I provided on the Mapping Process so that it would be considered in the development of any new mapping guidance. Section 5.4 steps through this engagement.

5.3 Testing ideas and findings with the BCO Network

As briefly explained in section 2.3.1 the BCO Network is an extremely important forum, facilitated by the EU Commission which enables networking and information sharing among peers across EU Member States.

In October 2019, I took the opportunity to present to this forum based on the initial findings of this research. The BCO Network meeting in October 2019, was a full day in-person meeting, hosted in the EU Commission buildings in Brussels. The meeting focused on mapping and EU Member States were encouraged to send representative who had a particular interest in the mapping activity. As a consequence, this meeting represented a good opportunity to test my initial ideas and receive direct feedback on their usefulness.

All EU Member States were represented at the meeting, however not all were in a position to send officials who had experience in the mapping activity. Whilst some EU Member States such as Ireland, Sweden and Germany had already built-up extensive experience in mapping and had developed more in-depth and detailed processes relating to the activity, most countries had yet to establish a significant mapping function and had little experience in what was required to achieve State Aid Approval. Understandably, the morning session of the meeting focused on introducing the basic concepts of the mapping exercise and its purpose to members. This was presented by the EU Commission themselves. The afternoon session provided an opportunity for EU Member States with more experience to share their learnings; this included my presentation 'The Challenges of Mapping NGA Areas to establish Market Failure for State interventions' (54), which was followed by extensive questions and answers from attendees.

By way of introduction my presentation firstly provided a high-level history of the project as outlined in Figure 5.1.

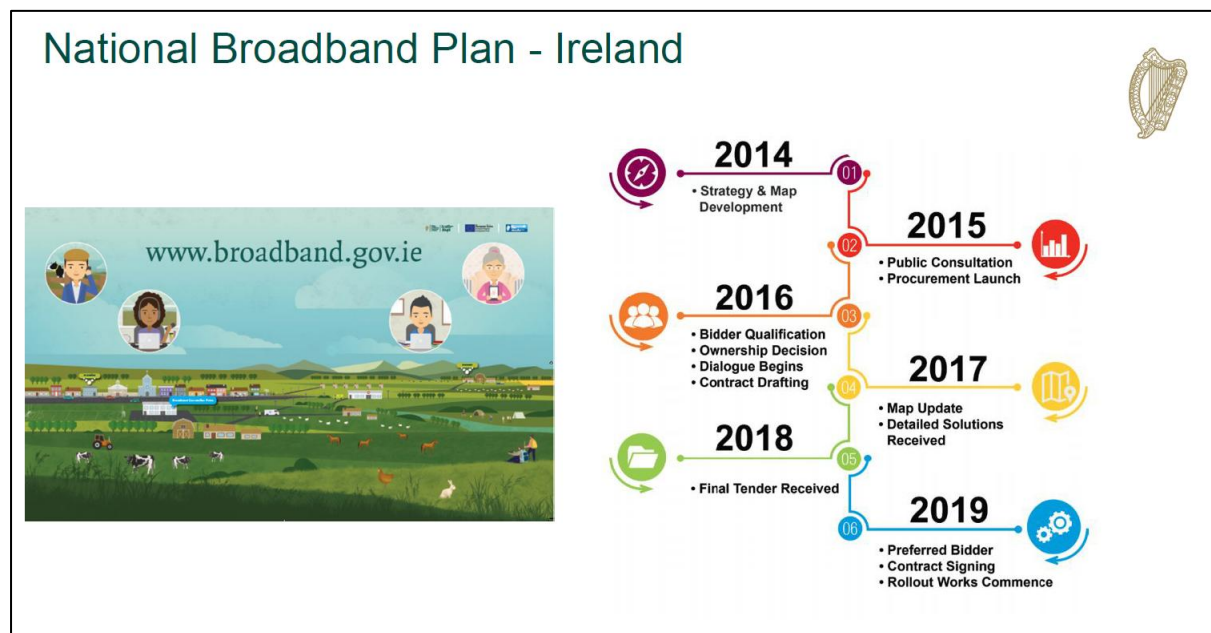


Figure 5.1. A high-level timeline of the NBP Intervention Project presented to the BCO Network.

Surprisingly, the simple NBP timeline presented in Figure 5.1, was of particular interest to all attendees and generated many queries, as historical records of State intervention projects are not commonly available. Based on this reaction I subsequently undertook to develop a more comprehensive record of the NBP project, which is now documented in section 3.3.

I then explained the various public consultations that were undertaken relating to the mapping exercise, as outlined in Figure 5.2.

Mapping Consultations



Title of consultation	Public Consultation period	Responses
Call for input	30 June 2014 to 15 Sept 2014	32 submissions
NBP High Speed Map Consultation	24 November 2014 to 12 February 2015	29 submissions
Supplementary Information Request	March – December 2015	6 submissions
NBP Intervention Strategy Public Consultation	15 July 2015 to 25 September 2015	41 responses received on the overall nine reports published around the Intervention Strategy, a subset of these responses related to the Map
Consultation on the Process for updating the High Speed Broadband Map - pre, during and post procurement	21 October 2015 to 11 November 2015	16 submissions
Consultation on Map and Strategic Environmental Assessment (SEA) and Appropriate Assessment (AA)	2 January 2018 to 9 February 2018	18 submissions received on the Map
National Broadband Plan Conclusion of the Mapping Exercise for the Intervention Area Pre Deployment	26 July 2019 to 30 September 2019	185 submissions received - 30 industry - 155 consumers

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Figure 5.2. A summary of the mapping consultations, presented to the BCO Network.

Again, sharing the perspective that more than one public consultation was needed (as described as observation 2 in section 3.4) came as a surprise to many attendees. The EU Commission and the SAG both indicate that a single public consultation is required, however it is found in practice several are actually needed. This view was corroborated by attendees from Sweden and Germany. Based on this feedback, I realised that I not only needed to identify more clearly the process to produce an online map, which is now documented in Chapter 4, I also needed to highlight how often the online map was consulted, why multiple consultations are needed and the level of reliance on the mapping process in general, which is now documented in section 3.4.

The latter part of the presentation shared high-level insights relating to the mapping process a sample of which is outlined in Figure 5.3. (a), (b), (c), (d).

Defining the criteria that must be met



Member States must develop detailed criteria for mapping

- ❑ what is the EU target of 30 Mbps?
 - An average over a certain period, a minimum committed as all times etc.
 - What level of service should a consumer expect?
- ❑ Other important service parameters such as Upload , latency, packet loss, reliability, availability, are these to be defined?
- ❑ Clear terminology and definitions
 - Premises Passed, Premises Connected, Busy Hour, Coverage etc

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Figure 5.3. (a) The complexity of defining the performance criteria.

Assessment of existing and future planned networks



- ❑ Member States must develop the assessment process
- ❑ Techniques to assess operator data must be developed
 - Should assessments seek to determine the performance on a per premises basis or wider areas?
 - The performance of an network is dynamic for example as more users connect and each user consumes more and more data very year
 - Operators commitments to a long term future business plans



9 An Roinn Cumarsáide, Gníomhaíthe ar son na hAeráide & Comhshaoil | Department of Communications, Climate Action & Environment

Figure 5.3. (b) The challenges of developing assessment methodologies.

Information accuracy



- ☐ Operators do not maintain service clear data identifying the locations where their services are available to customers.
- ☐ Performance measurement processes are operator specific
- ☐ The granularity of information varies between operators (per site, per exchange, per cabinet, per premises etc)
- ☐ How is information standardised?
- ☐ How can the information be validated?

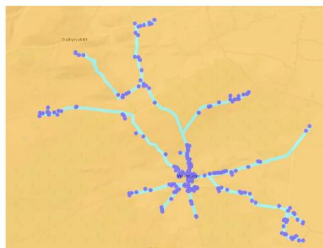
- ☐ Operators developments can change the data set, new plans, technology enhancements etc

Figure 5.3. (c) The challenges with information gathering.

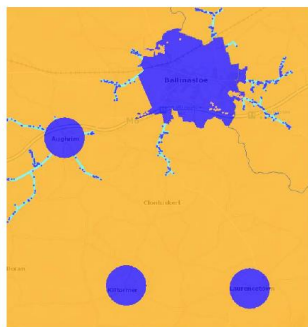
Technology Mapping



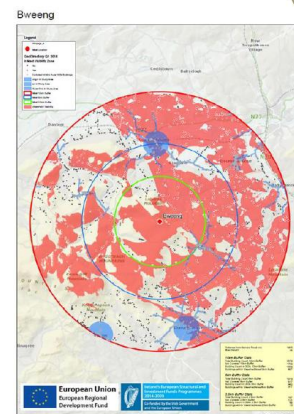
Each Technology presents different challenges to mapping:



Fibre to the Home - FTTH



Fibre to the Cabinet - FTTC



Fixed Wireless - FWA

Figure 5.3. (d) The challenges of mapping different technologies.

The slides outlined in Figure 5.3 (a), (b), (c), (d), are a sample of the several high-level insights presented. These high-level insights included, for example (i) that very specific and detailed performance criteria supported by precise definitions must be developed, (ii) the assessment processes must be developed separate to the performance criteria themselves, (iii) that information gathering from the Service Providers presented a difficult challenge for several different reasons and (iv) that each technology presented different challenges for

the mapping process. Each of the insights presented were well received, and even those attendees with little mapping experience were able to grasp the main concepts and ideas presented. This encouraged me to develop these high-level insights further, as documented in section 4.4 and to ensure that the insights were kept to a level that stakeholders with limited mapping experience could easily understand.

Lastly, attendees were surprised to hear the level of public, political and media interest in the NBP Map. I explained, that up to the time of the presentation, over 500 questions from members of Irish Parliament had been received, over 2,500 articles in National and local newspapers had been written, over 50 separate events had been held, including press conferences, consumer events, local authority events etc. I explained that the mapping exercise inevitably attracted a high degree of scrutiny from a variety of sources and therefore an extensive and highly skilled team are needed to implement the mapping process.

The mapping experience of attendees at the meeting varied considerably, so more detailed discussions on how to produce an online map was not possible or appropriate for the forum. And while the slides presented were made available to BCO network members after the event, only those in attendance benefitted from the side bar discussions and debates held at the meeting itself.

My main takeaway from the meeting was that presenting to the BCO Network was a very worthwhile exercise. I gained very positive feedback that the ideas and concluded that the insights presented had strong validity and were worthy of further development. At a minimum, the criticality of the online map to designing and implementing an intervention project was highlighted to all. However, I also concluded that presentations to this forum alone, would not materially shift the needle in terms of informing and improving future projects in the longer term. Further avenues would need to be pursued to achieve this objective.

5.4 The SAG evaluation and the revision of the SAG

A significant opportunity to materially influence future EU guidance arose while the research was being developed between 2020 and 2023. The EU launched an initiative to evaluate the effectiveness of the entire SAG and then update the SAG where they felt it was appropriate. The SAG were published in 2013 and after seven years, it was natural for the EU Commission to undertake a review to identify whether any updates were needed.

The EU Commission's approach was multifaceted. It involved internal analyses within the EU Commission, both public and targeted consultations with stakeholders, as well as a formal study conducted by external consultants. The main activities undertaken were:

- a public consultation related to the application of the Broadband Guidelines and the relevant General Block Exemptions Regulations provisions⁷⁰ – 8 September 2020 to 5 January 2021;
- a separate targeted consultation addressed to specific stakeholders (e.g., the BCO Network) that are directly impacted by the rules – 15 December 2020 to 8 March 2021;
- a series of bilateral discussions with stakeholders such as EU Member States and experts - April to June 2021;
- an internal analysis from case teams and experts within the EU Commission – September 2020 to July 2021;
- a publication of the EU's conclusions, identifying what areas needed to be revised in the updated SAG - July 2021; and
- a public consultation on the draft State aid rules for the deployment of broadband networks - From 19 November 2021 to 11 February 2022.

⁷⁰ The General Block Exemptions Regulations (GBER) relevant to broadband were updated in July 2021 through the adoption of the Commission Regulation (EU) 2021/1237. This update was conducted in parallel to the SAG Evaluation, '56. The European Commission. Commission Regulation (EU) 2021/1237' of 23 July 2021 amending Regulation (EU) No 651/2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty Official Journal of the European Union; 2021.'.

This evaluation and subsequent revision of the SAG was concluded when the EU Commission ultimately adopted an updated SAG which was fully published during 2023.

The main activities which I contributed towards were the EU's targeted consultation on mapping undertaken between December 2020 and 8 March 2021; contributions through a series of bilateral discussions with the EU Commission and other experts which I undertook between March and June 2021 and lastly through submissions to the EU's public consultation on the draft State aid rules between 19 November 2021 to 11 February 2022. These submissions and engagements are described in section 5.4.2.

But before I jump into the descriptions of my personal submissions and engagements over this period, it is interesting to highlight the EU's own conclusions from their evaluation of the SAG, which they published in July 2021.

5.4.1 The EU's conclusions from the SAG evaluation

The EU's evaluation concluded that the SAG had, to a large extent, proven to be effective in achieving their specific objectives, even though the SAG evaluation revealed various issues that required further clarification. The evaluation concluded that the SAG needed to be adapted to reflect recent legislative developments, up to date priorities, as well as market and technology developments.

However most importantly and encouragingly from the perspective of my research, the EU Commission's SAG evaluation concluded conclusively that the mapping activity was a key area requiring greater clarification and more guidance. This came as no surprise to me at the time, having implemented the NBP Mapping exercise over the previous six years and having since progressed research on the topic.

This conclusion was supported by the submissions from a host of different stakeholders across the EU who highlighted the difficulties and challenges faced in conducting the Mapping Process.

An EU Commission Staff Working Document (57) was published 7 July 2021 which included the results of the various consultation activities completed for the EU Commission's SAG evaluation. In particular, the EU Commission Staff Working Document, section 6, concluded that there was room for further clarification of the rules in the following areas relevant to mapping:

- '- The assessment suggests that the current intervention threshold of the Broadband Guidelines does not fully reflect Gigabit targets and recent policy developments, as well as the increasing importance of other parameters such as upload speeds. The intervention threshold identifies the minimum speeds below which networks could be overbuilt, and is therefore a key instrument to ensure that public money is channeled to market failure areas, avoiding crowding out of private investment.....'*
- '- The evaluation has shown that the Broadband Guidelines lack a clear explanation as to how to apply the rules to the deployment of mobile infrastructure. Such provisions would increase transparency and legal certainty for stakeholders.....'*
- '- The evaluation has shown that the current rules are not sufficiently clear on certain technical issues e.g. how to conduct a mapping consultation; how to take into account the impact of nomadic users when assessing the possibility for a mobile network to provide NGA services.'*

Along with the EU Commission Staff Working Document an external consultant report was also published on 7 July 2021 - 'The role of State Aid for the broadband networks rapid deployment in the EU' (58). This report considered the submissions received through the public consultation and reviewed a number of case studies from State Aid Approvals from several different EU Member States (including Austria, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, The Netherlands, Poland, Portugal, Spain, Sweden and the UK).

On deeper examination of these publications, it is clear that many stakeholders questioned the effectiveness and the numerous difficulties faced when conducting a Mapping Process. Some of the key findings outlined below are particularly noteworthy and greatly support the need for deeper research into the Mapping Process and how it is conducted.

The EU Commission Staff Working Document Footnote 77, which is referring to the Mapping Process, stated the process:

'is considered as a very obstructive barrier by 39% of the respondents'.

It is notable that 39% of respondents found the Mapping Process to be a significant barrier to implementation.

Some respondents to the public consultation highlighted that they found the mapping assessment criteria difficult to establish, particularly those criteria relating to future planned investments. The EU Commission Staff Working Document section 5.1.2.1. – 'Protecting existing investment' – Mapping states:

'In the public consultation, respondents have signaled that they have encountered problems in identifying the appropriate criteria to be used to carry out the mapping exercise. In particular, telecom operators, signaled that the criteria used to map existing investments should differ from the ones used to map future investments. Various stakeholders also suggested that such difference should vary according to the timeframe.'

Different stakeholders raise concerns over the effectiveness of the Mapping Process, the scope and methodology of the Mapping Process as well as the complexity of assessing planned investments. The Commission Staff Working Document section 5.1.1.2. – 'Address a market failure or major inequalities', stated:

'Regarding mapping, respondents to the targeted consultation consider that it enables partially the identification of areas most in need of a public support (48%). Here again responses differ between public authorities and private stakeholders. This time however private stakeholders have less positive views than public authorities. While private stakeholders are only partially convinced of the effectiveness of the mapping exercise (63%), public authorities find the mapping enables the identification either totally (36%) or partially (36%). Their concerns refer primarily to the scope and methodology of the mapping exercise, and secondly to the reliability of information on planned investments..... This suggests insufficient guidance by the Guidelines...'

A number of other specific items relating to the Mapping Process were also raised, as described in the EU Commission Staff Working Document (57) section 5.1.2.1. – ‘Protecting existing investment’, these included the below topics:

- a) The level of granularity used to map broadband infrastructure*
- b) The definition of premises passed*
- c) How to map wireless networks and mobile networks*
- d) The handling of fragmented coverage of a commercial operator in an area’.*

Finally, the effectiveness of the public consultation to verify the accuracy of the Mapping Process was found to be an effective method but more guidance was needed. The EU Commission Staff Working Document (57) section 5.1.2.2. Protecting future investment plans stated:

‘Respondents to the targeted consultation, in particular national authorities, totally or partially agree that the public consultations have been effective to identify the areas most in need of State aid’

‘Replies from stakeholders show that the public consultation is considered an effective tool to consult the market.... The information collected suggests that the combination of the mapping exercise with the public consultation has been effective in avoiding that State aid crowds out private sector investment to any significant degree...’

‘While open public consultation is considered a very effective tool to identify market failure areas avoiding crowding out of current and future investment, there is a call on more detailed guidance... in the way the public consultation is carried out’.

Unsurprisingly, many of these comments and findings tally directly with the findings documented in Chapters 3 and 4. From the perspective of this research, it is significant that the EU Commission’s SAG evaluation independently verified the need for greater level of guidance to be provided to EU Member States and other stakeholders in performing the Mapping Process. The EU’s SAG evaluation reinforced the importance and criticality of the research into the Mapping Process and the ever-expanding need from a wide range of stakeholders to address the complexity of the Mapping Process.

And as mentioned earlier, I personally contributed to the EU's evaluation at different points of the process (described in section 5.4.2). I am confident my research provided strong evidence to support the EU Commission in reaching these conclusions, however I do not claim to be the sole reason for these conclusions. As explained above, a number of other stakeholders expressed similar views on the mapping process. The EU's conclusions did however corroborate that the nature and direction of travel of my research was correct, that there was universal support for greater guidance on how best to conduct the Mapping Process and reinforced to me, at the time, that it worth continuing the journey to develop my findings further.

5.4.2 The EU's targeted Mapping Consultation and bilateral engagement with the EU Commission

As mentioned earlier, one part of the EU Commission's SAG evaluation involved a targeted consultation addressed to specific stakeholders. In December 2020, the EU Commission undertook the unprecedented step of launching a targeted consultation on the 'draft Methodology on the mapping of broadband coverage in Europe'. This consultation focused on developing greater guidance for the Mapping Process that could be followed by all EU Member States. This was the first consultation that targeted the development of more detailed guidance specifically for the Mapping Process. It therefore represented a unique opportunity to disseminate the key findings of this research and offered a clear opportunity to make a significant contribution to the guidance being developed by the EU Commission.

My engagement with the EU Commission involved both a formal submission of evidence to the targeted mapping consultation, which closed on 8th March and then a series of follow-on meetings which the EU Commission requested, between myself and their mapping experts, so that they could better understand the evidence submitted and to discuss the solutions that might address the issues raised. What follows is a description of this engagement and section 5.5.3 describes the resulting outcomes.

The EU invited submissions to comment on a draft methodology for mapping of broadband coverage. The consultation targeted BCO Network members (i.e. representatives from each

EU Member State who are member of the EU's BCO Network) and members of Body of European Regulators for Electronic Communications (BEREC), (i.e. these are representatives from each of the National Regulatory Authority in each EU Member State). The EU Commission invited stakeholders to provide feedback on, a draft mapping methodology, 'Draft methodology on the mapping of broadband coverage and quality of service' which was developed, on behalf of the EU Commission, by three academic experts in the field of telecommunications. These were Professor Petri Mähönen and Dr Ljiljana Simic, Principal Scientist and Research Coordinator from the Rheinisch-Westfälische Technische Hochschule Aachen University who were engaged by the EU Commission to advise on the mapping of wireless networks and Professor Javier Aracil, from the Universidad Autónoma de Madrid who was engaged to advise on the mapping of fixed networks. They considered a number of key policy and regulatory documents including:

- connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society - COM (2016)587 and Staff Working Document – SWD (2016)300;
- shaping Europe's digital future (COM (2020)67);
- EU directive 2018/1972 of the European Parliament and the Council of December 11, 2018; and
- BEREC Guidelines to assist NRAs on the consistent application of Geographical surveys of Network deployments (BoR (20) 42).

Once this methodology for mapping broadband coverage was drafted, it was expected to assist the EU Commission and EU Member States in:

- Monitoring of the achievement of the EU broadband objectives;
- Carrying out the mapping of broadband infrastructures to plan their public interventions; and
- Planning and implementation of EU funds dedicated to broadband deployment.

In response to this consultation, leveraging the findings and evidence I had already uncovered as part of this research (i.e. from dissecting the entire NBP intervention project, analyzing the importance of the mapping process, as well as uncovering and documenting

key insights that would never otherwise have been documented if this research was never undertaken), I submitted the following:

- an overview of the EU State Aid Intervention Process, described as four distinct phases, consistent with the findings outlined in section 3.5.1;
- an analysis highlighting the clear dependency on the mapping process at each distinct phase, consistent with the findings outlined in section 3.5.3 and calling for much greater emphasis to be placed on the mapping exercise in any updated SAG;
- a description of the three online map building blocks upon which the mapping process is constructed, consistent with the findings outlined in section 4.3;
- examples of the validation methodologies used in Ireland for wireless and wire line network assessments. This included information on the key parameters used in the verification methodology to verify Service Provider claims; and
- a copy of the information questionnaire used in Ireland to gather the necessary information to conduct the verification assessment.

In March 2021, after the conclusion of the targeted consultation the EU Commission invited me to participate in a working group with their experts so that they could better understand my submissions.

'Dear Patrick,

Thank you for your comments on the mapping methodology. The experts have been reviewing all observations and soon will be publishing a document stating how they mean to address the comments received.

Nevertheless, in the last meeting we had, the experts called for a video-conference meeting with you/your ministry with a view to understanding better some of your comments and the experience on the ground that prompted these remarks.

*Would it be possible to arrange a **video-conference next Monday 19th** afternoon around **15:00** or at another time of your convenience?*

Best regards

European Commission

DG CONNECT – Communications Networks, Content & Technology'

Figure 5.4 Email invitation received from DG CONNECT March 2021 to engage with their experts.

A series of online meetings followed between March and June 2021, whereby the EU Commission sought my input on their proposed mapping methodology. This engagement offered the opportunity to share the key insights that had been gleaned from this research. Over the course of this period the EU Commission outlined a number of targeted questions on the mapping process and requested my feedback leveraging the experience and expertise derived from the Irish NBP intervention project.

Firstly, the EU Commission issued a list of detailed questions relating to the submission I had made to the mapping consultation. These questions were compiled by the academic experts and were received on 15th April and 16th April. The questions were then discussed at the first online meeting held on 19th April. Further, follow up questions were then received on 24th April and 4th May which I subsequently answered on 2nd May and 4th May respectively.

Through this engagement I shared a sample of the mapping methodologies used in the NBP Mapping Process. After considering this input the EU Commission proposed that a shorter 'one pager' of guidance identifying best practice for mapping should be targeted as the output of the group. This decision was taken once the complexity and challenges of developing an end-to-end mapping methodology was explained and made obvious to them.

From this point onwards the focus of the group was to develop this 'one pager' of mapping guidance. A first draft one pager was produced by the academic experts and shared on 4th May which relating to mapping wireless networks and another one pager was shared on the 6th May which relating to mapping fixed networks. These papers were then discussed at the next online meeting on 10th May. Following the meeting, the next draft combining both wireless and fixed networks was then produced on the 25th of May and this was then discussed at an online meeting on 31st May. I undertook my final review and submitted my last comments on this paper on 11th June after the EU Commission thanked me for my contributions and the engagement came to a close.

While formal minutes were not taken, my field notes recorded the meetings themselves (held on 19th April, 26th April, 10th May, 31st May) and I also retained copies of my emails, reviews and submissions over the engagement.

Ultimately the ‘one pager’ produced as part of this engagement was subsequently published by the EU Commission as an annex to the updated SAG titled ‘Mapping of fixed and mobile access networks – best practices referred to in section 5.2.2.4.1 of these Guidelines’.

Lastly, the EU Commission launched a public consultation on the draft State aid rules for the deployment of broadband networks on 19 November 2021. My subsequent submission welcomed the EU Commission’s additional guidance outlined in the new annex 1, however I called for more to be done. For example, I recommended that (i) ‘The EU Commission should outline clearly where there is a reliance on the outputs of the Mapping Process at each phase of the State Aid Process.’; that (ii) EU Member States should be advised to mobilize the necessary resources and expertise required to conduct the Mapping Process on the basis that it will be required over many years, if not indefinitely; (iii) The EU Commission should outline clearly performance thresholds for different technical parameters such as download speed and upload speed that must be met for a broadband service to be considered a NGA broadband service; (iv) The EU Commission should develop detailed Mapping Assessment Validation Methodologies for each technology type e.g. Fixed Wireless, FTTC, FTTH, DOCSIS etc.; (v) Once EU Member States apply the relevant performance threshold and follow the assessment methodologies through a mapping consultation and publish their findings through an online map, I suggested this analysis should be considered correct, accurate and as up to date as possible for the following 2 years for the purposes of State Aid Approval. EU Member States should not be required to re-run the mapping consultation after the public procurement and prior to contract award; and (vi) The EU Commission should consider establishing a ‘centre of excellence’ centrally within the EU Commission and/or an appointed agency specifically to advise and assist EU Member States with the Mapping Process as the expertise needed to conduct a Mapping Process to satisfy the State Aid guideline conditions does not typically reside in EU Member

States. My full submission to the public consultation can be found in Appendix 4 of this thesis.

The following section examines both the updated SAG, along with the new mapping annex (annex 1). I examine both more closely to ascertain whether many attributes of this research can be found and whether I can conclude this research has had the desired impact on the updated guidance now published by the EU Commission.

5.4.3 The updated SAG the mapping annex and the impact of this research

Having concluded through their evaluation that the SAG needed to be updated, the EU Commission subsequently published 'Guidelines on State aid for broadband networks' (66), in 2023.

The provisions dealing with the mapping exercise were expanded considerably in the updated SAG. By contrast, and as highlighted repeatedly in this research, the SAG published in 2013 had only one Paragraph, 'Paragraph 78 (b)', which dealt with the mapping exercise whereas the updated SAG expanded the mapping provisions to eight separate Paragraphs (i.e. Paragraph 70 to Paragraph 77). In addition, to these new Paragraphs, a new annex (annex 1) which outlines certain mapping methodologies was also added. The new annex 1, which on its own runs to 4 pages in length, emanates directly from my EU engagement and the work conducted with other EU colleagues, outlined in section 5.4.2.

In relation to the first online Map Building Block, the 'Mapping Assessment Performance Criteria', which calls for precise definitions of the performance criteria, there is strong evidence that the EU Commission have tried to address this feedback, in different parts of the main body of the updated SAG.

If we examine, Paragraph 54 of the updated SAG, which states:

' 54. At the current stage of market development and given identified end users' needs, a market failure may be present where the market does not and is not likely to

provide end users with a download speed of at least 1 Gbps and an upload speed of at least 150 Mbps⁵¹.

Footnote 51 states:

‘While speeds are currently the most relevant quality of service parameters, other parameters (such as latency) may become relevant for certain end users. Such parameters may be taken into account to determine the existence of a market failure’.

Essentially, in Paragraph 54 of the updated SAG, the EU Commission sets out that download and upload speeds are the main technical performance criteria to be considered and helpfully they define these as 1Gbps for download and 150Mbps for upload. This represents an improvement in the definition of the technical performance criteria from the SAG published in 2013 which essentially asked EU Member States to define these technical performance criteria themselves.

Separately in Paragraphs 87 and 88, the updated SAG states the following, in relation to criteria for future planned investments:

‘87. When assessing the credibility of future investment plans, Member States may take notably the following criteria into account:

- (a) whether the stakeholder has submitted a project-related business plan, factoring in suitable criteria concerning, for example, time frame, budget, the location of premises targeted, quality of service to be provided, type of network and technology to deploy and take-up rate;*
- (b) whether the relevant stakeholder has submitted a credible high-level project plan that properly takes into account major project milestones, such as administrative procedures and permits (including rights of way, environmental permits, safety and security provisions), civil engineering works, the completion of the network, the start of operations and provision of services to end users;*

- (c) the suitability of the size of the company in the light of the size of the investment;*
- (d) the track record of the stakeholder in comparable projects;*
- (e) if necessary and appropriate, the geographical coordinates of key parts of the planned network (base stations, points of presence, etc.).*

88. If a Member State considers that the private investment plans are credible, it may decide to invite the stakeholders concerned to sign commitment agreements, which could include obligations to report progress on their stated milestones.'

These Paragraphs set out the performance criteria that can be applied for future planned networks. They are set out much more extensively and clearly than in the SAG published in 2013.

When we consider this more specific and extensively defined performance criteria, we can clearly see that the EU Commission has attempted to provide EU Member States with greater guidance on the necessary performance criteria in the updated SAG as suggested in the first online Map Building Block, the 'Mapping Assessment Performance Criteria' of this research.

In addition, the EU Commission goes somewhat further by prescribing certain attributes to the technical performance criteria in annex 1 of the updated SAG.

What is striking, is how the requirement for the development of assessment methodologies to verify Service Provider data is outlined and the information needed for this verification is set out extensively throughout annex 1 of the updated SAG.

The scope of annex 1 is defined as follows:

- 'This Annex sets out, for fixed access networks and for mobile and fixed wireless access networks, best practices on:*
- (a) the criteria for mapping the performance of the networks;*

(b) the information that the competent public authorities may collect to verify the accuracy of the information provided;

(c) the additional information about infrastructure that the competent public authorities may request operators to provide in specific situations, when it is duly justified in order to carry out an in-depth assessment (3).'

Annex 1 (b) and annex 1 (c) clearly align directly with the second Online Map Building Block, the 'Mapping Verification Methodology' and the third Online Map Building Block the 'Mapping information questionnaire', proposed through this research. There is a clear distinction established between the performance criteria and the assessment methods needed to verify Service Provider information. Presenting the information in such a manner, is a major step forward in providing clarity to EU Member States on what is actually required.

It is worth investigating whether the insights presented in this thesis are addressed in the updated SAG. While not all of the eight insights described in section 4.4 were fully developed at the time the EU were updating the SAG, many of them were developed and were shared with the EU Commission through the targeted mapping consultation and through the subsequent bilateral engagement described earlier in section 5.4.2. Of course, it is difficult to link my contributions directly to the updated SAG and I do not claim to be the only contributor on the themes raised by the insights. Instead, my analysis identifies whether the insights are addressed to some degree in the updated SAG or not; and if they are, to what extent they are addressed. Table 5.1 summarises this analysis.

Research insight number	Research Insight	To what extent is the insight addressed/discussed in the updated SAG. (High, Medium or Low extent).	Where is it addressed in the updated SAG
1.	The complexity of the verification methodology.	Medium - annex 1 goes some way in highlighting the potential complexity to EU Member States.	Annex 1 (b), Annex 1 (c)
2.	The number of Performance Criteria and sub parameters used should be minimized.	Low – the updated SAG does not suggest minimising the number of criteria/parameters.	Not applicable – his insight was not fully developed at

			the time.
3.	Verification Methodologies must be modified for each network type.	High - annex 1 identifies that different approaches must be taken for fixed wire line, mobile and fixed wireless access networks.	Annex 1 section 2 and section 3
4.	Determining the credibility of planned network that is yet to be deployed is a concept unique to State Aid rules.	High – Paragraphs 87, 88 identify the unique approach which must be taken for future planned networks.	Paragraphs 87, 88
5.	The Mapping Information Questionnaire is designed to gather the necessary information specifically for the verification activities.	Medium - annex 1 goes some way in highlighting the alignment needed between the information sought and verification activities.	Annex 1, section 2.2 and 2.3, section 3.2 and 3.3.
6.	The quality of network information varies considerably amongst Service Providers so a degree of data validation must be applied.	Medium - annex 1 goes some way in highlighting issues that might arise in seeking different levels of information.	Annex 1, section 2.2 and 2.3, section 3.2 and 3.3.
7.	Professional judgement and expert opinion is critical to the assessment.	Medium – while not explicitly stated, the clear emphasis on the mapping process throughout the updated SAG is clear and the requirement to conduct assessments and apply professional judgement is set out.	Throughout the updated SAG and annex 1.
8.	The mapping exercise is highly onerous, expert resources are needed across a broad set of disciplines.	Medium - while not explicitly stated, it is clear, particularly from annex 1 that expert resources will be required to implement the methodologies recommended for a mapping process.	Throughout the updated SAG and annex 1.

Table 5.1 – Analysis of the extent the research key insights are reflected/discussed in the updated SAG.

This analysis concludes that seven of the eight insights gleaned from this research are addressed to a medium to high degree in the updated SAG.

Lastly, if we examine annex 1 more closely, we can see that the values used for certain parameters align directly to the values used in Ireland, the importance of which were discussed and shared with the EU Commission as part of my engagement with them in the development of annex 1 (as described in section 5.4.2).

- Section 2.1 of annex 1, the definition of peak time conditions refers to '*conditions that exist whenever a minimum of 10 % of the users are transmitting concurrently at the nominal peak rate*'. This parameter value of 10% is identical to the value used in the Irish verification methodology.
- Section 3.1 (b) indicates network performance should be '*based on the calculation on a 95 % cell edge probability*', this 95% value is identical to the value used in the Irish verification methodology.

The values for these two parameters were clearly influenced by the evidence I submitted directly to the EU Commission and also through the subsequent discussions undertaken wherein I emphasized the importance of these values in the development of verification methodologies.

In summary, many of the concepts, insights and some specific parameter values, that I provided to the EU Commission can now be found in the documentation published and presented as best practice in the updated SAG and the new mapping annex 1. Therefore, I am confident my research concepts have been strongly corroborated by the EU Commission. Although, I cannot claim to be the sole provider of evidence to the EU Commission for all of these areas, I am confident my evidence strongly supported the EU Commission in reaching these conclusions to the extent they were sufficiently confident to published them in the updated SAG and annex 1.

5.5 Conclusion

Throughout the lifetime of this research, a consistent approach was undertaken to continually test the ideas and insights of this research with relevant stakeholders, as they were being developed.

My initial concepts were presented to representatives from the EU Commission and every EU Member State at a BCO Network in 2019. The feedback received at this forum encouraged me to develop a more thorough historical record of the NBP intervention

project. It also encouraged me to develop further high-level insights to help ensure general principles and issues could be easily followed by stakeholders who didn't have in-depth experience in the development of an online map. Significant efforts were undertaken to share the findings of this research for the purposes of aiding the development of the guidance provided by the EU Commission to all EU member States.

The process undertaken by the EU Commission, from 2020 to 2023, to update the SAG presented a unique opportunity to influence future guidance documents. Coupled with my participation in a dedicated working group, chaired by the EU Commission, which focused specifically on the development of mapping guidance enhanced the opportunity to directly influence the updated SAG. Ultimately the updated SAG were published in 2023 and they focused much more heavily on the mapping process. A new mapping annex 1 was added which provided greater detail on best practices that could be adopted for mapping and seven of the eight insights gleaned from this research are addressed to a medium to high degree in the updated SAG. Certain values are taken directly from the Irish verification methodology and set out as best practice by the EU Commission. And while individual contributions cannot be specifically endorsed by the EU Commission, I have concluded that my research concepts have been strongly corroborated by the EU Commission through the significant level of alignment between my findings and the documentation published as guidance by the EU Commission.

While the EU Commission's mapping guidance published in the updated SAG along with the new mapping annex 1, which is the main source of guidance for all EU Member States, has been greatly enhanced from the SAG published in 2013, the guidance does not go far enough. A significant amount of time, effort and expertise is still required to interpret the updated SAG and then design a robust process to produce an online map in practice. So, while improvements have been made, what is also clear is that much more can potentially be achieved and there is still much more to do.

I now turn to the final Chapter 6, which considers the research in its entirety and reflect on the options for the way forward and the next steps beyond this research.

Chapter 6 Overall Conclusions, Reflections and Final Recommendations

6.1 Introduction

We now come to the final Chapter of the thesis. The purpose of this Chapter is to look back at the work in its entirety, draw out the key conclusions, provide some wider commentary on the work, and to lay the ground for future research topics.

6.2 The research has met its overall objective

Having concluded this research, I must consider whether the research has met the original objective set out. To recap, the research objective is **‘how can the Irish experience be used to inform and improve future intervention processes?’**.

The research has led to many different contributions, but fundamentally, all the contributions of this thesis leverage the experiences gained through the Irish NBP intervention project to help unravel the extremely complex process of implementing a mapping process and applying for State Aid Approval. This rich series of contributions will therefore inform future intervention processes and providing them with the insights and key observations that will enable them to design and implement an improved intervention process.

Every EU Member State must undertake this process when intervening in the broadband market, however practical referenceable material to assist them in the design or implementation of this process was extremely limited before the existence of this work.

The first contribution traces the overall Intervention Process, this is outlined in Chapter 3. This shows, in a simplified manner, the activities needed to design a State intervention and apply for State Aid Approval. It is through the tracing of this Intervention Process that I identified the second contribution, that this multi-annual complex process can be better understood and followed, by distilling and grouping all the activities into four distinct phases. I then described how and why several versions of the online map are needed at a number of critical junctures throughout this multi-annual process. And it is highlighted that at least three different versions of the online map must, in fact, be created.

The fourth contribution is the conclusion reached in Chapter 3, that the Mapping Process is a central dependency and therefore on the critical path for completing the Intervention Process and securing State Aid Approval.

It is for this reason that I then delve deeply into the detail of the Mapping Process in Chapter 4. The fifth contribution uncovers what is needed to produce an online map, these are referred to as the three online map building blocks. The sixth contribution recasts the framework used as part of the NBP Mapping Process into a logically structured format. These three online map building blocks are outlined in granular detail in Appendix 3. While they are included in this appendix, they are very much a key part of the research contributions; they are included under an appendix to aid readability and so as to avoid putting the granular detail into the front Chapters of the thesis. This sixth contribution provides EU Member States the level of detail necessary for the creation of their own online map, allowing them to implement their Intervention Process efficiently and plan for this critical dependency from the outset.

Lastly but not least, the seventh contribution of eight key insights are also outlined in Chapter 4. These insights are written in an accessible manner for the benefit of the non-technical reader and are intended to guide EU Member States in the production of their own online map. These insights highlight key learnings from the Irish NBP intervention project that EU Member States should consider if they are to succeed in creating an effective, streamlined process of their own.

The contributions outlined are multifaceted and I would contend are extremely valuable for any EU Member State designing or implementing their own project.

The opportunity to test the findings presented itself during the research period when the EU Commission invited submissions from stakeholders for suggestions on how to improve the SAG. As discussed in Chapter 5, the centrality of the Mapping Process was clearly identified and discussed with the EU Commission as well as the more detailed findings of the research. As a consequence, there was significantly more emphasis placed on the mapping process,

an additional annex was introduced to the updated SAG specifically dealing with mapping issues and adopting directly a number of key concepts and insights unearthed through this research.

While it is not possible to receive a direct endorsement from the EU Commission for specific research as such endorsements are subject to official EU College of Commissioners or Cabinet approval, the EU Commission do acknowledge the contribution of representatives of the Irish NBP intervention project to the development of the EU guidance and best practice methodology for mapping.

Also, the EU Commission have formally recognized the importance of publishing the details of EU Member States mapping methodologies in detail. In fact, in Paragraph 76 of the updated SAG, publication of mapping methodologies is made mandatory for any new initiatives:

‘76. Member States must make the methodology and the underlying technical criteria (for instance, utilisation factor and cell load) used to map the target area publicly available’.

This new requirement will ensure the publication of mapping processes and assist EU Member States in gaining a better understanding of how different initiatives are developing and implementing their projects.

Highlighting the importance of the mapping process to other EU Member States and sharing the learnings gleaned from this research has been a constant theme that I have pursued. I presented initial findings of the research to all EU Member States in 2019 through the EU BCO Network, undertaking a presentation to the BCO network at their conference in Brussels in October 2019. The findings were extremely well received, and it raised awareness of the centrality of the mapping process to gaining State Aid Approval and the inherent complexity that comes with implementing a mapping process.

The Department’s Assistant Secretary with overall responsibility for the Irish NBP intervention project from 2016 to 2019, Ciarán Ó hÓbáin, stated:

‘The Department routinely reflects on the experience gained through our key projects to identify lessons that can be usefully shared with future projects within the Department. However, this research stands apart from that normal business as usual exercise. The comprehensive and detailed nature of this review is simply not possible in a day-to-day business environment where reviews are expected to be completed in a short period of time near to a projects closure. In addition, this research has clearly evolved the process that was undertaken and presented the mapping methodology in a much more accessible format, making the findings significantly more useful and referenceable for future projects. I am confident other EU Member States will find the research extremely useful in the design of their own interventions and mapping projects’.

Therefore, considering the feedback from key stakeholders as well as the influence the research has already had on the EU Commission’s updated SAG, I conclude the research has met its original objective to uncover how the key insights and learnings from the Irish NBP intervention project can be used to inform and improve future processes.

6.3 Some deeper reflections on the process and the way forward

The reflections and conclusions to date are specific to the intervention and mapping processes. In looking at the work that took place in Ireland in detail, there are other reflections that are worth unpacking around the process as whole. This section covers these deeper reflections.

6.3.1 The impact of market events, actions and reactions

Inevitably for any State intervention into a dynamic liberalized telecom market, significant market events are likely to happen; actions will be taken by market players; and these actions, in turn, will lead to reactions from other market players. The State must be ready to adapt and react as appropriate to these events.

Dissecting and analysing the Irish NBP intervention project in detail allowed me to trace and identify each of the key events that were undertaken over the course of the project.

Figure 6.1 below traces the key events of the Irish NBP intervention project from 2011 to 2019 which I created to aid readers navigate the progression of the project at a high level.



Figure 6.1 – The key events of the Irish NBP intervention project.

The events shown in Figure 6.1, identify not only the planned project milestones but also the market actions and reactions that occurred during the project, as well as the political decisions that were taken as part of the Irish NBP intervention project. These are the key events that were navigated by the project team as part of the journey to gain State Aid Approval and ultimately award the NBP contract.

If we consider, for example, one significant market event in 2017 (referred to as ‘NBP Map update (due to the eir 300k) – April 2017’ in Figure 6.1) where, as described in Chapter 3, the largest wire line Service Provider in Ireland, eir, developed a new investment plan to deploy fibre to the home technology to over 300,000 rural premises. Once accepted by the Minister this resulted in an update to the NBP Map, removing a significant portion of the premises within the original Intervention Area and resulting in significant delays to the

overall Intervention Process. This is a clear example of an unexpected market event which had a significant impact to the Intervention Process.

On reflection, projects will always have their own unique flavor, with different market and political pressures. These projects must expect the unexpected and be ready to address unforeseen events, as they will inevitably arise. While it is impossible to anticipate every circumstance, it does lead to the conclusion that projects must be designed to include careful proactive monitoring of political and market risks and include some contingency in terms of time and budget to cater for these risks and to mitigate their impact when they arise.

6.3.2 The role of Politics in the Intervention Process

On reflection, EU Member State's must expect and plan for a high level of political engagement, scrutiny and oversight over their Intervention Process. Politically contentious issues will arise during the process. For example, the technology is complex and there are several different potential technological approaches that can be pursued depending on whether a short-term solution or longer-term solution is targeted. Challenges will arise for policy makers when Service Providers, incentivized to make public claims and lobby for their technology and against approaches that would involve competing technologies. Or for example, dealing with the frustrations of people who have almost no broadband service, whose expectation is that a Government will deliver change quickly, whereas the State's policy might be to 'do it once and do it right' and resolve the digital divide comprehensively, which requires a longer period of time and which won't fit easily with normal electoral cycles.

Therefore, a very robust, transparent process must be designed and implemented from the outset to provide confidence to all stakeholders. Significant due diligence is needed in presenting highly contentious issues to the Government for decision.

The Irish project demonstrates this through the many political events that occurred and were navigated over the lifespan of the project, some of which are illustrated in the national media clippings outlined in Figure 6.2 below. The Irish NBP intervention is the largest

investment in rural Ireland ever undertaken by the Irish State. Broadband availability became key issues of considerable political debate in the Irish general elections held in 2011, 2015 and 2020. It is not surprising that where long term public funding is being committed, significant political scrutiny is attracted.



Figure 6.2 A sample of media clippings relating to political events during the Irish NBP intervention project.

Figure 6.2 highlights a small sample of some of the media coverage of the many notable political decisions, events and interventions made during the Irish NBP intervention project. These include Minister for Communications, Pat Rabbitte TD, announcing a budget of 500M€ for the project in 2013; the Government revising the State policy to target a longer-term infrastructure-based solution in 2014; opposition parties criticizing the strategy and demanding deeper scrutinization in 2018; and the Taoiseach suggesting a rethink of the plan following claims that eir could deliver the plan more efficiently in 2019 etc.

The political willingness to address the deficit in broadband availability is clear. The societal and economic need for high quality reliable broadband is reflected in the strategic importance it is given at European policy level as well as at national levels throughout the EU. However, some of the decisions needed to address this deficit can be very contentious. Political decisions are needed, strategic direction must be agreed, wider societal needs must be considered, and inevitably political events will happen.

An example, of one highly contentious issue in Ireland was the decision relating to who would own the network once it was deployed. Some politicians argued that the State should retain full ownership of the subsidized network, whereas the Government decided not to retain this ownership. Similarly, another highly contentious issue arose, triggered by the forecasted cost of the project. Several politicians argued that the forecasted cost to the exchequer of up to 2.7 billion euros was too high, so alternative less ambitious solutions should be pursued. Some suggested, for example, pursuing a shorter-term solution to less than 100% of premises, whereas the Government ultimately decided to persist with a longer-term solution, targeting a predominantly fibre-based strategy covering all premises in the country and thus approved the exchequer funding needed.

Intervening in any market to resolve a societal problem is ultimately a highly political issue. It should not be underestimated that the political system ultimately leads the project and for large scale infrastructure projects considerable political willpower, over a sustained period, is needed. The commitment of considerable precious time, energy, funds, and political capital is needed.

The Irish NBP intervention project's motto became 'Do it once and do it right!' and this was borne out through all aspects of the project. This may not be bad guidance for EU Member States to adopt, particularly as the stakes are so high for all concerned and where the level of political scrutiny is likely to be intensive.

6.3.3 A robust, detailed mapping process capable of withstanding legal challenges is needed. For State interventions, where long-term and market shaping decisions are required, it is inevitable that some stakeholders will not always be happy with or in agreement with the decisions taken. Legal challenges to such projects must be considered likely, therefore a robust, detailed mapping process is required.

In my experience, the Department undertook a thorough and rigorous exercise in the design of the NBP Mapping Process. Significant expertise and cost was expended to ensure the best possible process was put in place. The Department invested heavily in the development of a robust, equitable and transparent process. They objectively procured the necessary technical, economic and legal advisory services to assist in its development. Once developed they consistently implemented the process with the support of these advisors over the lifetime of the project.

Some Service Providers are likely to challenge the project either through the legal courts or through pursuing a targeted complaint to the EU Commission. Both avenues were pursued by Service Providers in Ireland. Legal proceedings were taken by one Service Provider against the Minister after the NBP contract was awarded, challenging the mapping decisions taken against them. The Irish courts subsequently found in favor of the Department in 2023. In addition, a number of complaints were issued by Service Providers to the EU Commission on foot of their approval of the NBP intervention project in 2019, some of which (at the time of writing in September 2024) are still under consideration from the EU Commission.

On deeper reflection, when you consider, the long-term consequences of decisions relating to the mapping process both for Service Providers and consumers, the comprehensive and robust approach undertaken in Ireland now appears entirely appropriate. EU Member States would be well advised to expect that challenges of a similar nature will arise and therefore design their mapping processes to at least the same high standard as the one designed and implemented in Ireland. It is advisable that EU Member States exercise a similar level of caution and adopt a similar level of care. The mapping team should be resourced with the specialised expertise needed to develop and implement the mapping

process effectively. The mapping process should be developed to a very granular level similar to the level of detail outlined in Appendix 3. It is only through adopting this level of vigilance that EU Member States can be assured that their mapping processes are well placed to defend any legal challenges that are likely to arise.

6.3.4 A better, faster way to bring high speed broadband to all citizens

One last reflection, is to consider whether there is a better more efficient approach to ensure citizens are provided with broadband services at the earliest opportunity? Could an alternative approach be adopted by EU Member States to achieve the EU's targets and national policy goals for connectivity but at an accelerated rate.

The focus of this thesis is to aid EU Member States in meeting the obligations set out in the SAG and ultimately achieving State Aid Approval as efficiently as possible. The question must be asked whether the whole process is appropriate or not. The SAG obligations place a significant burden on EU Member States. As clearly demonstrated through this research the Intervention Process which must be undertaken to gain State Aid Approval results in delays to the initiation of deployments by several years.

Owing to the urgency of the situation and the disproportionate impact that the lack of high-speed broadband has to society and the economy, perhaps emergency measures should be introduced to allow the immediate deployment of broadband services by EU Member States.

Should there be a radical rethink of what is required to achieve State Aid Approval while maintaining compatibility with the Treaty on the Functioning of the European Union, for example:

- If Service Providers of a certain scale were obligated to submit details of their broadband coverage to the National Regulatory Authority allowing the regular publication of a national broadband map, could this map then be used as evidence to identify those locations where market failure exists? Or

- Should the mapping process itself and the identification of White, Grey and/or Black broadband areas be parked until such time that EU Member States have deployed broadband services sufficiently to their citizens where they believe there is most need? Or
- Should EU Member States just be allowed to deploy broadband services in the short-term setting aside EU State Aid obligations entirely.

More radical approaches such as these might well speed up the deployment of broadband services in certain circumstances but the consequential impact of adopting these approaches must also be carefully assessed. For example, would the broader commercial deployment of broadband services decrease as a consequence. Service Providers might fear that Governments will subsidize the build of a new network in areas where they deploy services and therefore might delay or cancel their investments.

For now, these questions go unanswered as significantly more research is needed to consider options, ascertain impacts, examine and conclude whether a more radical approach should be pursued. And if so, which approach would be optimum.

6.4 Final Conclusions and Recommendations

This research traces the activities of a real-life project which has (i) defined a national broadband strategy, (ii) closely implemented the guidance of the SAG, (iii) awarded a publicly funded contract designed to address the deficit of high-speed broadband in the State and (iv) ultimately gained State Aid Approval.

The tracing of this project, to the extent now documented in this thesis, provides other EU Member States with an unprecedented, true-to-life and practical reference that they can leverage for the design and implementation of their own project. The research revealed five main contributions which may not otherwise have been identified through a theoretical analysis, including the recasting and streamlining of the original framework (as outlined in Appendix 3). This ensures EU Member States can more easily follow, reference and re-use this new framework for any new project they pursue.

As such this research bridges a knowledge gap for EU Member States embarking on their own State Aid Intervention project. It delves deeply into a mapping process for the first time, despite the fact that the mapping process and creating the map is the key to the whole State Aid Approval exercise. Clearly much more research can be done in this area and substantial benefit is likely to accrue as a result of more research.

This research is based on the experiences of one project. Many more projects have been conducted which could reveal many more learnings and opportunities for improvement. The findings of this research must be considered in light of the recently updated SAG and adapted as necessary. I would strongly recommend future research is invested in the topic to verify and expand on the findings of this research. It should also be noted that the follow-on activities that are required after State Aid Approval is granted, are not considered as part of this research. For example, the oversight and governance activities that are necessary, once a public contract is awarded are not considered. These activities would benefit from further in-depth research and a similar level of analysis, but they are not the focus of this thesis.

Appendix 1 – List of Basic and NGA Broadband Technologies published in 2013

Basic Broadband Technology	Definition
DSL (exchange launched services)	A premises has DSL coverage if it is in a telephone exchange area that is fully enabled for DSL.
ADSL (exchange launched services)	A premises has ADSL coverage if it is in a telephone exchange area that is fully enabled for ADSL
ADSL2/ 2+ (exchange launched services)	A premises has ADSL 2/2+ coverage if it is in a telephone exchange area that is fully enabled for ADSL. 2/2+
Up to DOCSIS 2.0 (Cable system or Radio delivery)	A premises has Cable/ Radio DOCSIS 2.0 coverage if it can be connected now to a Broadband service without requiring the construction of new network infrastructure.
Fixed Wireless Access	A premises has FWA coverage for Broadband if it is within the stated coverage area of at least one FWA base station without requiring the construction of new FWA infrastructure.
3G Mobile Networks (with and without HSDPA)	A premises is within coverage of a 3G mobile system if it is within the stated coverage area of at least one base station. Stated coverage in this case means that the household is within the designed maximum system range and its performance and reliability assure a typical availability of 99.99% In the context of this request coverage being cellular mobile indoor coverage
Satellite Systems	A premises is within coverage of a satellite

	system if it is within the stated service coverage footprint of the satellite system and the service is commercially available to that household. Stated coverage in this case means that the household is within the designed maximum system range and its performance and reliability assure a typical availability of 99.99%
NGA Technologies	
Technology Platform - Fixed	Definition
FTTC (Cabinet)	A premises has FTTC coverage if it can be connected now to a fibre service via a street cabinet and without requiring the construction of new fibre infrastructure. Note the customer drop section is over existing copper cables. VDSL . This is the normal service delivery platform for FTTC but may be delivered from an exchange or PoP.
FTTH (Home) & FTTP (premises)	A premises has FTTH coverage if it can be connected now to a fibre service without requiring the construction of new fibre infrastructure
FTTB (Building)	A multi-dwelling building has FTTB coverage if it can be connected now to a fibre service without requiring the construction of new fibre infrastructure
Cable Networks DOCSIS 3.0	A premises has DOCSIS 3.0 coverage if it can be connected now to a DOCSIS 3.0 service without requiring the construction of new cable TV network infrastructure.

Table A 1.1 Request for Information 2013 - Basic and NGA technology platforms (Source DCENR).

Appendix 2 – NBP Mapping Assessment Framework

Mapping Future High Speed Broadband Networks

Criteria for assessment of investment plans

October 2015



Table of Contents

1. Introduction	3
1.1. Aim of this document	3
1.2. Mapping in the context of SAG	3
1.3. Need to assess commercial investment plans	4
2. Assessment process	5
3. Detailed assessment criteria	8
3.1. Assessment methodology	8
3.2. Technical criteria	9
3.2.1. NGA solution	9
3.2.2. Reliable solution	10
3.3. Deployment criteria.....	10
3.3.1. Credible roll-out plan.....	11
3.3.2. Credible resource plan.....	11
3.4. Financial criteria.....	12
3.4.1. Sound business plan	12
3.4.2. Availability of funding	13
4. Mapping and agreements around deployment.....	14
4.1. Agreement on deployment	14
4.2. Outcome of the assessment: mapping.....	14
Appendix A: Supplementary Request for Information	16
Introduction.....	16
A.1. Technical information	16
A.2. Deployment information	20
A.3. Financial information	22

Important Notice

- This report is drafted by PwC on the request of the Irish Department of Communications, Energy and Natural Resources (hereafter: DCENR). PwC assists and advises DCENR on state aid related matters associated with the National Broadband Intervention Plan.
- This report is addressed to DCENR and is prepared solely for its benefit. The report has not been planned, nor prepared in contemplation of, for the purpose of the interests or needs of any other party than DCENR. No entity, party or person other than DCENR may rely on this report and no responsibility, duty of care or liability whatsoever (whether in contract, tort (including negligence) or otherwise) is or will be accepted by PwC in connection with this report, to any party other than the initial addressee(s) of the report. The primary aim of this report is to inform stakeholders about the DCENR's approach to assessing investment plans for high speed broadband in the context of mapping.
- This report is based on the information as available to PwC on Tuesday 13 October 2015. Further details of the scope and approach to PwC's work are included in the report. In order to draft the report, PwC reviewed the various documents supporting the National Broadband Plan for Ireland. These include policy documents from the Department and various reports from external advisors (Analysys Mason, KPMG) as well as supporting information from a wide range of sources. PwC did not carry out full investigations on the validity or quality of the information received, or other activities similar to 'due diligence'.

1. Introduction

1.1. Aim of this document

This document describes the criteria that the Department of Communications, Energy and Natural Resources (hereafter 'DCENR') has used and will continue to use in evaluating and determining the credibility of commercial investment plans for the provision of NGA broadband. There is a requirement under the European State Aid Guidelines for broadband (hereafter SAG¹) for all member states to thoroughly evaluate any commercial plans to ensure any aid granted by the member state is minimised to those areas where commercial investment is unlikely to occur in the foreseeable future. In light of the planned period for rollout of the government intervention, DCENR has revised the investment period under assessment from 2013-2016 to the period 2016 to 2020.

The NBP aims to provide NGA broadband services to areas where the market will not provide these services. The recently published Broadband Strategy for Ireland² sets out the details of the proposed state led intervention. State intervention will be limited to areas where NGA broadband coverage does not currently exist and where commercial investment is not expected in the foreseeable future. These areas will form the so-called Intervention Area.

In order to determine the scope of the Intervention Area, DCENR, the government body responsible for implementing the NBP, initiated a process of mapping in 2013. This process has involved extensive industry engagement at various stages. Current operators and potential future investors were invited to submit details on their existing and planned NGA broadband networks. Up to this point, this has led to the publication of the National high speed broadband map which is available at www.broadband.gov.ie. This map includes existing networks and networks which are projected to be deployed by 2016 (reflected as blue on the Map). The Map also shows areas in which next generation access broadband is currently not available and is not expected to be in the near future (amber on the Map).

DCENR must also evaluate the expected availability of NGA networks that will be available on a commercial basis from now up to 2020. Potential future operators and private investors have been invited to submit their detailed commercial investment plans. Given the importance of determining the appropriate Intervention Area, DCENR must assess the credibility of such plans. The framework described in this document reflects the principles and criteria guiding the engagement with industry to date and explains in detail how the assessment is carried out to allow DCENR to reach a conclusion on the credibility of any plans submitted. With the publication of this document DCENR aims to provide maximum transparency to stakeholders, in particular to those operators and investors that have submitted investment plans.

1.2. Mapping in the context of SAG

The Government Intervention under the National Broadband Plan is a public intervention into the telecommunications market. Such state intervention needs to be consistent with the European state aid rules. The SAG sets out a framework with conditions and principles that can guide the member state intervention.

A fundamental SAG principle is that the public intervention should minimise the risk of crowding out commercial investment. Distortions to commercial markets, affecting the competitive positions of private investors, should be minimised. A necessary step for public intervention in broadband roll-out, is therefore to map the areas in which NGA broadband is delivered commercially and the areas in which NGA broadband is not delivered on a commercial basis (SAG, paragraph 63). Because of the higher risk of competitive distortions, the state aid conditions placed on state interventions are more stringent if the intervention is carried out in an area where commercial operators are already active. In this regard, the SAG distinguishes between white areas

¹ EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks, 2013/C 25/01

² Published on 15 July 2015. Link to the document:

<http://www.dcenr.gov.ie/communications/Lists/Consultations%20Documents/NBP%20Intervention%20Strategy%20consultation%20reports/Broadband%20Strategy%20for%20Ireland.pdf>

(where no commercial NGA operators are active and do not plan to be in the near future) and grey or black areas where there are, respectively, one or more commercial operators active in an area (SAG, Chapter 3.2):

"For the purpose of identifying the geographical areas as white, grey or black, the aid granting authority needs to determine whether broadband infrastructure exist in the targeted area. In order to further ensure that the public intervention does not disrupt private investments, the aid granting authorities should also verify whether private investors have concrete plans to roll out their own infrastructure in the near future. The term 'near future' should be understood as referring to a period of 3 years. If the granting authority takes a longer time horizon for the deployment of the subsidised infrastructure, the same time horizon should also be used to assess the existence of commercial investment plans." (SAG, paragraph 63)

Through a process of extensive engagement with industry, the Government published the initial NGA broadband map in November 2014. This map includes only NGA networks which will be operational by the end of 2016. The map will be updated to reflect credible operator investment plans to deploy NGA networks between now and 2020. In order to map those planned networks, DCENR have asked potential private investors for their commercial plans for the period of the intervention to ensure those commercial plans are credible and if considered credible that any public intervention does not crowd the private investment planned.

1.3. Need to assess commercial investment plans

The Government's policy objective is that all homes and businesses in Ireland have access to NGA broadband. Against the background of this ambition, the Government welcomes announced commercial investments in NGA broadband, which can play a considerable role in achieving this policy objective. Yet DCENR needs to have sufficient certainty that an announced future investment will materialise before it can include a planned network on the DCENR map. Investment plans, once accepted on the map, have an immediate impact on the size of the Intervention Area. Therefore, the non-delivery of these plans would lead to citizens and communities being left behind in terms of NGA broadband access.

The SAG also recognises the need for certainty around announced plans (SAG, paragraph 65):

"There exists the risk that a mere 'expression of interest' by a private investor could delay delivery of broadband services in the target area if subsequently such investment does not take place while at the same time public intervention has been stalled. The aid granting authority could therefore require certain commitments from the private investor before deferring the public intervention. These commitments should ensure that significant progress in terms of coverage will be made within the 3-year period or for the longer period foreseen for the supported investment. It may further request the respective operator to enter into a corresponding contract which outlines the deployment commitments. This contract should foresee a number of 'milestones' which would have to be achieved during the 3-year period and reporting on the progress made. If a milestone is not achieved, the granting authority may then go ahead with its public intervention plans. This rule applies both for basic and NGA networks"

In addition, footnote 80 of the SAG elaborates on the issue and specifies that:

"the aid granting authority may request any operator who declares an interest in building its own infrastructure in the target area to deliver a credible business plan, supporting documents like bank loan agreements and a detailed calendar deployment within 2 months".

Given the above, private investors that have submitted investment plans are currently being reviewed under the framework proposed in this paper.

2. Assessment process

This chapter explains DCENR's process of engagement to date with industry for the purpose of establishing the NGA broadband map. Since the announcement of the NBP, DCENR has engaged in an extensive process of data gathering and consultation with potential investors. This process can be categorised into two types of engagement: 1) industry wide consultation on how the map should be determined and which criteria it should be based on; and 2) engagement with specific investors to obtain the information necessary to reflect existing and planned networks on the map. The sections below outline the details of this engagement in chronological order.

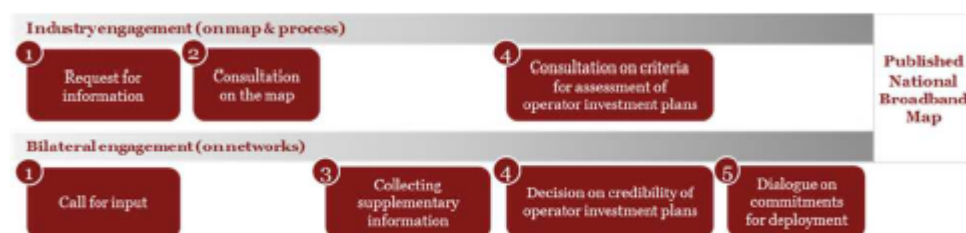


Figure 1: Mapping process

1. Request for information and call for input on mapping (July 2013 - November 2014)

The mapping process commenced in July 2013 when an Information Request was issued³. Investors and operators were asked to verify the data for existing and future coverage of basic and NGA broadband services. The request mainly concerned technical information on specific networks⁴. Broadband operators were invited to participate⁵. DCENR also sent letters to a number of internet service providers (ISPs). In these letters and on its central website, DCENR encouraged operators and investors to submit a 'Mapping Expression of Interest' containing information on their current and planned infrastructure.

Investors and operators were also asked to respond to a call for input on the definition of a "Next Generation Access broadband network". The definition specifies the technical criteria (NGA assessment criteria) that are used to assess if a certain broadband network qualifies as NGA. In addition, operators and investors were requested to provide input on the mapping process proposed by DCENR.

The information gathered through the call for input and the information requests to operators was used to establish the first NBP NGA broadband map, which was published in November 2014. The published NBP map showed DCENR's preliminary assessment of where NGA networks are either present or planned to 2016 (blue areas) and also where no provider is either currently offering an NGA service or planning to invest in the coming three years. These "NGA White" areas were characterised as amber areas on the NBP map published.

2. Consultation on the map (November 2014 - February 2015)

Following its publication, DCENR initiated a consultation on the map. Stakeholders were asked to provide information which could help DCENR refine the assumptions on the NGA assessment criteria. This was also the first time that stakeholders could comment on the map and its descriptive statistics. Publication and

³ http://www.dcenr.gov.ie/NP/rdonlyres/8Ao8D4F6-91B9-439C-96EC-6709811DeD45/o/2013_0628NBPMappingInformationRequestFINAL.pdf

⁴ Regarding network infrastructure, coverage, capacity (both current and planned) for the period up to 1 July 2016

⁵ ComReg's Quarterly Report Q4 2014 notes Eircom, UPC, Vodafone, Sky and Imagine as the top 5 players in the broadband market.

consultation was used to invite further submissions from stakeholders who have planned NGA networks not currently reflected on the map. The deadline for submissions was 12 February, 2015.

3. Collecting supplementary information for planned networks (April 2015 – September 2015)

In order to evaluate the credibility of planned future NGA networks, i.e. for planned networks for which the deployment completion was later than 2016, DCENR required more detailed information from operators and investors. In April 2015, DCENR therefore issued a Request for Supplementary Information addressed to investors that expressed had plans to invest in NGA networks. The request was also published on the DCENR's central website. The information requested concerned not only technical details, but also deployment information for each of the five years to the end of 2020 (for the period in which the proposed government intervention is planned to take place) as well as financial information about the underlying business case and funding to support the roll out.

The full supplementary information request can be found in Appendix A. The deadline for submissions was 14 September 2015, after which only clarifications of information provided by the deadline will be taken into account by DCENR and its advisors. It is currently planned to publish the updated NBP map later this year reflecting changes (if any) from the map published in November 2014.

4. Appraisal of information for planned networks (September 2015 – November 2015)

Once detailed investment plans become available, their credibility is evaluated. Figure 2 describes the framework which guides DCENR decisions on mapping future broadband investment. The framework involves two stages: (1) analysis and appraisal of the investment plans against the technical, deployment and financial criteria and, if all conditions in this step are met, (2) an agreement with the future investor on a specific deployment plan and on how deployment will be monitored. Plans will be included on the map if investors meet the assessment criteria and are willing to enter into binding commitments to deliver their investment plans. This is consistent with the SAG.



Figure 2: Assessment framework

In order to support its assessment of investment plans, DCENR works with external advisors with the relevant technical and financial know-how. Analysys Mason advises DCENR on the evaluation of the technical plans put forward by operators and on certain aspects of the deployment plans. KPMG advises DCENR on the evaluation of the financial plans put forward as well as parts of the deployment plans.

DCENR will update the Map to include planned networks considered credible on the basis of supplementary information received. All investors will be notified of the outcome of the assessment of their investment plan in advance of receiving a formal letter from DCENR notifying them of whether the plan is considered credible for the purposes of the intervention.

5. Agreements on deployment (November 2015 – December 2015)

Where an investor is notified that their plan has been assessed as credible for the purposes of the intervention, in particular given the timeframe involved in any roll out of such plans, there remains a real risk that such plans will not materialise (in full or in part). To address the risk stemming from delay or failure to deliver commercial plans, DCENR will require investors to commit to a credible network roll-out schedule in order to increase certainty that the plans will materialise. Such commitments will include agreements on deployment milestones as well as appropriate reporting and monitoring provisions (see chapter 4 for more detail).

6. Publication of the updated National Broadband Map (November 2015 – December 2015)

The updated map with existing and planned infrastructure is scheduled to be published later this year. It will serve as the basis for establishing the Intervention Area for procurement. However, this does not preclude the map from changing in certain circumstances in the future, as new information about commercial investment plans becomes available. This is discussed in more detail in the KPMG document currently under consultation.

3. Detailed assessment criteria

This section gives a detailed description of the methodology used to assess investment plans. The criteria set out show clearly how the appraisal of investment plans is carried out, and provide as much transparency as possible to all stakeholders on this process. This section starts with an explanation of the assessment methodology, i.e. how different elements of the assessment are weighed in order to draw conclusions on credibility. This is followed by an explanation of how the three different assessments (technical, financial and deployment) are broken down into clear criteria before a final assessment is carried out to allow DCENR to decide whether a plan should be accepted as credible or not.

3.1. Assessment methodology

Investments plans are appraised based on three types of assessment: technical, deployment and financial. Each type of assessment contains 2 to 3 criteria. For instance, in order to assess whether a technical plan is credible, one of the two criteria states that a proposed solution should be characterised as a high speed broadband network (NGA). This criterion is further broken down into several parameters, such as minimum down- and upload speeds (see Figure 3).

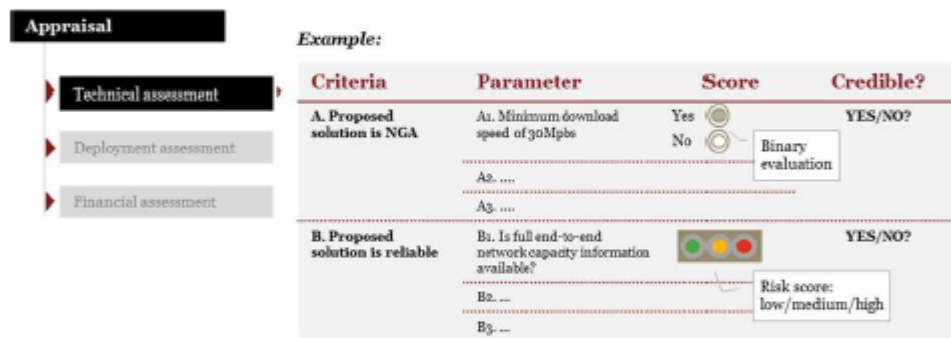


Figure 3: An example of the assessment structure

The parameters are evaluated either with binary questions (yes/no) or risk scores (high/medium/low). Binary questions are answered with a 'yes' or 'no' answer and used to evaluate parameters that are essential. The requirement for this parameter is considered a minimum requirement. For example, for a plan to be credible, the technical solution must be characterised as NGA and meet all the NGA parameters. If a solution fails to meet a requirement, for example the minimum down- or upload speed, then the criterion is not fulfilled. However, it is important to note that the evaluation of binary parameters is not a purely mechanical exercise: a subject matter expert view will be required to assess whether the plan proposed fully meets a minimum requirement.

In addition to binary parameters, there are parameters expressed with a risk score (low/medium/high). Risk score based decisions are used when the question of whether a requirement is fulfilled cannot be represented as a simple 'yes' or 'no'. 'Low' is a score given to the assessment of a parameter where one concludes that there is little concern about the credibility of a plan materialising in a timely manner. 'Medium' signals some concern about the credibility of a plan. 'High' is a score given if there is substantial concern about the credibility of a plan. Evaluation of whether the proposed plan meets a criterion (summarising assessment of individual

parameters) depends on the risk scores for each individual parameter. One or more high risk scores could result in a negative overall assessment for the criterion.

Weighing whether or not a criterion is met is not a strictly mechanical application of rules. It also involves qualitative, professional judgement. In this regard, all investment plans and the supplementary information received are reviewed by external advisors. Analysys Mason advise DCENR on the credibility of the technical plans, whereas KPMG advise DCENR on the credibility of financial plans. Deployment plans are reviewed by both parties to cross-check that they are aligned with financial and technical plans.

The expert advice serves as an important input to DCENR, which ultimately needs to conclude on the credibility of the plans received. DCENR is conducting three assessments (technical, deployment and financial), supported by DCENR, Analysys Mason and KPMG staff. The assessments will follow the criteria put forward in this paper to come to a view on the credibility of the investment plans. A recommendation will then be brought to the NBP Steering Group before being approved by DCENR for communication with the relevant operator.

3.2. Technical criteria

The technical assessment focuses on the question of whether the technology solution proposed is expected to deliver reliable services of an NGA standard (the “what”). Table 1 shows how this is considered through the assessment criteria and their parameters. Appendix A describes how these criteria are linked to the supplementary technical information requested from operators.

Table 1: NGA technical assessment

Criteria	Parameters	Score	Credible?
1. The proposed solution is NGA	1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies)	Yes ☐ No ☐	Yes/No?
	1.2 Minimum download speed of 30 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.3 Minimum upload speed of 6 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.4 Does the solution rely on optical (or equivalent) technology?		
	1.5 Is the solution able to support a variety of advanced digital services including converged all-IP services?		
2. The proposed solution is reliable	2.1 What is interference potential in the network?		Yes/No?
	2.2 Are there concrete measures to mitigate interference?		

3.2.1. NGA solution

DCENR has defined which networks could be recognised as NGA networks in the light of the Intervention Strategy. This definition is consistent with technical configurations qualifying as NGA as stated in the SAG (SAG, paragraph 58). In addition to the technology configuration, DCENR uses a set of metrics including minimum down- and upload speeds and reliability standards to define NGA. The full supplementary

information request and how the questions relate to the criteria below can be found in Appendix A. All parameters have to be positively assessed for a solution to be considered a high speed broadband network.

Plans that state that they will meet these requirements will be assessed from the network architecture and configuration point of view. DCENR will investigate whether the way the network is planned to be built gives enough confidence that premises covered by the planned network can be guaranteed those minimum speeds and service levels in line with policy objectives set out in the draft Intervention Strategy.

Specifically, with regard to criteria 1.2 and 1.3, DCENR will consider:

- If the proposed technology will deliver a minimum of 30Mbps download and 6Mbps upload to each user
- If the access network, using the proposed technology, is designed to deliver 30Mbps/s and 6Mbps to all users under normal operations⁶
- If the proposed backhaul network is designed to deliver 30Mbps download and 6Mbps upload to all users when the user demands it⁷
- If the distance between the first point of active aggregation and the premise, (over which a minimum 30Mbps and 6Mbps upload service is to be delivered) has been established using distance modelling and/or link budgets⁸ which are supported by evidenced assumptions.

In reaching a view on this, DCENR examines an array of technical specifications, including (but not limited to) CPE and equipment specifications, traffic models and capacity, evidence of testing, cable route lengths, etc..

Technical plans that propose a solution which is dependent on the use of spectrum not yet secured will be treated on the assumption that the necessary spectrum will be secured by the relevant operator, i.e. potential uncertainty around future spectrum allocation as such will not lead to a negative assessment in the technical test.

3.2.2. Reliable solution

The NGA network can only be accepted if the technology solution proposed is reliable. In order to evaluate reliability, DCENR will examine if the technology proposed is susceptible to any type of service-affecting external interference, for example radio frequency interference, the impact of weather on wireless reception and for pole-mounted cables, electro-magnetic interference from power sources, cross-talk, or mechanical stress on fibre by an outside agency, etc. DCENR would also expect the technical plan to include a description of measures to mitigate interference.

3.3. Deployment criteria

Deployment plans need to provide confidence that investors or operators are able to deliver the proposed solution in a given time frame. In other words, where the technical plan contains the 'what', the deployment plan contains the 'when, where and how'. Deployment will be evaluated by two main criteria: feasibility of the roll-out plan and the proposed implementation. Table 2 below outlines the scorecard for the deployment test.

⁶ Normal operation is meeting the performance parameters under normal operating conditions, that is, at any time except for:

- Any time that is required for pre-planned network maintenance, which requires the broadband service to be taken out of service (typically undertaken during the night when usage is low)
- Instantaneous, atypical network usage characteristics
- A force majeure event e.g. extreme weather conditions

In this regard, DCENR assess busy hour assumptions and consider the designed capacity of the access and backhaul networks during the busy hour

⁷ In this regard, DCENR assess busy hour assumptions and consider the designed capacity of the access and backhaul networks during the busy hour

⁸ For wireless link budgets, the cell edge probability should be 95% and the cell area probability should be 90% or greater in order for the coverage area to be mapped.

Appendix A describes how these criteria are linked to the supplementary information on deployment requested from operators.

Table 2: Deployment assessment

Criteria	Parameters	Score	Credible?
1. Credible roll-out plan ("when and where")	1.1 Does the plan specify which premises will be passed / connected and when?		Yes/No?
	1.2 Is the rationale for the roll-out plan credible and in line with Irish roll-out practice?		
	1.3 Are the volumes of sites achievable?		
	1.4 Is the project management approach adequate to support this scale of roll-out?		
	1.5 Does the progress of the project to date match the intended planning and milestones?		
	1.6 Does the investor have a track record of timely delivery of milestones during roll-out?		
	1.7 Does the deployment plan include a credible risk analysis and risk management plan?		
2. Credible resource plan ("how")	2.1 Is the project team experienced in roll-outs of this sort?		Yes/No?
	2.2 If subcontractors are being used, is the plan to engage them advanced sufficiently to support the roll-out timeframe?		
	2.3 Are the proposed or actual subcontractors experienced in this type of roll-out?		

3.3.1. Credible roll-out plan

The assessment of the roll-out plan ("when and where") should essentially answer the question whether the solution proposed can be implemented in the timeframe proposed. The roll-out plan is expected to contain coverage maps, locations of premises passed⁹ and locations of nodes, aggregate points and parts of networks, together with design and engineering assumptions. Furthermore, in order to verify credibility of the schedule it will need to include specification of workload in time, construction or acquisition strategy and the progress to the date (if the suggested investment plan demands that some activities should have started by the time of assessment). The plan should also involve evidence of previous track record, adequate risk assessment and measures to mitigate deployment risks. Failure to adequately demonstrate a detailed schedule would negatively affect the overall credibility of the business plan. Advised by Analysys Mason, DCENR also assesses whether the practical implementation of the deployment plan is credible in comparison with previous Irish broadband deployment experience.

3.3.2. Credible resource plan

The assessment of the resource plan ("how") is centred on the credentials and former experience of the core delivery team, including subcontractors. A previous track record can help build confidence on the ability to

⁹ Premises passed: a premise is considered passed for a) a wireline network when a premise for which the wireline network has a distribution point sufficiently close to that premises such that NGA broadband services can be provisioned for that premise within the service provisioning targets outlined in the Technical Report (National Broadband Plan for Ireland – Intervention strategy, Draft technical report, 2015) and at the benchmark Standard Connection Charge; and for b) a wireless network when a premise for which the wireless network has sufficient signal quality for that premises such that a NGA broadband services can be provisioned for that premises within the service provisioning targets outlined in the Technical Report and at the Standard Connection Charge.

deliver. Concrete plans about the delivery and organisation of the work, where possible evidenced by contracts, would also indicate an advanced stage of organisation and planning.

3.4. Financial criteria

The previous sections have clarified the technical and deployment criteria, both of which are necessary but not sufficient conditions for the overall investment plan to be deemed credible. A sound financial plan is also needed. Financial assessment is guided by two main criteria: 1) a business plan needs to demonstrate that the investment is credible from a financial point of view and 2) funding arrangements need to be in place to demonstrate that the deployment can be financed. Table 3 outlines the criteria and their parameters. Appendix A describes how these criteria are linked to the supplementary financial information requested from operators.

Table 3: Financial assessment

Criteria	Parameters	Score	Credible?
1. Sound Business Plan	1.1 Is the Net Present Value (NPV) of the investment positive and developed on a stand-alone basis (for both wholesale and retail)?		Yes/No?
	1.2 Revenue assumptions: is take up rate realistic, given market development and potential competition at a retail level?		
	1.3 Revenue assumptions: are pricing assumptions (both wholesale and retail) realistic, given potential regulation in the market?		
	1.4 Cost assumptions: are cost level (capex and opex) assumptions realistic and in line with design of the network?		
	1.5 Cost assumptions: can all costs (fixed and variable) be recouped?		
	1.6 Are the costs aligned with the deployment plan?		
	1.7 Does the time span of the business plan corresponds with the lifecycle of the investments?		
2. Availability of funding	2.1 Is the need for funding and associated costs adequately assessed?		Yes/No?
	2.2 Is funding structure available by source (own cash, debt or equity)?		
	2.3 Does the financial plan contain commitments from debt or equity providers, or the board in case it is funded by cash?		
	2.4 Do projected cash flows support the need for funding and/or debt financing?		

3.4.1. Sound business plan

A solid financial plan should be provided to demonstrate that the proposed investment is credible and commercially viable. The business case will need to show a positive NPV, as a negative NPV would cast doubt on the credibility of a plan actually materialising. In addition, a negative NPV would raise questions as to whether the investment plan can be called 'commercial'. The SAG is aimed at protecting commercial investment

by market forces in the absence of government action. To qualify for such protection, however, announced investment plans would need to reflect actual commercial intentions, independent of the Government intervention. In other words, the business case needs to be positive on a stand-alone basis.

In order to determine whether a plan has a positive NPV, its assumptions are scrutinised. If the plan is commercial only on the basis of unrealistic assumptions, again, the investment cannot be considered viable and, consequently, should not be accepted on the map¹⁰. Assumptions that will be scrutinised include revenue assumptions and costs assumptions. The various assumptions used in the business case should also be in line with the technical and deployment plans, in terms of how and when costs are incurred and revenues received.

As to projected revenues, take-up assumptions will need to be justified and substantiated. In addition, the assumed price levels need to be realistic and reflect the willingness to pay as well as the probable regulatory framework. If the positive NPV of the financial plan depends on the assumption that monopolistic prices can be charged at the wholesale or retail level, these assumptions might not be consistent with the likely regulatory framework or competition law. As such, the financial plan should not be accepted as credible. The question as to which regulatory framework should be assumed, for example for determining retail, wholesale or transfer prices, can be challenging as such regulation does not in all cases already exist and cannot necessarily be predicted. However, notwithstanding such difficulties, and given the likely monopolistic character of any network built in these areas, it is probable that any commercial network will face at least some level of regulatory scrutiny. DCENR would expect this to be reflected in the business case in terms of reasonable prices for wholesale and retail products or assumed internal transfer prices.

With regard to cost projections, capital and operating costs will be examined. The deployment plan and the financial plan should be consistent in terms of premises passed and connected. Another important consideration is whether the long-term costs can be fully recovered. The cost model supporting any business plan for an infrastructure build should ideally match the investment maturity and also account for the fact that asset maintenance and re-investment is eventually needed. As to operating costs, transfer prices would also need to be justified, as these are also likely to be subject to some level of regulatory oversight. Where necessary, the assessment may rely on benchmarks to available cost and roll-out information in the non-intervention area and international comparisons.

3.4.2. Availability of funding

The private investor should be able to show that the proposed roll-out can be funded. DCENR expects a funding plan with details on the approach to raising finance. Funding can come from a variety of sources, e.g. from equity, debt or available cash. DCENR does not have a preference for one source of funding over another, but the private investor is expected to show to what extent key decision makers have committed to funding. For example, in the case of debt funding, DCENR will look for evidence of commitments from banks (such as bank loan agreements). In the case of finance from retained earnings, DCENR would expect to see capex plans and cash flow projections as well as board approval documents for the investment. In case funding is not committed for parts of the plan, investors are asked to provide information on the proportion not yet committed and for a proposed strategy to ensure that funding will be raised within the deployment time frame.

In some cases the funding can be conditional on certain key uncertainties. For example, in the case of investors intending to use wireless technology, there is an appreciation that fully securing funding could be problematic because of uncertainty around spectrum allocation. In these instances there is room for accepting financial plans on the basis of *provisional* funding arrangements (e.g. conditional on spectrum availability). However, this does not replace the overall requirement to show a solid, credible funding plan that includes, depending on the funding strategy proposed, board approval documents, capex plans, and / or commitments from banks or equity providers.

¹⁰ However, a historical track record of a company will also be considered.

4. Mapping and agreements around deployment

The previous chapter described DCENR's approach to assessing the credibility of investment plans. In order for a private investor to be on the map with a planned network, it needs to commit to a deployment timeframe and agree with DCENR certain monitoring requirements to be considered for the NBP map. This chapter outlines the details of such an agreement and how an operator will be reflected on the map once its investment plan is credible and commitments are in place.

4.1. Agreement on deployment

Once an investment plan is decided to be credible, commitments will govern the actual delivery of the investment plan. This approach is consistent with the SAG (paragraph 65) and reflects the Government's wish to have certainty around timely delivery of 100% high speed broadband coverage by 2020. The Government requires commitments to minimise the risk of delay (or even non delivery). Any such delay or non-delivery of planned, private investment in areas that otherwise would have been subject to state intervention, will delay the access of citizens and communities to high speed broadband. In addition, such delays and non-delivery could increase the total costs for the intervention, for example if they would necessitate a second public procurement. Therefore, private investors will be asked to commit to timely deployment and too agree on certain reporting and monitoring provisions.

DCENR expects this agreement to consist of several elements. First of all, the commitment should include a deployment plan with concrete project milestones. Such milestones could include timelines for the construction, testing and commissioning of specific sections. The future operator should also specify the number of connections annually to 2020. The projections up to 2020 can be relatively high level, but for the immediate 6 months ahead, DCENR expects to see a detailed plan specifying the projected number and location of individual premises passed and connected. This might include some flexibility, for example to swap locations. The operator will be expected to report on progress on a monthly basis. After 6 months, an updated plan should be provided, covering the projections for the next phase of the roll out.

The agreement will also need to contain provisions on delayed deployment. Delays could be the result of many factors within or outside the investor's influence. For example, if an investor with an otherwise solid track record faces delivery problems due to certain unforeseen circumstances, it would be excessive to end the commitment right away and remove the operator from the map. Nevertheless, in some situations where it becomes apparent that the operator will not be able to meet his future deployment commitments, DCENR may need to reserve the right to end the agreement, remove the operator from the map and, potentially, revert back to the scope of the intervention.

4.2. Outcome of the assessment: mapping

The previous chapters have described the assessment framework and process for future high speed broadband networks. Once private investors have received confirmation that their investment plan is regarded as credible, and once they have entered into an agreement with the Department as to deployment, then their planned network can be included on the National Broad Map. The planned networks will be reflected in light blue, as the map distinguishes between:

- Areas that have access to high speed broadband services via an existing NGA network or it will be deployed by the end of 2016 (marked as blue);
- Areas where NGA network is expected to be deployed by 2020 since there are concrete and credible investment plans (marked as light blue); and

- Areas for which no plans exist to date and which will be addressed by the intervention (marked as amber).

Table 4 summarises the conditions to either accept or reject a planned network and the corresponding consequences for the high speed broadband map.

Table 4: Conditions to accept or reject planned investments

Outcome	When effectuated	Mapping consequence
1. Accept	- If the operator submits details on technical, deployment and financial plans; and - If the plan for the intended area meets all assessment criteria; and - The operator commits to a deployment agreement	- Plan will be reflected on the map - Area covered will be reflected as light blue
2. Reject	- If the operator does not submit sufficiently detailed information on technical, deployment and/or financial plan; or - If a plan fails to meet one of three tests; or - The operator does not commit to a deployment agreement	- Plan will be left out of the map

Appendix A: Supplementary Request for Information

Introduction

This section contains the full supplementary information request send out to all private investors or future operators in April 2015. For information purposes, it is demonstrated how the information requested is used to assess the criteria and parameters outlined in this report.

A.1. Technical information

Table 5: Supplementary Information request and corresponding technical assessment criteria

Request	Technical assessment criteria (set out in table 1) to which the SIR requirements primarily relate (for information purposes)
1 Generic	
Each operator is requested to provide the following information, separately, for its existing and planned networks: 1. A description of the overall network architecture. 2. A description of the access network technology and the specification of the access equipment (including the relevant telecoms standards with which the equipment complies). 3. A description of the backhaul network technology (national¹¹ and metro¹²) and the specification of the backhaul equipment (including the relevant telecoms standards with which the equipment complies). 4. A design for the national backhaul network including any traffic and capacity assumptions. 5. The specification of all types of customer premises equipment which the operator plans to use. 6. Coverage data, as illustrated in Figure 3.1 below, in the form of a Polygonised (vector) dataset with 'DOWNLOAD SPEED' attribute attached to the polygon, delivered in one of the following formats: • ESRI Shapefile (Polygon) • ESRI PGE (polygon feature class) • Map info MID/MIF (Polygon) • KMZ (Polygon) • DXF/DGN This coverage data is requested to include:	Technical criteria 1) the proposed solution is NGA, 1.1, 1.2, 1.3, 1.4 Deployment criteria 1) Credible roll-out plan, 1.1, 1.3

¹¹ National backhaul is defined as the network which connects aggregation points to the core network and the internet

¹² Metro backhaul is defined as the network which connects access nodes to aggregation points

- NGA broadband coverage with contours corresponding to available download speed or, a map showing all premises covered, with the premises coded according to the speed they will receive. The download speed must be no less than 30 Mbps
 - Any assumptions made in relation to the contours
 - Mapping of existing and planned coverage
7. Any other relevant information that could assist the DCENR in assessing the concrete nature of submission.

2 Platform specific information

2.3 Wired platforms:	Technical criteria 1) the proposed solution is NGA, 1.1, 1.2, 1.3, 1.4 and 2) the proposed solution is reliable, 2.1, 2.2
1. Please provide the following data in a spreadsheet on a <u>per access node</u>¹³ basis: a. access node ID b. access node coordinates and coordination projection system c. technology (including relevant standards) d. the access network frequency plan e. access node status (greenfield or existing) f. backhaul technology g. backhaul capacity h. line length distribution from cabinet to premises 2. Please provide details of the CPE and the general locations where it is proposed to install it in the premises. 3. Please describe any planned use of technological advancements to increase broadband speeds (e.g. pair-bonding, vectoring, phantom mode, channel bonding etc.). 4. Please describe the following inputs to the coverage map: a. propagation model i.e. speed performance versus line length b. supporting evidence including manufacturers performance data and trial results c. any assumptions made in translating straight line to actual route d. planning tool and associated configuration 5. Please provide a full Excel-based link budget for the downlink and uplink including all intermediary step calculations i.e. include all formula used to calculate all line items (e.g. line A + line B + line C = line D). The link budget should include at a minimum the following line items and their associated units: a. transmit power b. system bandwidth c. required signal-to-interference-plus-noise ratio (SINR) d. receiver sensitivity e. maximum allowable path loss f. mean propagation loss	Deployment criteria: 1) credible roll-out plan - 1.2, 1.7

¹³ The definition of 'access node' will depend on the type of fixed access technology planned and may include FTTC cabinet, HFC node, FTTH etc

g. formula showing conversion of link budget into design threshold on which coverage map is based 6. Please describe the planned approach to interference management in the access network making reference to frequency plans and any issues associated with the transmission medium. 7. Regarding any existing equipment or plant which the planned network will reuse (including copper wires, coaxial cable, poles, optical fibre), please describe: a. the general state of the existing equipment or plant b. the impact of the existing equipment or plant on the quality of service c. the approach to mitigating the risk of equipment or plant not meeting sufficient quality standards to meet the planned quality	
2.b <u>Wireless platforms:</u> 1. Please provide the following data in a spreadsheet on a <u>per sector</u> basis: a. sector ID b. site ID c. site coordinates and projection system d. sector azimuth e. access technology (including relevant standards) f. carrier frequency g. number of carriers h. bandwidth per carrier (e.g. 20MHz). i. structure status (greenfield or existing) j. tower or structure height (above ground level) k. transmit antenna height (reference base of antenna) l. transmit power m. antenna gain n. antenna radiation pattern for vertical and horizontal radiation pattern (patterns should be provided in Excel or another computer readable file, loss in dB per degree) o. MIMO scheme p. number of transmit antennas q. number of receive antennas r. antenna tilt – electrical (reference positive degrees for down-tilt, negative number for up-tilt) s. antenna tilt – mechanical (reference positive degrees for down-tilt, negative number for up-tilt) t. spectrum licence conditions including ComReg licence reference number 2. Please describe any planned use of carrier aggregation (CA) 3. Please provide the following data in a spreadsheet on a <u>per site</u> basis: a. number of sectors on installation b. any planned evolution of the number of sectors over time c. backhaul technology d. backhaul capacity e. site acquisition assumptions including information regarding site ownership and statement of probability of inclusion of site	Technical criteria 1) the proposed solution is NGA, 1.1, 1.2, 1.3, 1.4 and 2) the proposed solution is reliable, 2.1, 2.2 Deployment criteria: 1) credible roll-out plan - 1.2, 1.7

in rollout

4. Please provide the following data for each proposed mode of reception (e.g. indoor CPE, window-mounted CPE, external CPE) at the end user's premises:
 - a. describe the mode of reception
 - b. describe how service assurance for that mode of reception will be provided.
 - c. provide:
 - i. antenna height
 - ii. transmit power
 - iii. MIMO scheme
 - iv. number of transmit antennas
 - v. number of receive antennas
 - vi. antenna gain
5. Please describe the following inputs to the coverage map:
 - a. propagation model and selected parameters
 - b. planning tool and associated configuration
 - c. digital terrain map (including resolution)
 - d. clutter map (including resolution)
6. Please provide a full Excel-based link budget for the downlink and uplink including all intermediary step calculations i.e. include all formula used to calculate all line items (e.g. line A + line B + line C = line D). The link budget should include at a minimum the following line items and their associated units:
 - a. EIRP
 - b. system bandwidth
 - c. required signal-to-interference-plus-noise ratio (SINR)
 - d. receiver sensitivity
 - e. maximum allowable path loss
 - f. indoor penetration loss as applicable per clutter type or geographic type
 - g. cell edge probability
 - h. cell area probability
 - i. mean and standard deviation used to calculate slow fade margin
 - j. slow fade margin
 - k. mean propagation loss
 - l. formula showing conversion of link budget into design threshold on which coverage map is based
7. Please describe the planned approach to interference management in the access network making reference to carriers and frequency reuse plans.
8. Any other relevant information that could assist the Department in assessing the concrete nature of the technical plan.

A.2. Deployment information

Table 6: Supplementary Information request and corresponding deployment assessment criteria

Request		Deployment assessment criteria (set out in table 2) to which the SIR requirements primarily relate (for information purposes)
1	Rollout schedule	
1.a	Please provide a rollout schedule for the broadband coverage map(s) requested in Section 2. The rollout schedule should indicate on a monthly basis, where available, the equipment which will be deployed and its location.	Deployment criteria 1) credible rollout plan – 1.1, 1.3 and 2) credible resource plan – 2.1, 2.2, 2.3
1.b	Outline target rollout volumes for 2015, 2016, 2017, 2018, 2019 and 2020, and how these volumes relate to the overall deployment strategy	Deployment criteria 1) credible rollout plan – 1.1, 1.3, 1.5
1.c	Please describe the methodology for the provision of the services including: a. an overview of the project management approach to the rollout of the broadband service, and the access network and backhaul that support it. b. details of risks, together with details of expected difficulties, issues and mitigation plans. Operators' risk analysis and detailed mitigation plans shall include, but shall not be limited to, the following risks: i. node or site identification and selection ii. node or site acquisition iii. planning permission for site or node iv. backhaul v. local protest vi. wayleaves vii. vendor supply and lead times viii. location of stores ix. power supply and connection to the electricity network x. managing customer communication c. the rationale behind the rollout timescales	Deployment criteria 1) credible rollout plan – 1.2, 1.4, 1.7
1.d	Please describe how the Department will be kept updated regarding the rollout progress including: a. the process by which updates will be communicated b. the format in which coverage data will be provided c. the integration of planned coverage with existing coverage (where applicable)	Deployment criteria 1) credible rollout plan – 1.4, 1.7

- d. the process by which any amendments to the planned coverage will be notified

Any other relevant information that could assist the Department in assessing the concrete nature of the deployment plan

2 Resource plan

2.a Please provide a description of the programme team that will be responsible for providing the rollout including: 1) the principal members of the team that will manage the rollout 2) the organisational structure of the teams. 3) Details of any subcontracting contracts in place for the rollout 4) Equipment vendor contracts in place. 5) Orders placed for services and/or equipment 6) List of relevant inventory/ stock already in place to support the deployment	Deployment criteria 1) credible roll-out plan, 1.4, 1.6, 1.7 and 2) credible resource plan –2.1, 2.2, 2.3

A.3. Financial information

Table 7: Supplementary Information request and corresponding financial assessment criteria

Request	Deployment financial criteria (set out in table 3) to which the SIR requirements primarily relate (for information purposes)
1 Business plan	
1.a Outline of Business Plan required: A detailed business plan (incorporating the proposed deployment plan to 2020 or as close as possible to that date) for a timeframe that shows a return on investment to your entity. For example, if your deployment and capital investment requires financial forecasts over a 10 year period in order to achieve your expected return then the business plan should be for this duration. The plan should include all revenue, operating cost and capital cost assumptions, e.g.; take-up, addressable market, maintenance, deployment, inflation, etc. Each of the costs should be directly linked to the technical solutions proposed and fully costed based on the technical approach for the business. The plan should be in a cash flow, income statement and balance sheet format, in accordance with generally accepted accounting practice. Where it is proposed that the business plan is split into phases, then a plan supporting each phase can be provided or a consolidated plan that provides a breakdown of each phase linking to the proposed technical approach and the level of funding required.	Financial criteria 1) sound business plan – 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7 and link to 2) funding plan – 2.1
1.b Key Assumptions employed in Business Plan: All main assumptions in the Business Plan set out in 1a should be clearly set out, including: <u>Revenues</u> • Addressable market, with reference to competitors/level of competition identified • Take-up assumptions, including churn (differentiated by wholesale & retail) • Growth Assumptions (including new premises assumptions) • Product assumptions (differentiated by wholesale & retail) • Product pricing assumption (differentiated by wholesale & retail) <u>Capital costs</u> • Deployment plan linked to proposed technical solution	Financial criteria 1) sound business plan, revenues – 1.2 and 1.3, capital costs, operating costs and deployment – 1.4, 1.5 and 1.6

and phasing identified.

- Within deployment plans, clear differentiation between *premises passed* and *premises connected*, linked back to the proposed technical solution and phasing identified
- Main assets categories to be deployed linked to the technical solution
- The asset lives assumed for main assets categories

Operating Costs

- Own network operating cost assumptions
- Wholesale input cost assumptions (i.e. wholesale input costs – connections, rentals, co-location, etc.)
- Site rental costs

1.c Notes to Business Plan

The following notes are a guide to the details required for the Business Case set out in 1a.

- A detailed breakdown of the revenue elements including addressable market, products, pricing and take up linking to an overall revenue figure on an annual basis in the business plan.
- A detailed breakdown of the capital costs associated with the business should be linked to the technical solution proposed and the deployment and business plans.
- A detailed breakdown of the operating costs associated with the business, on an annual basis, linking to the technical solution proposed and the deployment and business plans.
- A listing of the useful lives of the major assets developed and the projections for any capital replacement costs that fall within the timeframe of the business plan linking to the technical solution proposed.
- A detailed breakdown of the cost of finance (debt and equity) including drawdowns, repayments, interest, dividends, coupons, etc., on an annual basis over the business plan.
- A detailed split of the funding into amounts already committed (and supported by the information requested in section 2 below) and the amount not yet committed if applicable.
- Projected returns to equity over the life of the business plan in the form of an Internal Rate of Return calculation as well as metrics such as Net Present Value, payback and margin where relevant to the business. For the avoidance of doubt, the equity IRR is calculated as the discount rate (rate of return) that would result in the Net Present Value of cash flows to equity being zero.
- Details of the risks and issues associated with this business plan and how these will be managed, to ensure

Financial criteria 1) sound business plan – 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, link to 2) funding plan – 2.1

that they are minimised. Broad categories of risk include:

- Revenue (pricing, take up, product, market); Operating costs (network operating expenditure, maintenance, overheads, marketing);
- Capital costs (network build costs and replacement);
- Rollout plan and timing; and
- Financing risk.

2 Funding plan

2.a	Details of a funding plan to include information on the approach to raising finance for the infrastructure and other funding requirements including (but not limited to):	Financial criteria 1) sound business plan – 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 and 1.7 and 2) funding plan – 2.1, 2.2, 2.3 and 2.4
	• funding structure; • equity finance; • debt finance and quasi equity (including subordinated and mezzanine debt); • working capital arrangements; • standby finance; • other forms of finance; and • strength of commitment. • Evidence of board approval of the investment is required. Indirect evidence, such as communications referring to board approval will not be sufficient.	
2.b	Details of each source of funding, including rights and obligations of each type of funding, and details of agreements with the organisations providing funding.	Financial criteria 2) funding plan - 2.2, 2.3 and 2.4 including a link back to criteria 1) sound business plan - 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 and 1.7
2.c	Equity: • Identity of investors; • Timing of investments; and • Terms and conditions of the subscription, including dividend rights attaching to shares, the extent to which funds are committed and the length of time funds will remain in the company; • Letter of support supporting the above.	Financial criteria 2) funding plan - 2.2, 2.3 and 2.4
2.d	Debt: • Identity of lead arrangers, lead managers and/or underwriting banks and/or quasi-equity providers that have given indications/commitments; • Type and purpose of facility; • Amounts committed by each funder; • Terms and conditions attaching to the loan such as conditions precedent to drawdown, principal covenants (including details of cover ratios); • Drawdown schedule, capital repayment moratorium (if applicable), repayment schedule and final maturity date,	Financial criteria 2) funding plan - 2.2, 2.3 and 2.4

	events of default, security required, any reserve accounts; • Interest rates specifying base rate and margins; • Any proposed hedging arrangements in respect of interest rates; • Arrangement and other fees; • Any other information which would be relevant to specific forms of debt finance; and • Letter of support supporting the above.	
2.e	To the extent that other forms of finance, other than debt and equity or quasi-equity are to be used (e.g. operating cash flows of the current business), provide appropriate information to support this.	Financial criteria 2) funding plan - 2.2, 2.3 and 2.4
2.f	Where funding is not yet committed (i.e. not supported by information requested in section 2.b to 2.e above), please provide information on the proportion that is not yet committed and a proposed funding strategy to ensure that this will be raised within the deployment plan timeframe.	Financial criteria 2) funding plan - 2.2, 2.3 and 2.4
3	General Questions	
3.1	What decisions would be required to trigger future investment plans?	All financial criteria
3.2	Is there any other relevant information that could assist the Department in assessing the concrete nature of the business and funding plans?	All financial criteria

Appendix 3 – The three Online Map Building Blocks detailed description

A 3.1 The Irish Online Map Building Block 1 – detailed description

The NBP Mapping Assessment Framework sought to outline the overall process for the assessment of any Service Provider claim. As part of this objective, it set out the Mapping Assessment Performance Criteria which had to be satisfied to confirm the existence of an NGA broadband service or the set of performance criteria that had to be satisfied to demonstrate that the plan for a future NGA broadband network was sufficiently credible and concrete so that the area covered by that network should be removed from the Intervention Area.

Figure A 3.1 below outlines the NBP Mapping Assessment Framework that was applied in Ireland for the Irish NBP intervention project. Whereas the framework in its entirety was applied to planned networks, only the technical assessment was applied in respect of the assessment of existing networks.

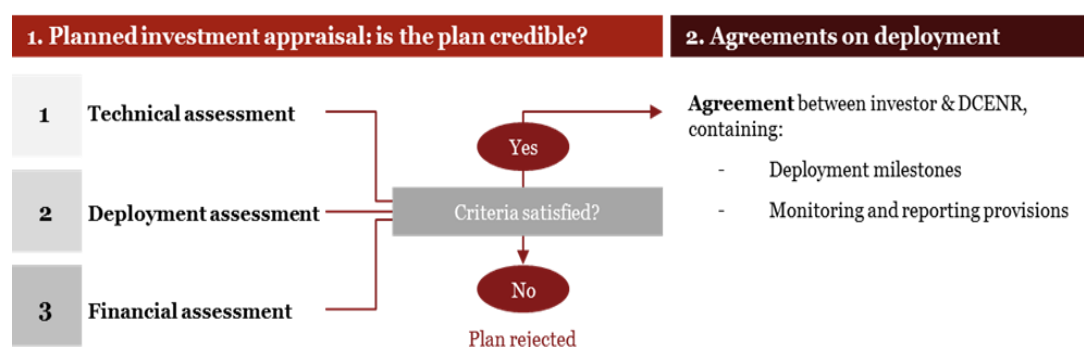


Figure A 3.1 - NBP Mapping Assessment Framework (Source DCENR).

As outlined in Figure A 3.1 above, the framework involves two stages:

- Stage 1: Is the Plan credible? Within which technical, deployment and financial assessment criteria are defined; and (if all of the conditions in this stage are met, to then progress to Stage 2, if they are not the plan is rejected); and
- Stage 2: Agreements on deployment. The Service Provider is required to enter into a binding contractual agreement with the Department to meet specific deployment milestones for the planned network and to commit to certain reporting obligations.

The NBP Mapping Assessment Framework and the set of Mapping Assessment Performance Criteria is set out in 'Mapping Future High Speed Broadband Networks' (65), in Appendix 2.

The NBP Mapping Assessment Framework therefore contains the Online Map Building Block 1 for the Irish NBP intervention project. What follows is a description of the NBP Mapping Assessment Framework and each of the criteria defined.

A 3.1.1 Stage 1 – Is the plan credible?

Each of the areas within stage 1 of the NBP Mapping Assessment Framework (i.e., technical, deployment and financial) have a number of Mapping Assessment Performance Criteria defined. The Mapping Assessment Performance Criteria contain several sub parameters, which are considered when verifying whether the criteria are met or not.

A 3.1.1.1 Stage 1 – The Technical Criteria

For the technical assessment, two technical criteria are defined, these are:

1. Is the proposed solution NGA? and
2. Is the proposed solution reliable?

Figure A 3.2 outlines the Mapping Assessment Performance Criteria that applied to the technical area.

Criteria	Parameters	Score	Credible?
1. The proposed solution is NGA	1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies)	Yes ☐ No ☐	Yes/No?
	1.2 Minimum download speed of 30 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.3 Minimum upload speed of 6 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.4 Does the solution rely on optical (or equivalent) technology?		
	1.5 Is the solution able to support a variety of advanced digital services including converged all-IP services?		
2. The proposed solution is reliable	2.1 What is interference potential in the network?		Yes/No?
	2.2 Are there concrete measures to mitigate interference?		

Figure A 3.2 - NBP Mapping Assessment Performance Criteria - Technical (Source DCENR).

Each technical criterion is further broken down into several parameters, five parameters (1.1 to 1.5) for the first technical criterion and two parameters (2.1 to 2.2) for second technical criterion.

The parameters are evaluated either with binary questions (yes/no) or risk scores (high/medium/low). Binary questions are used to evaluate parameters that are considered a minimum requirement. For a network to be regarded as an NGA network it must meet all of the binary parameters. If a solution fails to meet a binary parameter, for example the parameter 1.2 relating to the minimum download speed performance, then the criterion is not fulfilled.

In addition to binary parameters, there are parameters expressed with a risk score (low/medium/high), for example the parameter 2.2 relating to whether there are concrete measures to mitigate interference. Risk scores are used when the question of whether a requirement is fulfilled cannot be represented as a simple 'yes' or 'no'. 'Low' is a score given to the assessment of a parameter where it is concluded that there is little concern about the network's ability to deliver NGA services and/or its reliability. 'Medium' indicates some concern about the network's ability to deliver NGA services and/or its reliability. 'High' is the score given if there is substantial concern relating to the network's ability to deliver NGA services and/or its reliability. Evaluation of whether the network meets a criterion (summarizing the assessment of individual parameters) depends on the risk scores for each individual parameter.

A 3.1.1.2 Stage 1 – The Deployment Criteria

For the deployment assessment, two deployment criteria are defined, these are:

1. Is there a credible roll-out plan? and
2. Is there a credible resource plan?

Figure A 3.3 outlines the Mapping Assessment Performance Criteria that applied to the deployment Area.

Criteria	Parameters	Score	Credible?
1. Credible roll-out plan ("when and where")	1.1 Does the plan specify which premises will be passed / connected and when?		Yes/No?
	1.2 Is the rationale for the roll-out plan credible and in line with Irish roll-out practice?		
	1.3 Are the volumes of sites achievable?		
	1.4 Is the project management approach adequate to support this scale of roll-out?		
	1.5 Does the progress of the project to date match the intended planning and milestones?		
	1.6 Does the investor have a track record of timely delivery of milestones during roll-out?		
	1.7 Does the deployment plan include a credible risk analysis and risk management plan?		
2. Credible resource plan ("how")	2.1 Is the project team experienced in roll-outs of this sort?		Yes/No?
	2.2 If subcontractors are being used, is the plan to engage them advanced sufficiently to support the roll-out timeframe?		
	2.3 Are the proposed or actual subcontractors experienced in this type of roll-out?		

Figure A 3.3- NBP Mapping Assessment Performance Criteria - Deployment (Source DCENR).

The deployment criteria only apply to the assessment of proposed future investments as the networks are not yet deployed. They are designed to reasonably evaluate whether the Service Provider will be able to deliver the proposed future network solution in the timeframe proposed. In other words, if the technical criteria evaluate the “what”, the deployment criteria evaluate the “when, where and how”.

The first deployment criterion has seven parameters (1.1 to 1.7) and the second deployment criterion has three parameters (2.1 to 2.3). All parameters are expressed with a risk score (low/medium/high). A ‘low risk score’ is a score given to the assessment of a parameter where it is concluded that the proposed plan relating to that parameter has a low level of risk and is therefore credible, ‘a medium risk score’ indicates some concerns exist about the credibility of the plan relating to that parameter and ‘High risk score’ is the score given if there is substantial concern relating to the credibility of the plan proposed for that parameter and it is therefore not credible. An example of a parameter attracting a ‘high risk score’ might be for example (for parameter 2.2) where the level of engagement of the Service Provider with subcontractors has been limited or non-existent, but where their proposed deployment has a heavy reliance on these subcontractors.

Evaluation of whether the network meets a deployment criterion (summarizing the assessment of individual parameters) depends on the risk scores for each individual parameter. Ideally a low-risk score is attained for all deployment parameters but where some medium risk scores are attained (or indeed a single high-risk score) a level of professional judgement must be applied to examine the materiality of the risks and to then conclude the overall outcome for the deployment criterion.

A 3.1.1.3 Stage 1 – The Financial Criteria

For the financial assessment, two financial criteria are defined, these are:

1. Is there a sound business plan? and
2. Is the funding available?

Figure A 3.4 outlines the Mapping Assessment Performance Criteria that applied to the financial Area.

Criteria	Parameters	Score	Credible?
1. Sound Business Plan	1.1 Is the Net Present Value (NPV) of the investment positive and developed on a stand-alone basis (for both wholesale and retail)?		Yes/No?
	1.2 Revenue assumptions: is take up rate realistic, given market development and potential competition at a retail level?		
	1.3 Revenue assumptions: are pricing assumptions (both wholesale and retail) realistic, given potential regulation in the market?		
	1.4 Cost assumptions: are cost level (capex and opex) assumptions realistic and in line with design of the network?		
	1.5 Cost assumptions: can all costs (fixed and variable) be recouped?		
	1.6 Are the costs aligned with the deployment plan?		
	1.7 Does the time span of the business plan corresponds with the lifecycle of the investments?		
2. Availability of funding	2.1 Is the need for funding and associated costs adequately assessed?		Yes/No?
	2.2 Is funding structure available by source (own cash, debt or equity)?		
	2.3 Does the financial plan contain commitments from debt or equity providers, or the board in case it is funded by cash?		
	2.4 Do projected cash flows support the need for funding and/or debt financing?		

Figure A 3.4 - NBP Mapping Assessment Performance Criteria - Financial (Source DCENR).

Similar to the deployment criteria, the financial criteria only apply to the assessment of proposed future investments. They are designed to reasonably assess whether the Service Provider's business plan is credible or not (i.e., commercially viable) and whether they have access to sufficient funding to fulfill the proposed plan. The financial criteria are designed to provide confidence in the Service Provider following through on the proposed investment.

The first financial criterion has seven parameters (1.1 to 1.7) and the second financial criterion has four parameters (2.1 to 2.4). Like the deployment criteria all parameters are expressed with a risk score (low/medium/high) with a 'low risk score' is a score given to the assessment of a parameter where it is concluded that the proposed plan relating to that parameter has low level of risk and is therefore credible etc. And the overall assessment is determined by considering all the parameters together. An example of a parameter attracting a 'high risk score' might be, for example, where the project requires significant up-front capital funding, but the Service Provider has not yet established where this funding will come from.

A 3.1.2 Stage 2 – Agreements on Deployment

Once a Service Provider's claim relating to a future planned network is deemed to have passed Stage 1 and fulfilled the Mapping Assessment Performance Criteria set out for technical, deployment and financial, the Service Provider is then invited to enter into a contractual agreement on their deployment with the Minister for Communications. This stage is only relevant for future planned networks.

The agreement is a legally binding contract committing to meet specific deployment milestones for the planned network and to commit to certain reporting obligations. The agreement introduced an additional safeguard for the State to ensure proposed plans were actually implemented.

A 3.2 The Irish Online Map Building Block 2 – detailed description

A 3.2.1 The Irish development of the Mapping Verification Methodologies

As well as defining the Mapping Assessment Performance Criteria in the Online Map Building Block 1, appropriate techniques or verification methodologies must be developed to assess Service Provider claims to establish whether they meet the Mapping Assessment Performance Criteria or not. These verification methodologies vary dependent on the technology used in the Service Provider network and whether it is an existing network or future planned network.

While the general concept of assessing a network or a planned network against a set of criteria appears straight forward, this is in fact extremely complex. Considerable thought and effort are required to develop the verification methodologies. The SAG encourages consultation with the National Regulatory Authority (NRA) in this process. Paragraph 78 (a) states:

*‘Detailed mapping and analysis of coverage: Member States should clearly identify which geographic areas will be covered by the support measure in question ⁽⁹²⁾, whenever possible in cooperation with the competent national bodies. **The consultation of the NRA is encouraged but optional.** Best practice examples suggest creation of a central database of the available infrastructure at a national level thereby increasing transparency and reducing the costs for the implementation of smaller, local projects. Member States have the freedom to define the target areas, however, they are encouraged to take into account economic conditions in the definition of relevant regions before launching the tender ⁽⁹³⁾’.*

The SAG does not provide any insights into how these verification methodologies should be determined other than to encourage this consultation with the NRA, presumably as the NRA may have some level of relevant expertise in evaluating network performance.

The outcome of the assessment of Service Provider claims is determined by following the verification methodology. This outcome is typically of the upmost strategic importance to

the Service Provider and in some cases critical to the future viability of the Service Provider's business⁷¹. The verification methodologies are likely to come under significant scrutiny from these companies and therefore robust verification methodologies are needed.

The effort required to develop these methodologies should not be underestimated; for the Irish NBP intervention project it required considerable time, resource effort and specialist expertise. No reference material was available to the Department from other EU Member States and no guidance was provided by the EU Commission. The Department relied on the expertise within the NBP project team supported by expert advisors Analysys Mason, KPMG and PwC to develop the verification methodologies.

Two Mapping Assessment Verification Methodologies were developed for the technical criteria to cater for both wire line and wireless technology-based networks; while the Mapping Assessment Verification Methodologies for deployment and financial were the same irrespective of the technology used.

The NBP Verification Methodologies therefore represent the Online Map Building Block 2 for the Irish NBP intervention project.

These NBP Verification Methodologies are now explained in detail in the following sections. The detailed nature and level of complexity of the NBP Verification Methodologies is demonstrated through the detailed description of the Technical Criteria Verification Methodology for wireless networks. The description provided herein expands and explains what is required for each step involved in this methodology. However, for subsequent NBP Verification Methodologies described herein, a concise table format has been created, outlining the different steps required in a more accessible and useable format. The tables

⁷¹ Service Providers providing broadband services in the target intervention area will typically seek to have their network coverage area removed from the State's intervention as they will not want to compete with a State subsidized network.

are then represented in a flow chart so that the logical relationship between the different outputs of the verification can be more easily followed.

It is likely that by distilling the NBP Verification Methodology to these concise tables and flow charts that readers will be able to follow the logic more easily. Consequently, the descriptions provided herein are more likely to be re-used by other EU Member States in the design of their own verification methodologies.

A 3.2.2 The NBP Technical Criteria Verification Methodology

A 3.2.2.1 Introduction

The Technical Criteria Verification Methodology is used to establish whether a solution proposed by a Service Provider meets the Mapping Assessment Performance Criteria for the Technical area or not. As described already, there are two technical criteria set out under which there are several parameters.

Criteria	Parameters	Score	Credible?
1. The proposed solution is NGA	1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies)	Yes ☐ No ☐	Yes/No?
	1.2 Minimum download speed of 30 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.3 Minimum upload speed of 6 Mbps to all users when they demand it	Yes ☐ No ☐	
	1.4 Does the solution rely on optical (or equivalent) technology?		
	1.5 Is the solution able to support a variety of advanced digital services including converged all-IP services?		
2. The proposed solution is reliable	2.1 What is interference potential in the network?		Yes/No?
	2.2 Are there concrete measures to mitigate interference?		

Figure A 3.5 - NBP Mapping Assessment Performance Criteria - Technical (Source DCENR).

The verification methodology takes each parameter in turn and describes how a determination is made for each i.e., how a score is assigned to each parameter and how an overall conclusion is derived.

For the technical area two different verification methodologies were needed in Ireland, one for wireless networks and one for wire line networks. It should be noted that for the Irish

NBP intervention project, mobile networks were considered networks serving a separate market and not relevant to the NBP intervention project, therefore Service Providers did not submit claims that were based on mobile network solutions. However Fixed Wireless Access (FWA) networks were considered relevant and many Service Providers using FWA network solutions submitted claims as part of the NBP Mapping Process. Therefore, an appropriate verification methodology was required to verify these claims as well as claims from Service Providers using wire line network solutions. The verification methodologies used for wireless and wire line networks against each technical criteria are described in the following sections.

As will become apparent from these verification methodologies, the verification of scores for each parameter is not always a purely mechanical exercise; a subject matter expert's view is required to opine on whether the proposed solution fully meets the criteria or not.

A 3.2.2.2 Technical Criterion 1 – Is the Proposed solution NGA? - Wireless

The following sections outline the NBP Technical Criteria Verification Methodology for wireless used against the parameters 1.1 to 1.5 as set out in Figure A 3.5 above. These parameters are then used, when considered together as a whole, to determine whether technical criterion 1- 'Is the proposed solution NGA?' met or not.

A 3.2.2.2.1 Technical Criterion 1 – Parameter 1.1 - Wireless

Technical criterion 1 parameter 1.1 states the following:

'1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies).'

Helpfully, Paragraph 56 of the SAG lists those technologies which can be considered basic broadband solutions.

'Several different technology platforms can be considered as basic broadband networks including asymmetric digital subscriber lines (up to ADSL2+ networks), non-enhanced cable (e.g. DOCSIS 2.0), mobile networks of third generation (UMTS) and satellite systems.'

Therefore, if the Service Provider proposes to use a technology which is classified in the SAG as being a basic broadband technology, then the parameter score is a binary 'No', and any

part of the Service Provider network that is based on this technology is classified as basic broadband and no further verification is necessary. If a proposed solution is not classified as basic broadband, then the parameter score is a binary 'Yes' and the Service Provider's technology solution is then assessed against the other parameters under technical criterion 1, as set out in Figure A 3.6 below.

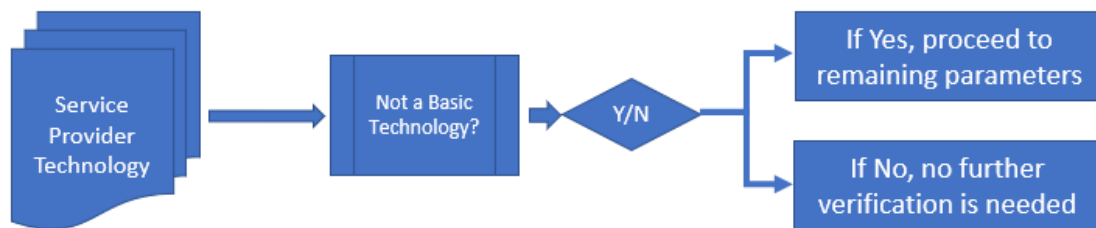


Figure A 3.6 Process Flow for the technical criterion 1 – Parameter 1.1 Verification
Methodology

A 3.2.2.2.2 Technical Criterion 1 – Parameter 1.2 - Wireless

Technical criterion 1 parameter 1.2 states the following:

'1.2 Minimum download speed of 30 Mbit/s to all users when they demand it'.

This parameter 1.2, along with parameter 1.3 which relates to delivery of a minimum upload speed, involves substantial and multi-faceted verification methods. Many aspects of the Service Providers end-to-end network must be reviewed to establish whether this parameter is met or not. For a wireless network this is quite a complex exercise and must be conducted by a wireless expert so that an expert view can be provided on items that require professional judgment.

In order to verify parameter 1.2, four more granular characteristics of the Service Provider's proposed solution are considered, these are:

- whether the proposed technology will deliver a minimum of 30 Mbit/s download to each user;

- whether the access network, using the proposed technology, is designed to deliver 30 Mbit/s download to all users in the target coverage footprint under normal operation;
- whether the distance between the first point of active aggregation and the premises (over which a minimum 30 Mbit/s download service is to be delivered) has been established by using distance modeling and/or link budget which are supported by evidenced assumptions; and
- whether the proposed backhaul network is designed to deliver 30 Mbit/s download to all users when they demand it.

These four characteristics, have different aspects which must all be reviewed in turn.

The verification methodologies followed for each of these granular characteristics are outlined in the following sections.

A 3.2.2.2.2.1 Will the technology deliver a minimum of 30 Mbit/s download to each user?

To assess whether the proposed solution will deliver a minimum of 30 Mbit/s download to each user, the capability of the technology proposed is firstly reviewed. The review will conclude whether the technology is theoretically capable of delivering a minimum of 30 Mbit/s download speed.

The verification methodology involves a system matter expert undertaking a review of the equipment manufacturers' specifications for the equipment that is being used in the network solution. These specifications will typically outline the download speed performance the technology can achieve, in principle. The system matter expert then concludes based on this information whether the technology is capable of deliver a minimum of 30 Mbit/s download speed or not.

If it is determined that the technology can theoretically deliver a minimum of 30 Mbit/s download speed, then the remaining characteristics are reviewed. They consider how the technology has actually been deployed in the network (or how the technology is proposed to be deployed if we are considering a future planned network).

A 3.2.2.2.2 Is the access network built using the proposed technology designed to deliver 30 Mbit/s to all users, under normal operation?

To verify whether the access network built using the proposed technology is designed to deliver 30 Mbit/s to all users under normal operation, the technology solution is reviewed regarding the following aspects:

- review of the access equipment configuration; and
- review of the engineering design relating to coverage and capacity.

This characteristic refers to delivering 30 Mbit/s to all users the performance ‘under normal operations’. The reference to ‘under normal operations’ clarifies that it is not expected that the network is designed to deliver the download service during pre-planned maintenance, force majeure events such as extreme weather conditions and/or atypical network traffic events.

Review of the access equipment configuration

This verification involves reviewing the equipment configuration the Service Provider proposes to use for each sector of each of their wireless base stations. The number of carriers per sector is identified as well as the amount of spectrum allocated for each carrier. The division of the spectrum they are using between downlink and uplink (if applicable) is also identified for each carrier.

For each carrier, the target average throughput that the Service Provider is claiming to achieve is then identified. Once this configuration is established the credibility of achieving the target average download throughput is reviewed. This is done by calculating the spectral efficiency⁷² that would need to be achieved to deliver the target average download

⁷² As defined by CTIA Wireless Association spectral efficiency is the bits per second (bps) obtained relative to Hertz (Hz) of spectrum used (bps/Hz), (see http://www.rysavy.com/Articles/2011_05_Rysavy_Efficient_Use_Spectrum.pdf for details). In other words, the spectral efficiency relates to the capacity in bit/s which can be supported by the radio system for every 1 Hz of spectrum available.

throughout and comparing this spectral efficiency to industry benchmarks for the technology used.

If we take for example, a carrier where 15Mhz is allocated to the downlink and where a Service provider claims to be able to achieve a target average download throughput of 100 Mbit/s per carrier. For the downlink, the Service Provider, in our example, is therefore assuming an average spectral efficiency of 6.7 bit/s/Hz can be achieved. This can be derived as follows:

$$\text{Downlink spectral efficiency} = 100 \text{ Mbit/s} / 15 \text{ MHz} = 6.7 \text{ bps/Hz}$$

The spectral efficiency expected to be achieved by the Service Provider is then compared with industry spectral efficiency benchmarks to assess whether it is a credible or an achievable spectral efficiency or not. For example, for LTE-A systems an Ofcom report entitled '4G Capacity Gains' (67) provides a low-end, a typical and a high-end spectral efficiency for LTE R10 and for different antenna configurations. If the proposed Service Provider is deploying an LTE R10 based wireless solution, then the Ofcom industry benchmark is compared with the Service Provider spectral efficiency assumption of 6.7 bps/Hz.

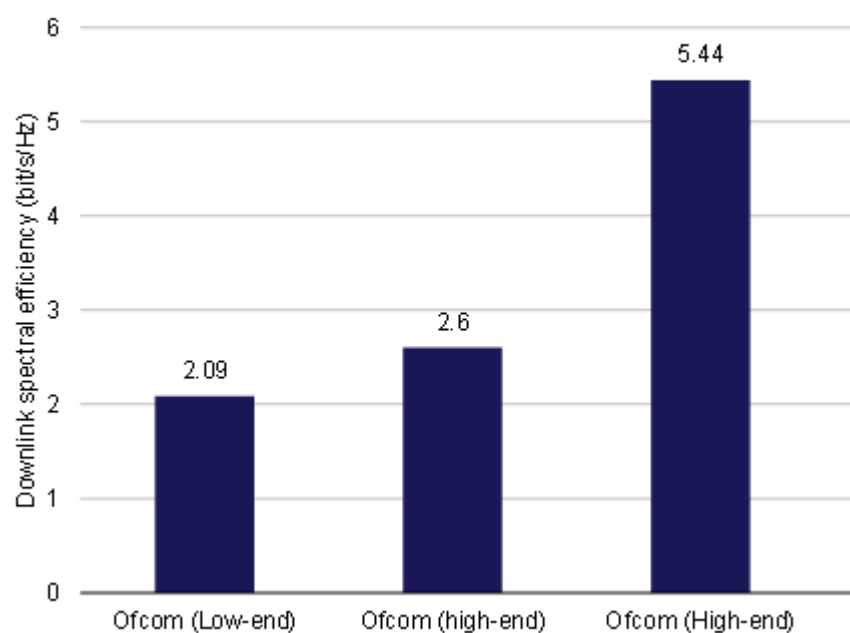


Figure A 3.7: Spectrum efficiency for LTE-A R10 [Source: Ofcom]

The “high-end” spectral efficiency of the Ofcom benchmark might be considered reasonable for a fixed wireless network where a receiving CPE will generally exhibit better performance than a mobile handset device (e.g., with higher antenna gain, higher power, higher altitude location, etc.). However, in the example used, the Service Provider’s assumed downlink spectral efficiency of 6.7 bits/Hz is significantly greater than the “high-end” Ofcom benchmark. Therefore, this would be considered an aggressive/ overly optimistic assumption. This introduces a risk that the network configuration will fail to deliver the target average download throughput assumed in the design.

The target average download throughput is used later in the verification methodology to determine the number of premises that can be supported by the proposed network. Therefore, where there is a high risk in achieving the target average download throughout assumed by the Service Provider in their design, this is likely to lead to a high risk in the design delivering the capacity necessary to deliver 30 Mbps download speeds to all users when they demand it. This is explained later in this verification methodology.

The Service Prover are requested to outline the different Customer Premises Equipment (CPE) types used in their network. The performance of different CPEs can impact the overall performance experienced by users significantly. Therefore, the assumptions made relating to CPE performance in the design must be examined carefully. For example, whether the CPE devices assumed would be available on the market in the timeline anticipated by the Service Provider and whether the CPE devices will be available at the frequencies being used by the Service Provider. The level of risk (if any) regarding CPEs must therefore be considered. It should also be noted that the capabilities of the CPE equipment are used later in the verification as part of the coverage review.

Engineering design – coverage

The Service Provider’s radio link budget and target radio coverage map are reviewed to analyze the Service Provider’s anticipated network coverage area and determine whether it is credible or not.

A radio link budget defines the wireless radio signal propagation characteristics assumed by the Service Provider for the design and planning of its network. The assumed radio link budget therefore defines the minimum number of base station sites required to ensure that users receive a given minimum broadband speed within a specific probability.

Ensuring the assumptions underpinning the radio link budget are credible and achievable is therefore an important part of the verification methodology. These are taken in turn and examined to ensure that reasonable values are attributed.

A sample of the key features and assumptions relating to the radio link budget are outlined below.

The cell edge coverage probability is defined as ‘the percentage probability that an end user located at the edge of the cell radius will receive a signal of sufficient quality to experience an NGA broadband service (i.e., a 30 Mbit/s download service)’. It is an important input to a radio link budget. Where a cell edge coverage probability is reasonably high i.e., greater than 85%⁷³, then there is a stronger likelihood that the users at the cell edge will have access to a signal of sufficient quality to experience an NGA broadband service. However, where a cell edge coverage probability is lower than 85%, then the risk of users at the cell edge not being able to have access to a signal of sufficient quality to experience an NGA broadband service is higher. For the NBP Mapping Process a cell edge probability of at least 95% was required and a cell area probability of at least 98% was required. Assumptions relating to CPE antenna height are also reviewed. Typically, a height of 5 meters for fixed wireless access is assumed. Where higher CPE antenna heights are assumed without explanation, this is likely to give rise to some concern and introduce a level of risk to the coverage being achieved.

⁷³ NBNCo’s, (in Australia), fixed wireless network design was based around a cell edge probability of 85% and the Rural Broadband Initiative’s, (in New Zealand), fixed wireless network was based on a cell edge probability of 95%.

Once the radio link budget has been fully reviewed and all input assumptions examined and scrutinized, the level of credibility of the design for the target coverage area can be concluded. The verification methodology confirms whether the input assumptions used for the radio link budget are reasonable or not and whether any high risks or concerns exist relating to the radio coverage design. Usefully, the number of target premises to be covered by the radio design are also confirmed through this analysis as this is used later as part of the engineering design capacity review.

Engineering design – capacity

The solution's capacity is reviewed to determine whether the capacity dimensioned is sufficient to serve all premises within the target coverage area with 30 Mbps download speed when they demand it.

The input assumptions for the dimensioning are reviewed to ensure they are reasonable and any risk to the capacity dimensioned are identified.

The overall download capacity available from a base station site is calculated as follows:

'Spectral Efficiency for Download x Spectrum allocated to Download per carrier x No of carriers x No of sectors = Total Mbit/s capacity available'

For the example we used earlier, for a three-sector base station site with two carriers in each sector this would be:

'6.7 bits/Hz/s x 15 Mhz x 2 carriers x 3 sectors = 603 Mbit/s'

The percentage of users assumed to be concurrently accessing the broadband service during busy hour is also an important dimensioning assumption. In normal practice only a percentage of premises will ever access the broadband service at any one time, even during the busiest time of the day i.e., the busy hour. Service Providers will take this into account when designing the capacity available in their networks. Based on the expert advice of Analysys Mason the NBP Verification Methodology considers a 'concurrency ratio' (CR) of between 10% and 30% for the dimensioning of the downlink in FWA networks to be reasonable. This means that only between 10% and 30% subscribers need to be assumed to be using the service at the same time during the busy hour.

Therefore, to check how many premises can be served from any one base station site and still receive a 30 Mbit/s service during the busy hour, the overall available download capacity is firstly divided by 30Mbit/s. This outlines the number of premises that could be served from a base station if every single premises used the service during the busy hour. The concurrency ratio is then taken into account and say where a concurrency ratio of 10% is used, then the number of premises that can actually be served from that base station during the busy hour is 10 times higher. This is calculated as follows:

'Total number of premises with 30mbit/s download per site

= (Total Mbit/s capacity available / (30bits/s)) / CR.

For the example we used earlier, this would be:

'((603 Mbit/s)/(30Mbits))/10%) = 203 premises'

In order to account for this in the design of the network, a user concurrency ratio (CR) is usually provisioned in capacity models to ensure that operators do not over-provision their networks. The concurrency ratio represents the percentage of the premises which will simultaneously (i.e., at the same time) access the service at a particular site.

A range of concurrency ratios can be used to calculate the number of premises that can potentially be covered depending on the behavior of users during the busy hour.

Concurrency Ratio	10%	20%	30%	100%
Spectral Efficiency = 6.7Bit/s/Hz				
Total available capacity 603 Mbit/s per base station	203 Premises per base station	100 premises per base station	67 premises per base station	20 premises per base station

Figure A 3.8 The number of premises that can be served with 30Mbit/s download speed from an example network design using different concurrency ratio assumptions.

The Service Provider may not outline their assumed concurrency ratio in their claim. However, the earlier analysis of the radio coverage design confirms the number of target premises within the coverage area of each base station. Therefore, by comparing the total capacity available to the target number of premises, the concurrency ratio that would need to be achieved can be determined. For our example, if the Service Provider’s radio coverage design targets 300 or 400 premises as being served from each base station, the concurrency ratio can be identified using the same formula as above:

$$\begin{aligned} &\text{'Total number of premises with 30mbit/s download per site} \\ &= (\text{Total Mbit/s capacity available} / (30\text{bits/s})) / \text{CR.}' \end{aligned}$$

For a 400 premises base station site:

$$\begin{aligned} 400 &= ((603\text{Mbit/s})/30 \text{ Mbits/s})/\text{CR} \\ \text{CR} &= 5\% \end{aligned}$$

For a 300 premises base station site:

$$\begin{aligned} 300 &= ((603\text{Mbit/s})/30 \text{ Mbits/s})/\text{CR} \\ \text{CR} &= 6.7\% \end{aligned}$$

<i>No of premises per base station</i>	<i>50</i>	<i>100</i>	<i>200</i>	<i>300</i>	<i>400</i>
Concurrency Ratio Needed	40%	20%	10%	6.7%	5%
<i>Using the example design with: Spectral Efficiency = 6.7Bit/s/Hz</i>					
<i>Total available capacity 603 Mbit/s per base station</i>					

Figure A 3.9 The concurrency ratio that would be needed to deliver premises with 30Mbit/s download speed from an example network design using different numbers of target premises.

As shown in Figure A 3.9, even allowing for the aggressive spectral efficiency assumed by Service Provider in our example (i.e. 6.7 bps/Hz), which is in excess of the “high-end” Ofcom

benchmark, the maximum number of premises who would be able to access the service during the busy hour and still receive a minimum download speed of 30 Mbit/s, is 200, for a concurrency ratio of 10%.

If the Service Providers radio coverage design (or the Service Providers business plan) assumes a larger number of premises can be served per site, then this assumption would be of high concern. The verification exercise would likely conclude that there is insufficient capacity, notwithstanding the aggressive design parameters assumed, to ensure a minimum of 30 Mbps download can be delivered to each user.

However, where the Service Providers radio coverage design (or the Service Providers business plan) assumes a lower number of premises can be served per site, then this assumption would be considered more credible.

- Assessment of whether or not the access network built using the proposed technology is designed to deliver 30 Mbit/s to all users under normal operation?

The assessment of whether or not the access network built using the proposed technology is designed to deliver 30 Mbps to all users under normal operation is then concluded by considering the against these different aspects in aggregate i.e., the radio access equipment configuration review together with the engineering design relating to coverage and capacity are all considered.

A 3.2.2.2.2.3 Is the maximum distance between the first point of active aggregation and the premises over which a minimum 30 Mbit/s service can be delivered established using distance modeling and/or link budgets which are supported by evidenced assumptions? For a FWA network the first point of aggregation in the network is the base station. This verification exercise reviews the calculations and assumptions used to establish the maximum distance between the base station and the premises over which a minimum 30 Mbps service can be delivered.

Service Providers typically establish this maximum distance through the use of a radio planning tool such as Atoll⁷⁴. The assumptions and inputs used to calculate the maximum distance from the base station are reviewed to ensure they are robust and in line with normal industry practice.

As outlined already, the link budget assumptions relating to cell edge coverage probability is assessed. In addition, the details of the calculations used to establish the thresholds in the Service Provider's coverage map are reviewed. Information on the configuration of the planning tool is reviewed and how the generation of coverage maps has been achieved and any evidence provided to support the assumptions.

The verification exercise determines whether the assumptions and inputs used to calculate the maximum distance from the base station are credible or not and whether the coverage maps produced are credible or not and in line with normal industry practice.

A 3.2.2.2.4 Is the proposed backhaul network designed to deliver 30 Mbit/s download to all users when they demand it?

This verification exercise reviews the Service Providers backhaul solution i.e., the network that transmits data to/from the base station to the Service Provider core network. The backhaul equipment manufacturers' specifications are reviewed along with the network configurations deployed and the traffic and capacity assumptions applied.

The review establishes the backhaul network capacity that the network is designed to deliver on each segment of the backhaul network.

⁷⁴ Atoll is a radio planning tool commonly used in Ireland by wireless Service Providers, more details can be found at <https://www.forsk.com/atoll-overview>

The review will assess whether there is sufficient backhaul capacity available at each base station so that the minimum download speeds can be delivered for the number of premises covered by each base station.

'Backhaul capacity per site required can be calculated as follows = Total number of premises 30/Mbit/s*CR*Statistical Mux Gain for the site*

For the example we have used, where the backhaul has a 33% Mux Gain the following minimum capacity is needed:

$200 \times 30 \times 10\% \times 33\% = 198 \text{ Mbit/s}$

The capacity at each point of aggregation on the backhaul network is examined to ensure that no bottlenecks exist.

The verification exercise determines whether the backhaul network designed to deliver 30 Mbps download to all users when they demand it and whether any bottlenecks exist in the backhaul network that would restrict or choke the service being delivered to premises during the busy hour.

A 3.2.2.2.5 Overall assessment of Technical Criterion 1 – Parameter 1.2

To then conclude the verification of parameter 1.2, the verification findings against the four granular characteristics of the Service Provider's proposed solution are considered together in aggregate:

- whether the proposed technology will deliver a minimum of 30 Mbit/s download to each user;
- whether the access network, using the proposed technology, is designed to deliver 30 Mbit/s download to all users in the target coverage footprint under normal operation;
- whether the distance between the first point of active aggregation and the premises (over which a minimum 30 Mbps download service is to be delivered) has been established by using distance modelling and/or link budget which are supported by evidenced assumptions; and

- whether the proposed backhaul network is designed to deliver 30 Mbps download to all users when they demand it.

Each of these characteristics must support the delivery of parameter 1.2, (i.e., the delivery of a 'minimum download speed of 30 Mbit/s to all users when they demand it'), for the parameter to be met. Where each of the four characteristics demonstrate that parameter 1.2 is likely to be met then a score of 'Yes' is assigned. Where one or more characteristic does not support the delivery of parameter 1.2, i.e., that it is unlikely or there is a high risk that a minimum download speed of 30 Mbit/s to all users when they demand it will be achieved then a score of 'No' is assigned. The outcome of the verification of parameter 1.2 is binary. If the score assigned is 'No' then the overall technical criterion 1 is not met and the proposed solution is not considered NGA. If the score assigned is 'Yes', then the remaining parameters within technical criterion 1 need to be reviewed.

A 3.2.2.2.3 Technical Criterion 1 – Parameter 1.3 - Wireless

Technical criterion 1 parameter 1.3 states the following:

'1.3 Minimum upload speed of 6 Mbit/s to all users when they demand it'.

As mentioned earlier, this parameter 1.3, along with parameter 1.2 involves substantial and multi-faceted verification methods. To verify parameter 1.3, the same four more granular characteristics of the Service Provider's proposed solution are considered as were for parameter 1.2 but in this case the design is reviewed in the context of the upload performance. Therefore, for parameter 1.3 these are:

- whether the proposed technology will deliver a minimum of 6 Mbps upload to each user;
- whether the access network, using the proposed technology, is designed to deliver 6 Mbit/s upload to all users under normal operation;
- whether the distance between the first point of active aggregation and the premises (over which a minimum 6 Mbps upload service is to be delivered) has been established by using distance modeling and/or link budget which are supported by evidenced assumptions; and
- whether the proposed backhaul network is designed to deliver 6 Mbps upload to all users when they demand it.

These four characteristics must all be reviewed in turn following the same verification methodologies used for the parameter 1.2 verification, except by considering upload performance rather than download performance. As they are essentially the same methods, the verification methodologies are not repeated under this section.

Each of these characteristics must support the delivery of parameter 1.3, (i.e., the delivery of a 'minimum upload speed of 6 Mbit/s to all users when they demand it'), for the parameter to be met. The outcome of the verification of parameter 1.3 is also binary. If the score assigned is 'No' then the overall technical criterion 1 is not met and the proposed solution is not considered NGA. If the score assigned is 'Yes' then the remaining parameters within technical criterion 1 need to be reviewed.

A 3.2.2.2.4 Technical Criterion 1 – Parameter 1.4 - Wireless

Technical criterion 1 parameter 1.4 states the following:

'1.4 Does the solution rely on optical (or equivalent) technology?'

For a FWA network the backhaul network is likely to rely on optical (or equivalent) technologies. The verification of this parameter requires a review of the manufacturers' specifications for the major components of the backhaul equipment, together with details of any proposed wholesale backhaul suppliers that may be used to deliver the end to end backhaul network for the Service Providers network.

The verification exercise establishes whether the design will rely on optical equipment at points of aggregation on the backhaul network i.e., where traffic from a number of base stations aggregates and/or will use high-speed wireless point to point connections to link base station sites to aggregation points.

The review determines whether there is a high, medium or low risk relating to the proposed solution relying on optical technology and a technology somewhat equivalent to optical.

A 3.2.2.2.5 Technical Criterion 1 – Parameter 1.5- Wireless

Technical criterion 1 parameter 1.5 states the following:

'1.5 Is the solution able to support a variety of advanced digital services including converged all-IP services?'

The verification of this parameter involves a review of the manufacturers' technology specifications and future roadmap for new features. The review verifies the extent the equipment supports digital services and whether industry standard releases are followed by the manufacturer (providing a clear evolutionary path) or not. Both the network equipment and CPE equipment are reviewed.

The review determines whether there is a high, medium or low risk relating to the proposed solution supporting a variety of advanced digital services including converged all-IP services or not.

A 3.2.2.2.6 Technical Criterion 1 – Wireless Conclusion

Once each of individual parameters have been assessed then an overall conclusion can be made regarding technical criterion 1 - Is the Proposed solution NGA?

Technical Criterion 1 - Is the proposed solution NGA?		
Parameter	Items considered	Examples of supporting evidence.
1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies)	The technology used in the proposed solution e.g. LTE, LTE-Advanced, 5G, Wi-Fi 5.	The specifications of the technology used in the proposed network.
1.2 Minimum download speed of 30 Mbit/s to all users when they demand it.	The theoretical download speed capability of the technology being used in the proposed solution.	The manufacturers performance specifications of the technology used in the proposed network.
	----- The radio access equipment configuration and design with	----- Details of the radio configurations deployed to

1.2 continued....	respect to download speed: - the radio access equipment configurations; and - the engineering design for coverage and capacity. The link budget modelled to demonstrate the likely radio access download speed performance of the solution. The backhaul network capacity and configuration.	each site. Details of the designs used to determine coverage. Details of the capacity calculations and assumptions used in the design. Details of the configuration of customer premises equipment. Details of the link budget outputs, the assumptions used and evidence on the validity of the assumption used for the area targeted by the network. Details of the backhaul equipment configurations deployed from each site to the handover to the core network. Details of the capacity calculations and assumptions used in the design of the backhaul network.
1.3 Minimum download speed of 6 Mbit/s to all users when they demand it.	The same items are considered for parameter 1.3 as for parameter 1.2 except upload speed performance is reviewed instead of download speed performance.	Same evidence is required as for parameter 1.2 except details relating to upload speed are needed.
1.4 Does the solution rely on optical (or equivalent) technology?	Where the solution uses optical fibre for backhaul purposes. The backhaul solutions used at points of aggregation within the backhaul network.	Details of the technologies used, or the capacity leased in backhaul network. The theoretical backhaul capacity of the links serving aggregation points in the

		backhaul network. Details of the nodes which are served with optical fibre or with very large capacity wireless solutions.
1.5 Is the solution able to support a variety of advanced digital services including converged all-IP services?	The list of services and/or products which is proposed to be made available on the network.	Services or products already launched and being used on the network. Services and products available on other networks of a similar nature.

Table A 3.2 A concise summary of the NBP Technical Criteria Verification Methodology for wireless networks against technical criterion 1.

Parameter 1.1, 1.2, 1.3 are assigned a binary score of 'Yes' or 'No'. Where a 'No' is assigned to any of these parameters then the outcome of the technical criterion 1 is then a 'No'. Where a 'Yes' is assigned to each of these parameters then the level of risk assigned to parameters 1.4, .15, 1.6 must then be reviewed. Ideally each of these parameters have a score of 'Low', however where a medium or high risk is scored then an expert view must determine the materiality of this risk to the overall technical criterion 1, considering all aspects of the Service Provider's technical solution.

Where it is determined that the technical criterion 1 is met, a score of 'Yes' is applied to the overall technical criterion 1 - Is the Proposed solution NGA? Technical criteria 2 is then reviewed.

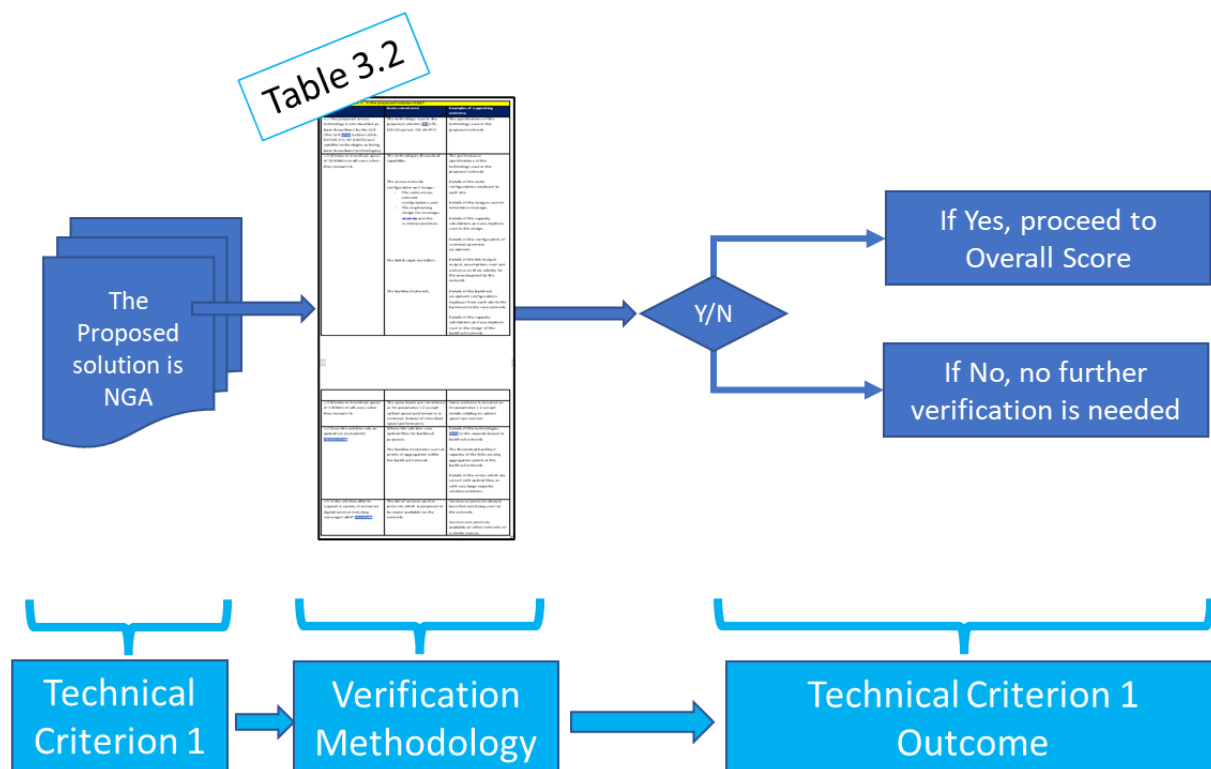


Figure A 3.10 The scoring of NBP Technical Criteria Verification Methodology for Wireless networks for technical criterion 1 using table A 3.2.

A 3.2.2.3 Technical Criterion 2 – Is the Proposed solution reliable? - Wireless

The following sections outline the NBP Technical Criteria Verification Methodology for wireless used for parameters 2.1 to 2.2 as set out in Figure A 3.5 above. These parameters are then used, when considered together, to determine whether technical criterion 2 – ‘Is the proposed solution reliable?’ is met or not.

A 3.2.2.3.1 Technical Criterion 2 – Parameter 2.1 - Wireless

Technical criterion 2 parameter 2.1 states the following:

‘2.1 What is interference potential in the network?’.

The verification of this parameter involves a review of what spectrum is used in the technical solution. Where licensed spectrum is used a low risk is likely to be assigned, as licensed spectrum has sufficient protections afforded to it, once it is deployed in line with any conditions associated with the spectrum licence. However, where licence-exempt

spectrum is used the solution is likely susceptible to interference to other wireless signals. It has no protection from interference from any other licensed or license-exempt services provided in the band. Any Service Provider can use this frequency band if it is compliant with general conditions associated with the licence-exempt band e.g., power transmission limits. In extreme cases, the solution is susceptible to loss of service because of partial or total path obstruction due to a high level of interference.

Criterion	Parameters	Risk Score
2. The proposed solution is reliable	2.1 What is interference potential in the network?	Low/Medium/High risk score

A 3.2.2.3.2 Technical Criterion 2 – Parameter 2.2 - Wireless

Technical criterion 2 parameter 2.2 states the following:

‘2.2 Are there concrete measures to mitigate interference?’.

The verification of this parameter involves a review of the mitigation measures or protections in place to mitigate interference. The review will examine the different mitigation measures the Service Provider has in place to mitigate the impact of interference to the network.

For example, some equipment providers have inherent features which support the management of interference in general (i.e., beamforming, transmit frame synchronization). However, the ability of the technology to mitigate interference is highly dependent on network design and specific configuration details of each base station.

The network design is reviewed to verify whether any of the technology’s interference management capabilities are used and whether the installation practices are modified depending on the interference risk (e.g., the use of separate channels for transmitters on the same mast, robust installations at customer premises utilizing high gain antennas and narrow beam filters). These measures are likely to mitigate the impact of potential interference. The monitoring capabilities and the ability to quickly address issues as they arise is also reviewed.

Criterion	Parameters	Risk Score
2. The proposed solution is reliable	2.2 Are there concrete measures to mitigate interference?	Low/Medium/High risk score

A 3.2.2.3.3 Technical Criterion 2 - Wireless Conclusion

Once each of individual parameters have been assessed then an overall conclusion can be made regarding technical criterion 2 - Is the Proposed solution reliable?

Technical Criterion 2 – Is the proposed solution reliable?		
Parameter	Items considered	Examples of supporting evidence.
2.1 What is interference potential in the network?	The spectrum used by the proposed solution and whether it is licensed or licensed-exempt spectrum. The conditions of use relating to the spectrum being used in the network, e.g., power constraints.	Details of the licences held for the spectrum used in the proposed solution.
2.2 Are there concrete measures to mitigate interference? 2.2 continued....	The mitigation measures or protections in place to mitigate interference.	Details of the equipment providers specifications or features designed to mitigate interference. Details of measures used in the network design to mitigate interference outlined where the technology's interference management capabilities are used in the network. The specific configuration details of each base station where mitigation measures are to be deployed. Details of how installation

		practices are modified depending on the interference risk (e.g., the use of separate channels for transmitters on the same mast, robust installations at customer premises utilizing high gain antennas and narrow beam filters). Details of the monitoring capabilities and the ability to quickly address issues as they arise is also reviewed.

Table A 3.3 A concise summary of the NBP Technical Criteria Verification Methodology for wireless networks for technical criterion 2.

Both parameters 2.1 and 2.2 are assigned a risk score of 'High', 'Medium' or 'Low'. Where each of these parameters have a score of 'Low' then the technical criterion 2 can be considered met and a score of 'Yes' applied, however similar to technical criterion 1 where a medium or high risk is scored then an expert view must determine the materiality of this risk, considering all aspects of the Service Provider's technical solution. A single high score or two medium scores could result in the technical criterion 1 score of a 'No'.

Where it is determined that the technical criterion 2 is met, a score of 'Yes' is applied to the overall technical criterion 2 - Is the Proposed solution Reliable?

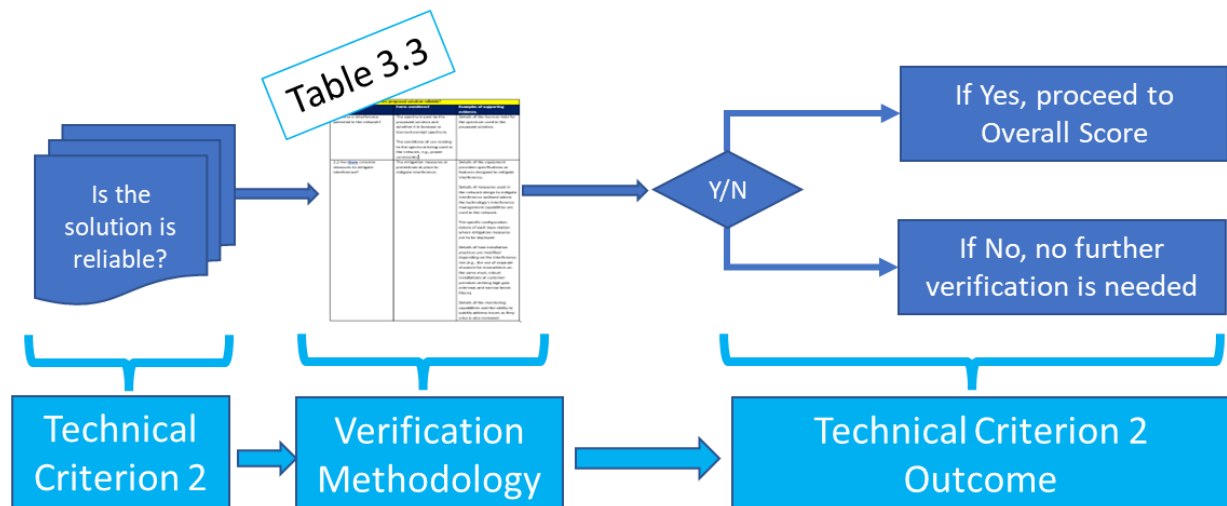


Figure A 3.11 The scoring of NBP Technical Criteria Verification Methodology for Wireless networks for technical criterion 2 using table A 3.3.

A 3.2.2.3 Technical Criterion 1 – Is the Proposed solution NGA? - Wireline

This section outlines, in a concise manner, the NBP Technical Criteria Verification Methodology for wire line used against the parameters 1.1 to 1.5 as set out in Figure A 3.5 above. These parameters are then used, when considered together as a whole, to determine whether technical criterion 1- 'Is the proposed solution NGA?' is met or not.

Technical Criterion 1 - Is the proposed solution NGA?		
Parameter	Items considered	Examples of supporting evidence.
1.1 The proposed access technology is not classified as basic broadband by the SAG (The SAG have defined ADSL, DOCSIS 2.0, 3G (UMTS) and satellite technologies as being basic broadband technologies)	The technology used in the proposed solution e.g., ADSL, DOCSIS 2.0.	The specifications of the technology used in the proposed network.
1.2 Minimum download speed of 30 Mbit/s to all users when they demand it.	The theoretical download speed capability of the technology being used in the proposed solution.	The manufacturers performance specifications of the technology used in the proposed network.
1.2 continued....	The access network	Details of the configurations

	configuration and design with respect to download speed: - the configurations of each element within the access network from the premises to the first point of active aggregation e.g., Line Terminal, Local Cabinet, Drop Points, Network Termination points; and - the engineering design with respect to the capacity of network and how many premises will be served from the 1st point of aggregation. ----- The link budget modelled to demonstrate the likely access download speed performance of the solution.	deployed to point in the access network. Details of the capacity calculations and assumptions used in the design. E.g. GPON technology can deliver an aggregate download bandwidth of 2.5Gbit/s, how many premises is assumed to be served from each ribbon of the PON? Details of the configuration of customer premises equipment. ----- Details of the link budget outputs, the assumptions used and evidence on the validity of the assumption used for the area targeted by the network. The typical signal loss assumed at each splitter might be supported by real-life examples of the results achieved in the similar deployments Details of the calculations used to determine the typical reach of the network i.e., the maximum distance from the 1st point of aggregation where a download speed of at least 30Mbit/s can still be maintained. E.g., a line test system may be used to demonstrate the typical download speeds achieved at

1.2 continued....	----- The backhaul network capacity and configuration.	different distances from the cabinet or exchange. ----- Details of the backhaul equipment configurations deployed from each aggregation point to the handover to the core network. Details of the capacity calculations and assumptions used in the design of the backhaul network.
1.3 Minimum download speed of 6 Mbit/s to all users when they demand it.	The same items are considered for parameter 1.3 as for parameter 1.2 except upload speed performance is reviewed instead of download speed performance.	Same evidence is required as for parameter 1.2 except details relating to upload speed are needed.
1.4 Does the solution rely on optical (or equivalent) technology?	Where the solution uses optical fibre for backhaul purposes. The backhaul solutions used at points of aggregation within the backhaul network.	Details of the technologies used or the capacity leased in backhaul network. The theoretical backhaul capacity of the links serving aggregation points in the backhaul network. Details of the nodes which are served with optical fibre or with very large capacity wireless solutions.
1.5 Is the solution able to support a variety of advanced digital services including converged all-IP services?	The list of services and/or products which is proposed to be made available on the network.	Services or products already launched and being used on the network. Services and products available on other networks of a similar nature.

Table A 3.4. A concise summary of the NBP Technical Criteria Verification Methodology for fixed wire line networks against technical criterion 1.

Following the same process as that used for the wireless verification methodology, parameter 1.1, 1.2, 1.3 are assigned a binary score of 'Yes' or 'No'. Where a 'No' is assigned to any of these parameters then the outcome of the technical criterion 1 is then a 'No'. Where a 'Yes' is assigned to each of these parameters then the level of risk assigned to parameters 1.4, .15, 1.6 must then be reviewed and an overall technical criterion 1 determined.

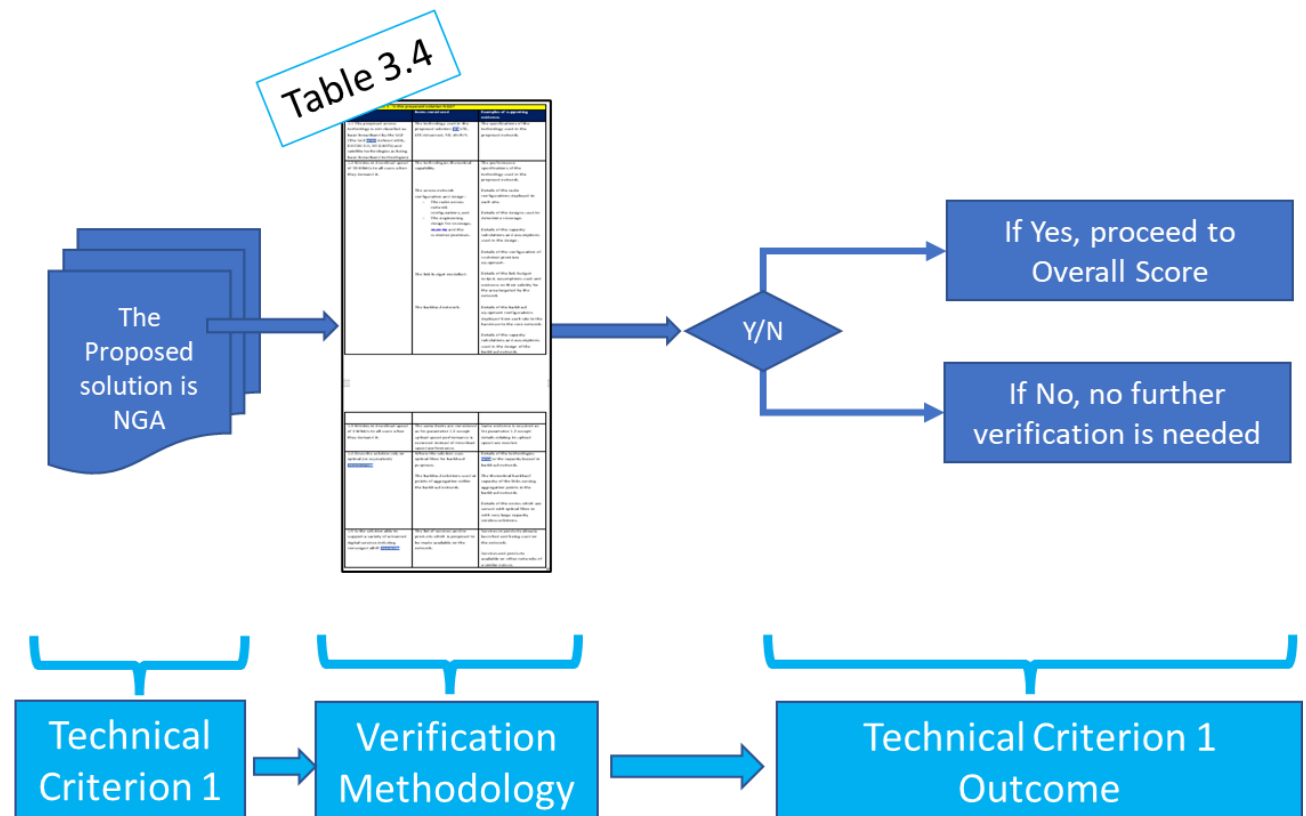


Figure A 3.12. The scoring of NBP Technical Criteria Verification Methodology for Wireline networks for technical criterion 1 using table A 3.4.

A 3.2.2.4 Technical Criterion 2 – Is the Proposed solution reliable? - Wireline

This section outlines, in a concise manner, the NBP Technical Criteria Verification Methodology for wire line used against the parameters 2.1 to 2.2 as set out in Figure A 3.5 above. These parameters are then used, when considered together as a whole, to determine whether technical criterion 2 – 'Is the proposed solution reliable?' is met or not.

Technical Criterion 2 – Is the proposed solution reliable?		
Parameter	Items considered	Examples of supporting evidence.
2.1 What is interference potential in the network?	Is the solution susceptible to external interference? Are there certain frequencies where interference is more likely?	Details of the frequencies used in the proposed solution where applicable and outline of any risks.
2.2 Are there concrete measures to mitigate interference?	The mitigation measures or protections in place to mitigate interference.	Details of the equipment providers specifications or features designed to mitigate interference. Details of measures used in the network design to mitigate interference outlined where the technology's interference management capabilities are used in the network.

Table A 3.5. A concise summary of the NBP Technical Criteria Verification Methodology for wire line networks for technical criterion 2.

Following the same process as that used for the wireless verification methodology, both parameters 2.1 and 2.2 are assigned a risk score of 'High', 'Medium' or 'Low'. Where each of these parameters have a score of 'Low' then the technical criterion 2 can be considered met and a score of 'Yes' applied, however where a medium or high risk is scored then an expert view must determine the materiality of this risk, considering all aspects of the Service Provider's technical solution.

Where it is determined that technical criterion 2 is met, a score of 'Yes' is applied to the overall technical criterion 2 - Is the Proposed solution Reliable?

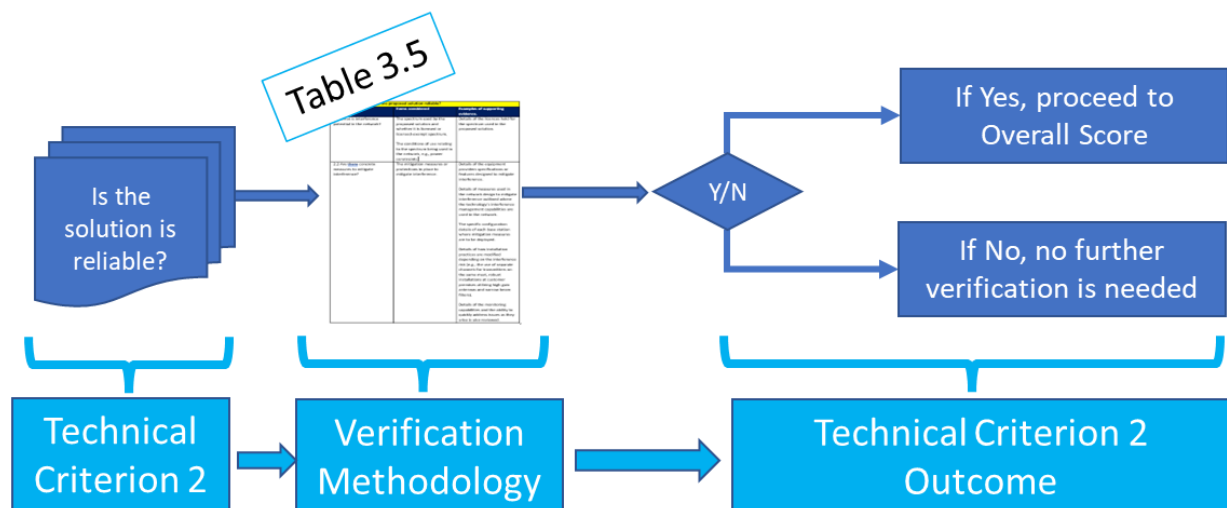


Figure A 3.13. The scoring of NBP Technical Criteria Verification Methodology for Wireline networks for technical criterion 2 using table A 3.5.

A 3.2.2.5 Overall Technical Criteria Verification Outcome – Wireless and Wireline

Both technical criterion 1 and technical criterion 2 must be scored 'Credible = Yes' for the technical criteria to be met. If the Service Provider has proposed a wireless network, then the wireless verification methodology is used whereas the wire line verification methodology is used if a wire line network solution is used. Both result in a score being determined for technical criterion 1 and technical criterion 2.

For an existing network only these two technical criteria must be met, and no additional verification is needed to confirm the existence of the NGA network.

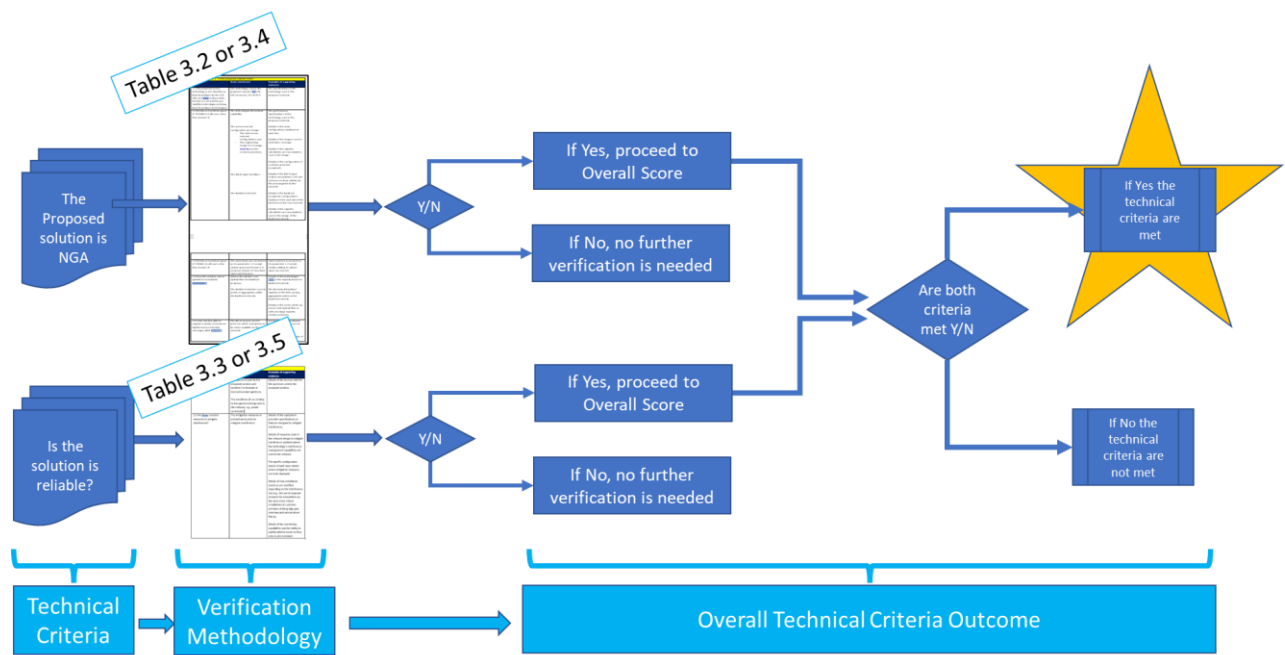


Figure A 3.14 Summary of the NBP Technical Criteria Verification Methodology for Wireless networks using the verification methodologies outlined in tables A 3.2 and A 3.3 for wireless networks and tables A 3.4 and A 3.5 for wire line networks.

For a future planned network, verification of the deployment and financial criteria are also needed and then stage 2 must then be completed in order for the future planned network to be considered a credible plan.

A 3.2.4 The NBP Deployment Criteria Verification Methodology

A 3.2.4.1 Introduction

The Deployment Criteria Verification Methodology is used to establish whether a future planned network proposed by a Service Provider meets the Mapping Assessment Performance Criteria for the Deployment area or not. As the network is not yet built, the verification methodology essentially examines whether the Service Provider has designed a credible rollout plan and whether they have the capability to deliver that plan.

The two deployment criteria are as follows:

1. Is there a credible roll-out plan? and
2. Is there a credible resource plan?

As explained earlier, Figure A 3.3 outlines the Mapping Assessment Performance Criteria that applied to the deployment Area. The first deployment criterion has seven parameters (1.1 to 1.7) and the second deployment criterion has three parameters (2.1 to 2.3). All parameters are expressed with a risk score (low/medium/high). The following sections describe, through the use of a concise table format, the items considered when assessing each of these parameters and highlight examples of the supporting evidence that would be useful when determining whether a high/medium or low risk score should apply or not. This verification methodology is not strictly a mechanical application of rules. It involves qualitative, professional judgement from a relevant expert. For the deployment area, the view of an expert experienced in the rollout of a projects similar in scale and nature is needed.

In the case of the Irish NBP intervention project, relevant experts were provided by Analysis Mason and they advised the Department on what score should apply for each parameter when assess a Service Provider plan.

A 3.2.4.2 Deployment Criterion 1 – Is there a credible roll-out plan (“when and where”)?

Deployment Criterion 1. Credible roll-out plan (“when and where”)		
Parameter	Items considered	Examples of supporting evidence.
1.1 Does the plan specify which premises will be passed / connected and when?	Does the plan specify which premises will be passed e.g., via a list of eircodes, addresses or a coverage map? Does the plan outline when each of these premises is forecasted to be passed?	The technical solution is confirmed as delivering the NGA performance to these particular premises. A month-by-month project plan confirming the dates when each premises is expected to be passed.
1.2 Is the rationale for the roll-out plan credible and in line with Irish roll-out practice?	Does the rollout follow a logical sequence, targeting areas which align to the	The logic of the rollout sequencing, i.e., what areas are targeted first or what sites

	business plan? Is the rollout in line with common industry practice?	are deployed initially, is explained and how the sequencing supports or de-risks the achievement of the target business plan is explained.
1.3 Are the volumes of sites achievable?	Does the plan outline the number of network nodes or lengths of cable to be deployed per month? Are these volumes realistically achievable and in line with industry practice?	The forecasted volumes have previously been achieved in the Irish market. The forecasted run rate for site build is conservative when compared with other rollouts achieved in the Irish market. Multi-site agreements may be in place with site owners to facilitate fast rollout to certain sites/locations.
1.4 Is the project management approach adequate to support this scale of roll-out? 1.4 continued....	Is that the project management processes described in line with industry practice?	The processes described relating to the project management of the project are in line with best industry or use an industry recognized framework. The overall roll-out project plan is produced using the project management processes outlined.
1.5 Does the progress of the project to date match the intended planning and milestones?	How is the deployment already performing? Are the forecasted milestones and volumes being met?	Evidence of the project's key milestones and forecasted rollout volumes being met successfully i.e., on time and within budget.
1.6 Does the Service Provider have a track record of timely delivery of milestones during roll-out?	How has the Service Provider performed against the delivery of previously announced investment plans?	Evidence of previous projects implemented by the Service Provider.
1.7 Does the deployment plan include a credible risk analysis and risk management plan?	Is there an overall risk management framework defined for the project? Is the risk analysis in line with	The processes described relating to the risk management of the project are in line with best industry practice or use an industry

A 3.2.4.3 Deployment Criterion 2 – Is there a credible resource plan (“how”)?

Deployment Criterion 2. Credible resource plan (“how”)		
Parameter	Items considered	Examples of supporting evidence.
2.1 Is the project team experienced in rollouts of this sort?	Does the deployment organisation contain the roles expected for a project of the scale forecasted? Do the key personnel have appropriate levels of experience to deploy such a network?	An organisation chart, explaining the different roles and functions is outlined with roles such as a project director, a network roll-out manager, individual personnel responsible for acquisition, design and construction, and a project management office and support team etc. included. The details of the project team’s previous experience in deploying networks of a similar scale and nature is outlined.
2.2 If subcontractors are being used, is the plan to engage them advanced sufficiently to support the roll-out timeframe?	Are contracts in place or at an advanced stage that secure the subcontractor resources and capabilities required to deliver the project?	Details of orders placed, and the supply chain established delivery of the necessary subcontractor resources and capabilities. Signed contracts with subcontractors for the works required. Procurement progressed to an advantaged stage, designed to contract the necessary subcontractor resources.
2.3 Are the proposed or actual subcontractors experienced in this type of roll-out?	Do the proposed subcontractors have the capability and experience to roll out the network?	The details of subcontractors’ previous experience in fulfilling their anticipated function in the project or case studies from subcontractors rolling out networks of a similar scale and nature is provided.

Table A 3.7. A concise summary of the NBP Deployment Criteria Verification Methodology for deployment criterion 2.

Again, a risk score must be assigned to each parameter and then the parameters must be considered in aggregate when determining whether there is a credible resource plan or not.

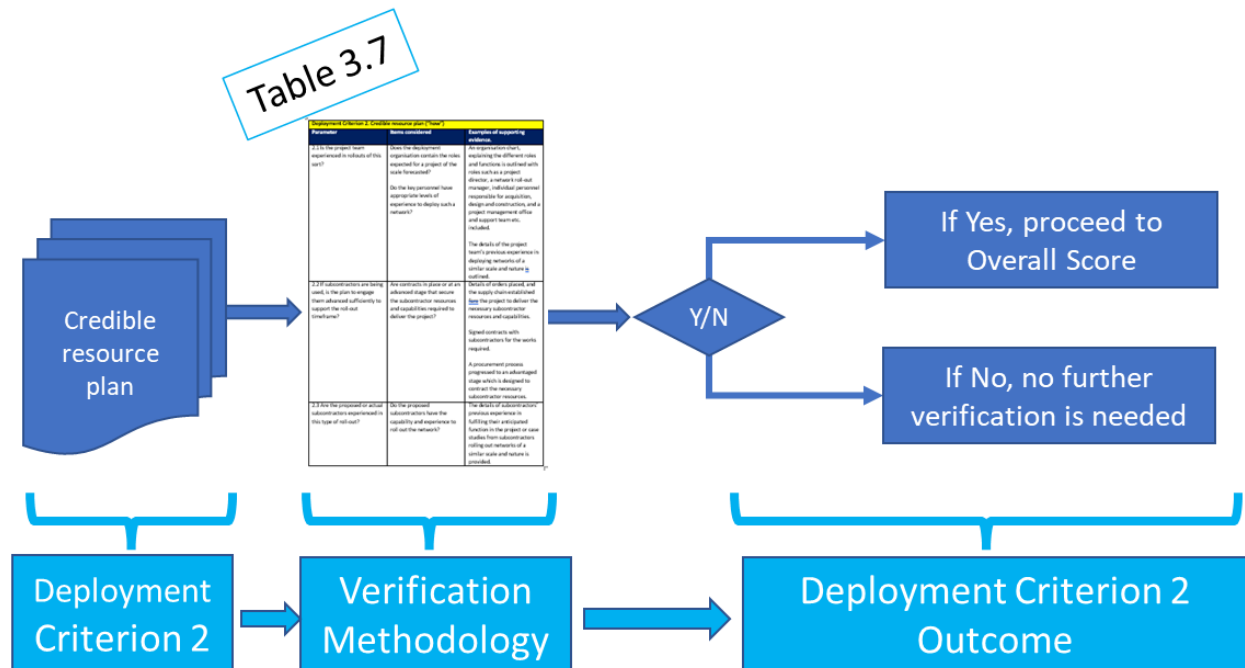


Figure A 3.16. The scoring of NBP Deployment Criteria Verification Methodology for deployment criterion 2 using table A 3.7.

A 3.6.5.4 Overall Deployment Criteria Verification Outcome

Both deployment criterion 1 and deployment criterion 2 must be scored 'Credible = Yes' for the deployment criteria to be met.

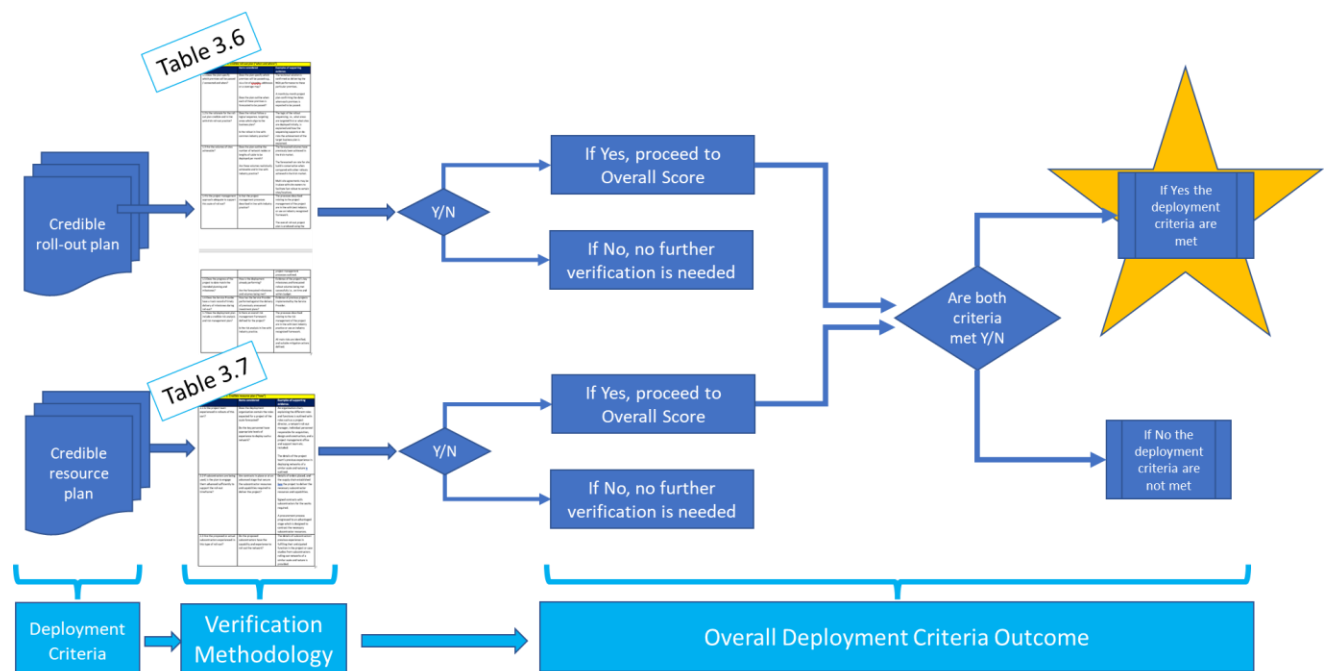


Figure A 3.17. Summary of the NBP Deployment Criteria Verification Methodology using the verification methodologies outlined in tables A 3.6 and A 3.7.

For a future planned network, verification of the technical, deployment and financial criteria are needed and then stage 2 must then be completed in order for the future planned network to be considered a credible plan.

A 3.2.5 The NBP Financial Criteria Verification Methodology

A 3.2.5.1 Introduction

The Financial Criteria Verification Methodology is used to established whether a future planned network proposed by a Service Provider meets the Mapping Assessment Performance Criteria for the Financial area or not.

There are two financial criteria:

1. Is there a sound business plan? (i.e., the business plan needs to demonstrate that the investment is credible from a financial point of view); and
2. Is the funding available? (i.e., the funding arrangements need to be in place to demonstrate that the deployment can be financed).

Figure A 3.4 outlines the Mapping Assessment Performance Criteria that applied to the financial Area. Similar to the deployment criteria the parameters for each financial criteria are scored as a high, medium or low risk score. These parameters are then considered in aggregate to determine whether the criterion is met or not.

A 3.2.5.2 Financial Criterion 1 – Is there a sound business plan?

Financial Criterion 1.1 Is there a sound business plan?		
Parameter	Items considered	Examples of supporting evidence.
1.1 Is the NPV of the investment positive and developed on a stand-alone basis (for both wholesale and retail)?	What is the Net Present Value (NPV) of the project positive? Is there a sensitivity analysis that demonstrates the range within which the investment is still NPV positive?	The projected discounted present value of all future cash flows should be positive for the investment plan to be credible. The business plan should be sufficiently robust so that reasonable percentage variances of income and expenditure can be withstood for the NPV to remain positive.
1.2 Revenue assumptions: Is take up realistic, given market development and potential competition on a retail level?	Is the target market share realistic within the target area? Is the rate of take up realistic and in line with industry norms? What risks exists to the forecasted revenue projections?	Analysis of the level of competition already providing broadband services in the target area. The take up aligns to the deployment plan, with a reasonable rate of take up projection once the deployment is finalised and marketing activities have been completed. Market research supporting the revenue projections.

1.3 Revenue assumptions: Are pricing assumptions (both wholesale and retail) realistic, given potential regulation in the market?	Are the proposed products and prices prudent and in line industry norms? Is the pricing and product offering designed to be competitive and likely to secure the projected revenues?	The products and pricing align to identified benchmarks in other areas e.g., urban areas. The products and/or pricing are designed to provide a step change from other provider of broadband in the area. Market research supporting the attractiveness of the prices and products proposed.
1.4 Cost assumptions: Are cost level (capex and opex) assumptions realistic and in line with design of the network?	Are capital expenditure projections for the deployment as well as replacement costs realistic and aligned with the design proposed in the technical solution? Are Operating expenditure projections realistic and aligned with the design proposed in the technical solution?	The capital expenditure forecasted aligns to the bill of materials needed to deploy the proposed technical solution. The capital expenditure costs are confirmed through subcontractor contracts or quotations. The operating expenditure forecasts align to industry norms for a similar network Sufficient contingency funding is allowed for in the business plan.
1.5 Cost assumptions: Can all costs (fixed and variable) be recouped?	Are all fixed and variable costs included in the business plan? Are all fixed and variable costs recouped over a reasonable timeframe?	A comprehensive list of all variable costs in line with industry norms for a business of similar nature.
1.6 Are the costs aligned with the deployment plan?	Is the forecasted timing for costs consistent with the proposed deployment plan?	A direct alignment of the forecasted costs with deployment schedule.

1.7 Does the time span of the business plan correspond with the lifecycle of the investments?	Are the forecasts for the equipment replacement and upgrade in line with manufacturing roadmaps or industry norms?	Evidence from manufacturers for the replacement cycle for any active equipment in the technical solution e.g. of customer premises equipment, radio base stations, exchange equipment etc. Assumptions for passive equipment replacement which are in line with industry norms e.g., pole replacement.

Table A 3.8. A concise summary of the NBP Financial Criteria Verification Methodology for financial criterion 1.

A risk score must be assigned to each parameter and then they must be considered in aggregate to determine whether the plan should be considered credible or not. Where the risk scores are mainly scored low then the plan is deemed credible. The opinion of an expert is critical when making this determination.

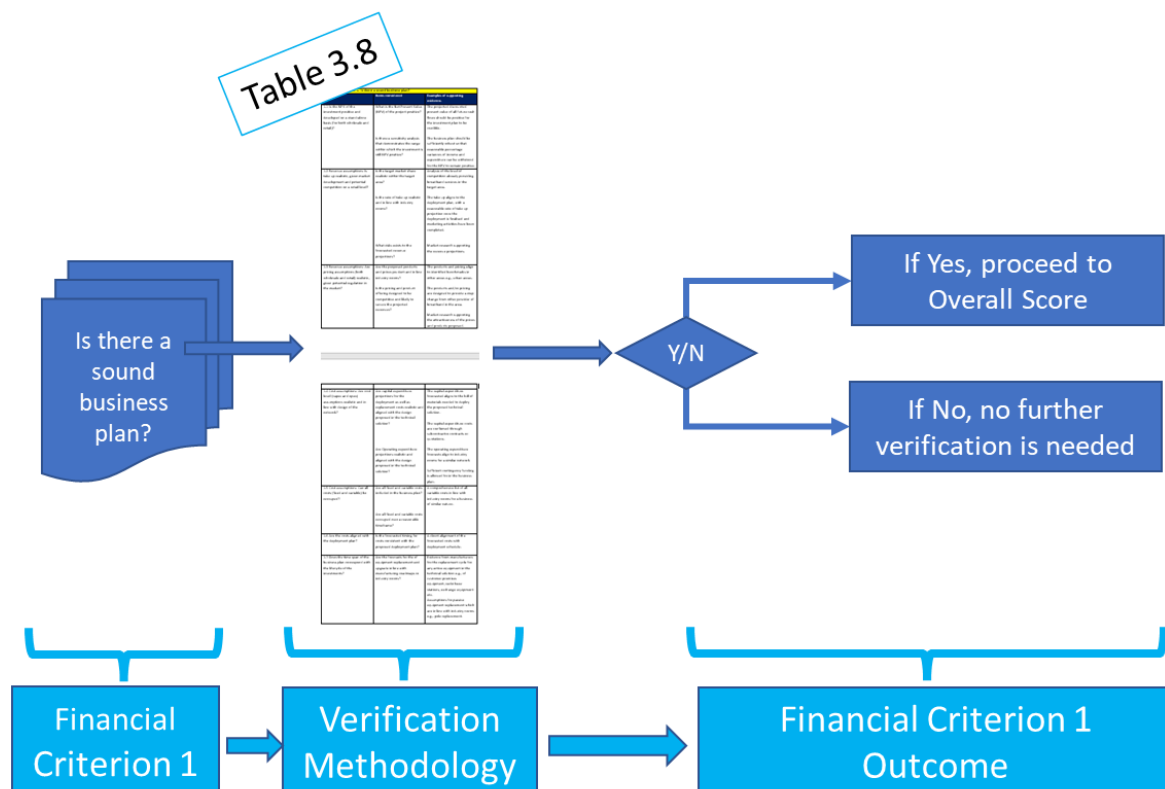


Figure A 3.18 The scoring of NBP Financial Criteria Verification Methodology for financial criterion 1 using table A 3.8.

A 3.2.5.3 Financial Criterion 2 – Is the funding available?

Financial Criterion 1.2 Is the funding available?		
Parameter	Items considered	Examples of supporting evidence.
2.1 Is the need for funding and associated costs adequately assessed?	Are the funding requirements adequately identified in the business plan. Are the costs associated with servicing the proposed funding adequately catered for in the business plan?	Robust sensitivity analysis against the levels of funding required. Prudent forecasts for the costs repayments in line with financial market forecasts.
2.2 Is funding structure available by source (own cash, debt or equity)?	Is the source of funding identified? Are there substantial risks to accessing the proposed funding source and are the assumptions credible regarding the availability of funding?	Board approval for the use of cash, to raise debt, or equity. The key risks are identified and mitigated to a significant degree. Debt and/ or equity options identified with banks and/or investors.
2.3 Does the financial plan contain commitments from debt or equity providers, or the board in case it is funded by cash?	Are firm commitments in place from investors or the company board to provide the necessary funding e.g., commitment letter, funding agreement, board approval.	Debt and/or equity agreements with banks and/or investors. Letters of commitments from investors.
2.4 Do projected cash flows support the need of funding and/or debt financing?	Are there substantial risks to the forecasted cash flows and are the assumptions credible regarding the availability of cash from the business. The level of flexibility to source additional funding if necessary.	The key risks are identified and mitigated to a significant degree. Robust sensitivity analysis against the levels of cash to be generated from the business.

Table A 3.9. A concise summary of the NBP Financial Criteria Verification Methodology for financial criterion 2.

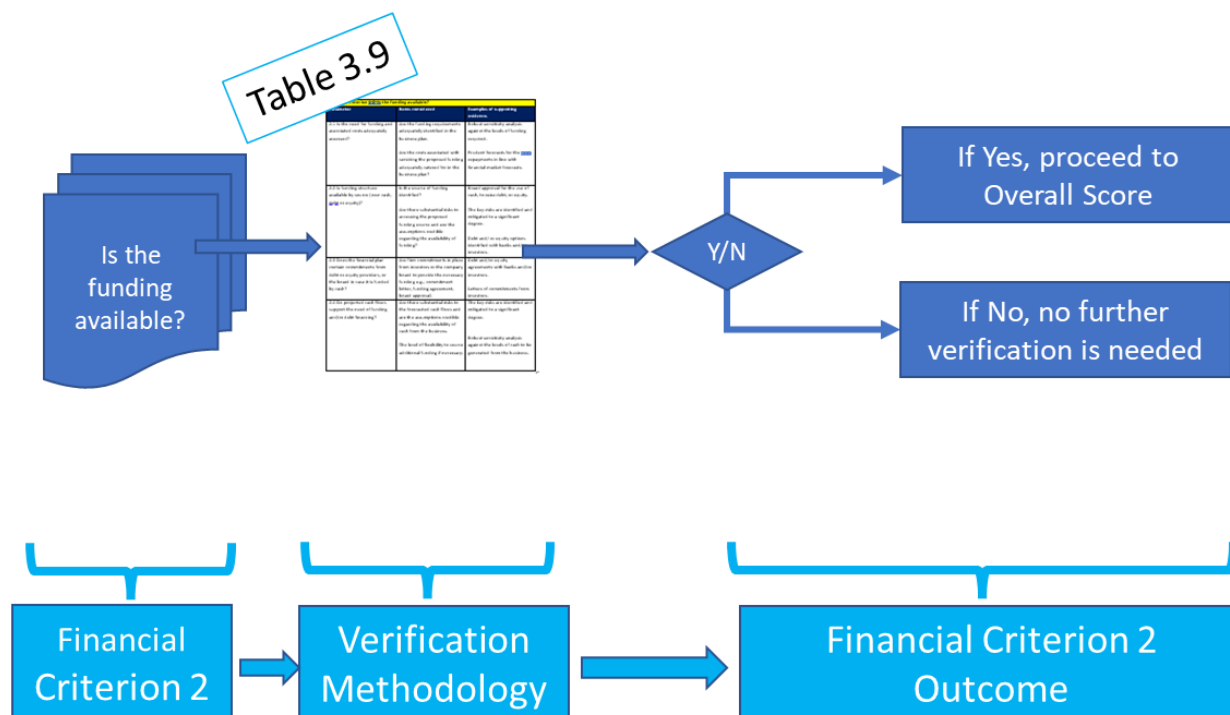


Figure A 3.19. The scoring of NBP Financial Criteria Verification Methodology for financial criterion 2 using table A 3.9.

A risk score must be assigned to each parameter and then they must be considered in aggregate to determine whether the plan should be considered credible or not. Where the risk scores are mainly scored low then the plan is deemed credible. The opinion of an expert is critical when making this determination.

A 3.2.5.4 Overall Financial Criteria Verification Outcome

Both financial criterion 1 and financial criterion 2 must be scored 'Credible = Yes' for the financial criteria to be met.

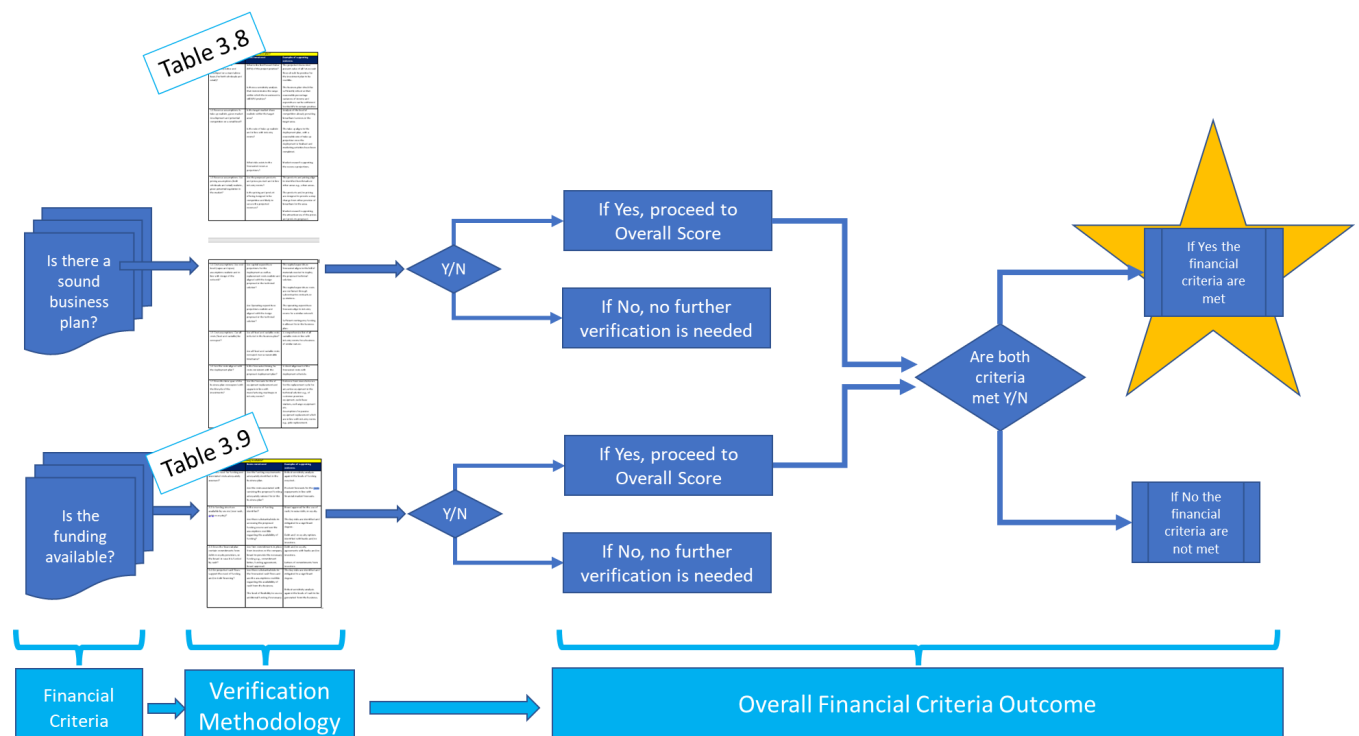


Figure A 3.20. Summary of the NBP Financial Criteria Verification Methodology using the verification methodologies outlined in tables A 3.8 and A 3.9.

For a future planned network, verification of the technical, deployment and financial criteria are needed and then stage 2 must then be completed in order for the future planned network to be considered a credible plan.

A 3.2.6 The NBP Verification Methodology – Stage 1 Summary

A flow chart depicting the full end-to-end process of Stage 1 is outlined in Figure A 3.21. This summary shows where each of the Online Map Building Blocks apply.

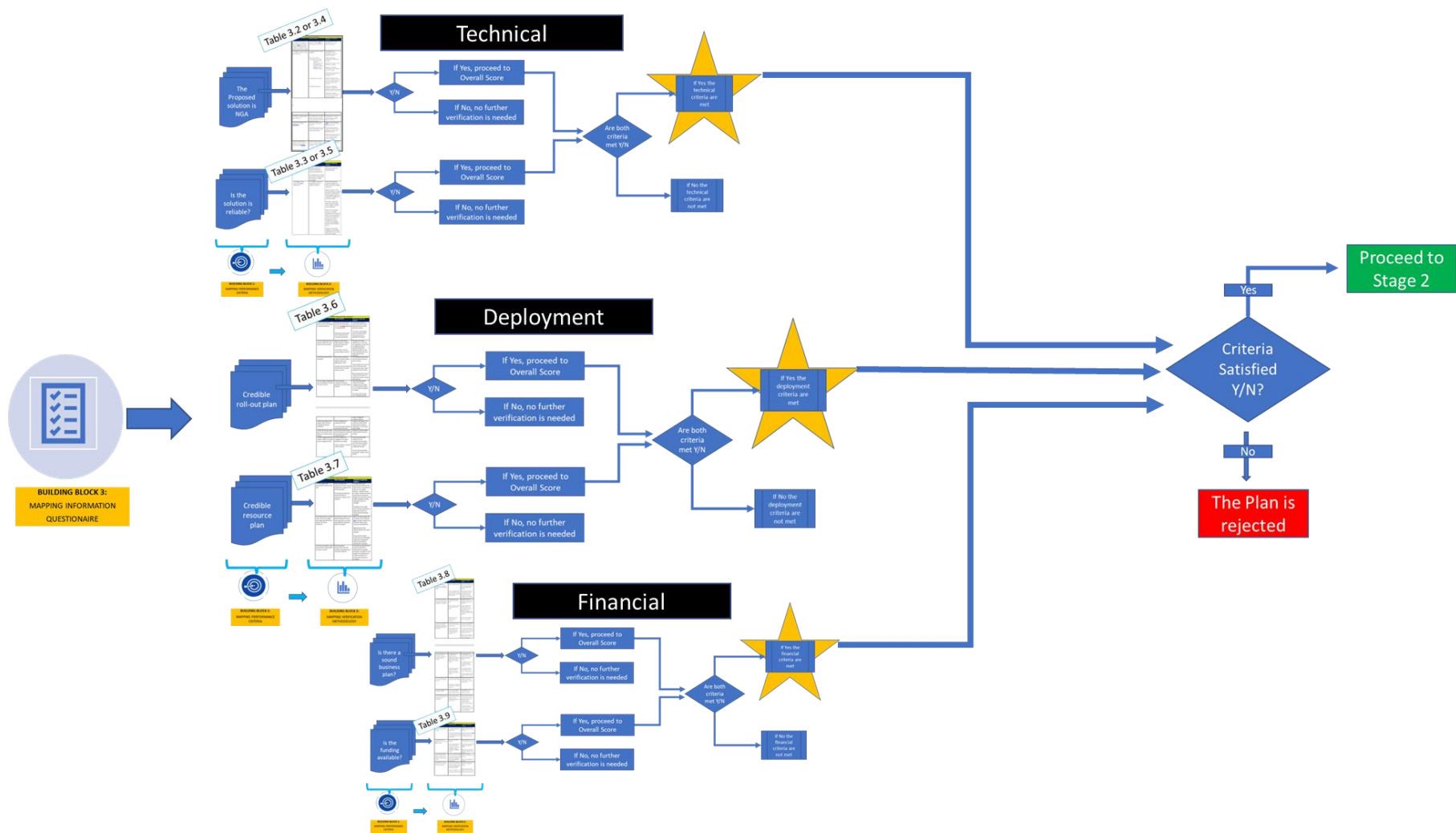


Figure A 3.21 Summary of the NBP Verification Method for a future planned network claim - Stage 1.

Figure A 3.12 outlines if each of the technical, deployment and financial assessment criteria are satisfied then the assessment progresses to Stage 2, if they are not the plan is rejected.

And as explained earlier only the technical criteria are applied for an existing network and stage 2 is not needed. Therefore, only subset of the NBP Verification Methodology is required as illustrated in Figure A 3.22.

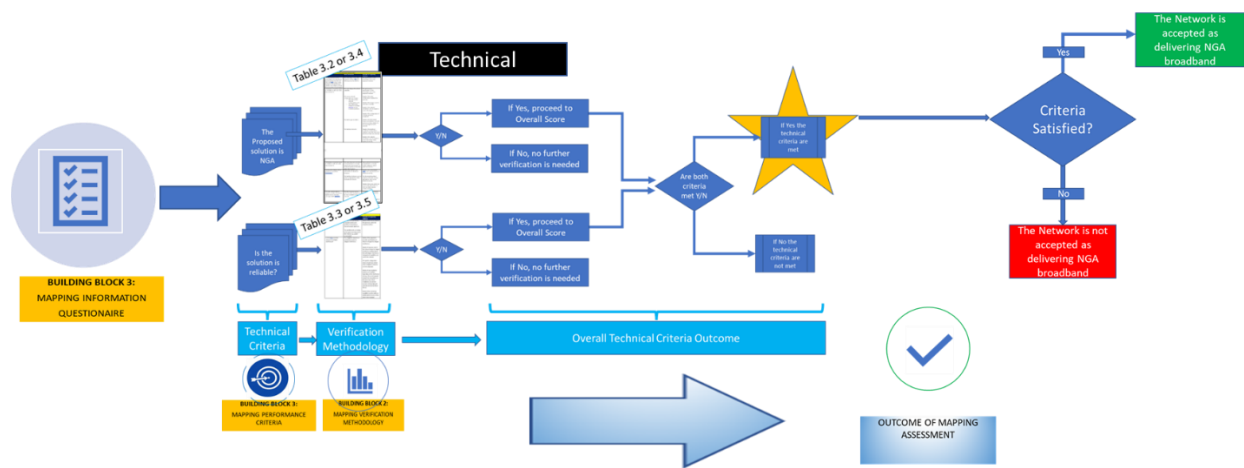


Figure A 3.22 Summary of the NBP Verification Method for an existing network.

A 3.2.7 The NBP Verification Methodology – Stage 2

Stage 2 involves inviting the Service Provider to enter into a contractual agreement on their proposed deployment with the Minister for Communications. Only Service Provider claims relating to a future planned network that have passed Stage 1 and fulfilled the criteria set out for technical, deployment and financial are invited. And importantly stage 2 is only relevant for future planned networks as the investment has yet to take place.

The agreement is a legally binding contract committing to meet specific deployment milestones for the planned network and to commit to certain reporting obligations. There are many instances of Service Providers announcing plans to deployment services and then subsequently failing to do so. The agreement was introduced as a safeguard for the State to ensure proposed plans actually go ahead.

For stage 2 a template contract⁷⁵ was developed and published by the Department outlining the level of commitment required by a Service Provider. This required the Service Provider to commit to certain obligations, including:

- identifying the premises they would provide NGA broadband service to;
- confirming the timeline by which they will have the service in place i.e., through a project plan for the deployment;
- agreeing to meeting key milestones in their deployment to demonstrate progress;
- providing regular status update reports to the Department throughout the deployment period;
- committing to connect premises within an agreed duration (for example, 20 working days) for any premises passed; and
- to publishing details of their deployment plan so that premises owners could see when the service will be made available to them;

In turn, as part of the agreement, the Minister committed to removing the target premises from the NBP Intervention Area, thereby removing the prospect of a State intervention in the area.

This approach was designed to provide transparency to premises owners on which Service Provider was committing to pass them and by when. It also provided the assurances necessary that the premises targeted by the future network deployment would within a specified time receive NGA broadband through the Service Provider's investment. Therefore, it was unnecessary to include those premises in the State intervention project.

⁷⁵ A draft head of terms, outlining the key provisions required for this contract can be viewed at <https://www.gov.ie/pdf/?file=https://assets.gov.ie/302560/07f770a2-1a86-4f17-8ec1-cc1b1c22bc99.pdf#page=null>

A 3.3 The Irish Online Map Building Block 3 – detailed description

For a Service Provider to submit a claim they must first submit details of their network or future planned network. However, as can be seen from the Online Map Building Blocks 1 and 2, very precise information is required across a broad range of areas. Not only is very detailed technical information required of the Service Provider's network, but detailed deployment and financial information is also needed if a future planned network is being claimed.

Service Providers must be provided with clear guidance on what information is required. As discussed early in Chapter 3, in 2013 the NBP intervention project issued a 'Request For Information' to all Service Providers, requesting them to submit details of their fixed and wireless NGA broadband services and to outline any plans they may have to deploy NGA broadband services by 2016. The request relied on Paragraphs 57 and 58 of the SAG to outline and to define what was to be considered an NGA broadband service. What quickly became apparent was that this request proved to be unsuitable, as each Service Provider interpreted the SAG Paragraphs very differently. Subsequently after several consultations the Supplementary Request for Information questionnaire was developed. This questionnaire set out the level of detail required to conduct the assessments against the technical, deployment and financial criteria. This document provided specific guidance to service providers on the level of information required when submitting a claim in respect of an existing or future planned network. The Supplementary Request for Information questionnaire for Technical, Deployment and Financial is set out under Appendix A to the NBP Mapping Assessment Framework (52) and is therefore Online Map Building Block 3.

A 3.3.1 The NBP Supplementary Request for Information

Through the Supplementary Request for Information questionnaire the NBP intervention project clearly identified what information was required from Service Providers so that the verification of the Service Provider claim could be conducted.

For an existing network, a Service Provider was requested to provide the technical details of their network. For a future planned networks, Service Providers were requested to (in addition to the technical details of their network) provide details of their deployment strategy and their business plan and outline the sources of funding for the investment.

As can be appreciated, the consequence of developing very detailed performance criteria and verification methodologies is that substantial Service Provider information is needed to make a determination relating to the criteria. The Supplementary Request for Information questionnaire was designed to ensure all the necessary information needed for the verification of a claim was outlined.

Identifying the NBP Supplementary Request for Information questionnaire as part of this thesis provides readers with the third and final Online Map Building Block used as part of the NBP Mapping Process and forms a valuable reference for future mapping projects.

The technical information was requested under Supplementary Request Appendix A.1 as follows.

Firstly, Supplementary Request Appendix A.1 part 1 requested generic information on the network (or future planned network), which included a request for a description of:

- the entire network architecture;
- the access network;
- the backhaul network;
- the customer premises equipment used;
- a coverage map confirming the target premises; and
- any other relevant information the Service Provider thought might support their claim.

Secondly, Supplementary Request Appendix A.1 part 2 requested platform specific information. Appendix A.1 part 2a requested information specific to wire line platforms

whereas Appendix A.1 part 2b requested information specific to wireless platforms. This part of the information requested a description of:

- the configuration and location of the nodes in the network;
- the assumptions used in the planning and projection of coverage;
- the capacity assumptions used in the design of the network;
- the protections against interference and methods used to assure the service;
- the configuration of customer premises equipment used; and
- any other relevant information the Service Provider thought might support their claim.

Thirdly, Supplementary Request Appendix A.2 requested the deployment information including detailed on the proposed rollout schedule, the volumes expected to be achieved each year of the deployment, the level of planning conducted to date on the deployment itself as well as details of different aspects of the resource planning such as the deployment organization, subcontractor arrangements or contracts, equipment vendor contracts and the stock already ordered or in place. Any other relevant deployment information the Service Provider thought might support their claim was again requested.

Lastly, Supplementary Request Appendix A.3 requested the financial information including information on the forecasted business plan, the key assumptions underpinning the business plan, details of the target revenues, take-up projections, products and pricing, market intelligence conducted as well as the projected scale and timing of the costs needed to deploy and operate the network. Service Providers were encouraged to submit detailed supporting evidence for the assumptions. In addition, details of the sources of funding were requested including the proposed funding structures e.g., funding from cash generated from an existing business, raised from debt or equity finance. Details of funding agreements, board approvals or letters of support were requested. Any conditions attached to the funding was also requested. Again, the Service Provider was encouraged to provide any additional information they felt would support their claim.

Great care was taken to ensure the NBP Supplementary Request for Information questionnaire was sufficiently detailed and comprehensive so that a verification of the Service Provider claim could be conducted.

It should be noted that the full onus was with the Service Provider to provide this information to support their claim to the best of their ability. Where a Service Provider did not provide all the information requested despite being given the opportunity to do so, the verification could proceed in any case using the information that was provided.

Appendix 4 – My submission to the EU Commission’s public consultation, in 2022

Submission in response to the Public Consultation on the Revision of the Guidelines on State aid for broadband networks

Mr. Patrick Neary

Post Graduate Research Student

Trinity College Dublin

11-02-2022

CONFIDENTIAL

To whom it may concern,

This submission is made in a personal capacity, as a research student of Trinity College Dublin.

Best Regards,

Patrick

1. General

I welcome the Commission's additional guidance to EU Member States outlined in Annex 1 on how to conduct the State Aid Mapping Process and the additional guidance provided under section 5.2.2.4.3 Best Practices: assessment of private investment plans in public investment.

My submission outlines proposals on how this guidance can be further expanded. I have a keen interest in ensuring EU Member States are provided with strong guidance in the Mapping Process and I am happy to assist in the further development of this guidance if for example supplemental guidance is considered appropriate.

Please note that the information provided is confidential and should not be re-used or cited without confirming prior permission with myself.

2. Centrality of the Mapping Process

The Mapping Process forms the cornerstone to the overall State Aid process and ultimately allows States to subsidise the deployment of broadband to the underserved areas identified. By improving the Mapping Process and enabling it to be completed faster, I believe this will allow the overall State Aid process to be accelerated. So we believe the improvement of this guidance to be of critical importance to EU Member States.

A first and critical clarification is to outline where at what times there is a reliance on the Mapping Process and when the outputs and findings of the Mapping Process are used when designing an intervention in the market (referred to herein as the State Aid Process). The Mapping Process is often misconstrued as a 'one off exercise' which must be conducted once as part of the State Aid Process. This is not the case. The findings of the Mapping Process must be revisited and revalidated on multiple occasions throughout this process. As will be explained below, a number of iterations of the Mapping Process are needed at different stages of the State Aid Process. This is a hidden dependency not obvious from the guidelines provided. The overall State Aid Process can be divided into the following four high level phases; Phase 1 being the development of the State Policy for broadband, Phase 2 the development of an Intervention Strategy; Phase 3 the public procurement and Phase 4 the finalisation of the contracts and State Aid Approval.

The Mapping Process plays an integral role in each phase and is of high importance in three of these phases. Figure 1 below illustrates the level of dependency on the Mapping Process at each of these phases.

Phase 1	Phase 2	Phase 3	Phase 4
Development of an overall State Policy on the availability of broadband for its citizens.	Development of an intervention Strategy	Conduct a Public Procurement to implement the intervention	Finalisation of the contract and State Aid Approval.
<u>Mapping Process</u> <u>reliance is medium.</u>	<u>Mapping Process</u> <u>reliance is high.</u>	<u>Mapping Process</u> <u>reliance is high.</u>	<u>Mapping Process</u> <u>reliance is high.</u>
During this phase the Mapping Process plays less of a central role. Only a broad and general understanding of the availability of services is considered in the development of the State's policy.	During this phase the Mapping Process is one of a number the factors which is considered in the development of a suitable intervention strategy.	The Mapping Process is fundamental to the procurement phase as a confirmed scope is needed to implement the procurement. - An Intervention Area must be identified through the Mapping Process at the start of the procurement. - The Intervention Area <u>must be also be</u> maintained and updated	The Mapping Process is central to the finalisation of the contract where the scope is re-<u>confirmed</u> and State Aid Approval is sought for the intervention from the EU Commission. The State Aid review conducted by the EU Commission examines <u>a number of</u> factors relevant to the intervention measure, including an in-depth examination of the Mapping Process conducted.

		throughout the procurement phase	

Figure 1 – Reliance on the Mapping Process across the overall four phases of the State Aid Process

Recommendation 1: *The EU Commission should outline clearly where there is a reliance on the outputs of the Mapping Process at each phase of the State Aid Process.*

Recommendation 2: *EU Member States should be advised to mobilize the necessary resources and expertise required to conduct the Mapping Process on the basis that it will be required over many years, if not indefinitely (as the mapping exercise may continue even after the contract award to ensure the accuracy of the mapping exercise is maintained for example). The Mapping Process is the cornerstone of the EU State Aid process it must be treated as such for planning, resourcing and budgeting purposes.*

3. The ‘Building Blocks of the Mapping Process’

To produce an online map three key building blocks must be established. These building blocks are introduced briefly below and are described in more detail later in this Chapter.

Building Block 1 - ‘Mapping Assessment Framework’.

This framework identifies

- the Mapping Assessment Performance Criteria which must be met; and
- the overall assessment process that is followed to establish whether a service provider network (for either an existing or future planned network) meets the required performance criteria.

This Building Block 1 states the performance thresholds for different technical parameters such as download speed and upload speed that must be met for a broadband service to be considered a NGA broadband service. Unfortunately there is no industry standard definition that defines a NGA broadband service not is this defined in sufficient detail in the Guidelines; it is left to EU Member States to define the ‘standard’ through their Mapping Process. In addition, other complimentary criteria must also be defined for planned networks so that their credibility can be confirmed. These

criteria may include whether they have a credible financial plan and whether they have a credible or well advanced deployment strategy.

Building Block 1 defines the 'standard' that must be met for a broadband service to be considered a NGA broadband service or a future planned network to be considered credible and likely to deliver a NGA broadband service once it is deployed.

Service Providers already delivering basic broadband services in an area may be motivated to have this 'standard' reduced or diluted. This is so that they can ring-fence an area where they are already delivering basic broadband services and prevent any State subsidized network being built in the same area therefore protecting their existing business and livelihoods.

Also as there is no standard definition outlined by the EU Commission, there is a high risk that EU Member States will interpret these parameters and define the 'standard' differently in each country therefore diluting the EU ambition to have consistency across all EU Member States.

This 'standard' is therefore very contentious and leaves the EU Member State open to legal challenge by Service Providers. Great care must be taken in defining the standard, each performance threshold and all relevant criteria.

Recommendation 3: The EU Commission should outline clearly performance thresholds for different technical parameters such as download speed and upload speed that must be met for a broadband service to be considered a NGA broadband service. The definitions currently in the annex 1 are still ambiguous and need further development to ensure specificity.

Building Block 2 - the 'Mapping Assessment Validation Methodology'.

This identifies

- The methods that will be used to analyze service providers information to determine whether the Mapping Assessment Performance Criteria are met or not.

When determining whether a Service Provider's network meets the Mapping Assessment Performance Criteria or not; it appears that the guidance assumes that an expert will determine whether the thresholds are met or not. This is true to some extent but a detailed method is followed in making this determination and this detail method should be applied consistently across all EU Member States. Therefore further guidance is needed in this area. Annex 1 provides some relevant parameters that may be used but it does not provide a coherent method to be followed.

An example of a Mapping Assessment Validation Methodologies developed for Wire line networks is attached as Appendix A. Further detailed validation methodologies are not included in this [submission](#) but I am happy to assist in sharing insights and learning's relating to these validation methodologies if the Commission wants to develop supplementary guidance for these methodologies.

Recommendation 4: The EU Commission should develop detailed Mapping Assessment Validation Methodologies for each technology type e.g. Fixed Wireless, FTTC, FTTH, [DOCSIS](#) etc. These are step by step processes by which the method to assess operator submission should be followed. The guidelines today do not provide any standard methods or [procedures](#) and these are left to eh Eu Member State to develop.

Building Block 3 - the 'Intervention Area Map'.

This map identifies:

- the locations (through an online map), where the State intends to intervene and outlines how the map is created, updated, maintained and/or otherwise altered.

Building block 3 covers the process by which the locations on the map are represented in an online map and the process by which the Intervention Area Map is created, updated, maintained and/or otherwise altered. This building block [in itself](#) is complex and requires a number of clear input assumptions and definitions as well as robust processes so that the Intervention Area Map is maintained and kept as accurate as possible throughout the process.

These three building blocks are revisited and reused on multiple occasions throughout the Mapping Process. Considerable time and effort must be undertaken to develop each.

Recommendation 5: The EU Commission should outline clearly that the burden of proof lies with the operator to demonstrate the performance of their network and the credibility of any future investment plan. The Operator must also provide commitment and assurances on the accuracy and correctness of the information submitted.

Recommendation 6: Once EU Member States apply the relevant performance threshold and follow the assessment methodologies through a mapping consultation and publish their findings through an online map. I suggest this analysis should be considered correct, accurate and as up to date as possible for the following 2 years for the purposes of State Aid Approval. EU Member States should

not be required to re run the mapping consultation after the public procurement and prior to contract award. The time elapsed during the public procurement is required and necessary and should be allowed, any re running of the mapping process after this, introduces the risk of unravelling the procurement and any contract that might be awarded.

Recommendation 7: The EU Commission should consider establishing a 'centre of excellence' centrally within the EU Commission and/or an appointed agency specifically to advise and assist Eu Member States with the Mapping Process. The expertise needed to conduct a Mapping Process to satisfy the State Aid guideline conditions does not typically reside in EU Member States; this must be developed or sourced in most cases from complimentary functions and fields e.g. from the NRA from consultants or advisors. A central function within the EU Commission could more efficient run this exercise on behalf of certain EU Member States or at least advise on how best to design a mapping process to meet the specific needs of the EU Member State.

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