Modelling the Economic Impacts of Alternative Wayleave Regimes

Prepared for:

Department for Culture, Media and Sport

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October 2013

About Nordicity

Nordicity (www.nordicity.com) is a leading consulting firm specialising in policy, strategy, and economic analysis for the public and private sector client in the media, creative, telecommunications, and information and communications technology sectors.

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Glossary

Allocative efficiency	A concept in economic theory whereby the resources in an economy are deployed in an optimal manner – i.e. societal benefits are maximised.
Backhaul	The part of the communications network that connects a local exchange or communications mast to a communications operator's core network.
Broadband	An Internet service or connection that is generally defined as being 'always on' and providing a bandwidth greater than 128 kilobits per second (kbps).
Code operator	A communications operator that has had the Electronic Communications Code applied to it by Ofcom under section 106 of the Communications Act 2003.
Compensation	A payment that offsets (i) loss from a reduction in the value of land affected by the installation of communications equipment or cables, or (ii) loss or damage sustained as a result of the installation of communications equipment or cables.
Consideration	A payment above and beyond compensation, which reflects the value of the wayleave right.
Electronic Communications Code	Refers to Schedule 2 of the Telecommunications Act 1984 and promulgates the statutory rights that govern communications wayleaves.
Gross domestic product (GDP)	A standard measure of the monetary value of all goods and services produced in an economy.
Mast	A self-supported or externally supported apparatus to which mobile communications antennae can be affixed.
No-scheme basis	A valuation approach under which the value of land or a right should reflect a scenario absent of the communications operator's or utility's demand for that land or right.
Overhead	An aerial cable laid on poles or towers.
Price elasticity of demand (PED)	A measure of the sensitivity of a product's sales to changes in its price. Equal to the ratio of the percentage change in demand and the percentage change in price.
Ransom pricing	The pricing that occurs in situations where a payee controls some unique asset or location, and therefore can hold out for a price that is equal to the payer's expected increase in profit. It is often considered synonymous with a demand for a share of profits.
Stay	A steel wire connected to the top of a pole and anchored diagonally to the ground to provide additional support to the pole.
Strut	A wooden pole placed at an angle to a vertical pole for the purpose of providing additional support by counteracting the pull of the overhead wires.
Superfast broadband	Broadband service with a speed of at least 24 Mbps (megabits per second).
Sync speed	Refers to the modem sync speed and is a measure of broadband data transmission capacity. The modem sync speed is the maximum downstream rate at which an Internet service provider's equipment

	(installed at the local exchange office or cabinet) is capable of sending data (i.e. downloading data) to the customer's modem.
Underground-rural	Refers to communications cables (e.g. fibre-optic cables) buried underground in rural areas.
Underground-urban	Refers to communications cables (e.g. fibre-optic cables) buried underground in urban areas.
Wayleave	An agreement between a landowner and communications operator or utility that grants the communications operator or utility a right to install, access and maintain cables or other equipment on private land.

Executive summary

1. When a communications operator or utility wishes to pass over or under privately owned land, it must obtain the right to do so from the landowner. This right may take a variety of forms, one of which is a *wayleave*[1]. A wayleave is an agreement whereby a landowner essentially grants a licence to a communications operator for the right to install, access and maintain cables or other equipment on private land. Because communications operators must obtain and then pay for wayleaves before they can install broadband communications cables and equipment, wayleaves represent a potential barrier to the timely deployment of broadband infrastructure.

2. The vast majority of wayleaves in the UK result from negotiated agreements between landowners and communications operators. However, in the event that a landowner and communications operator cannot reach a voluntary agreement, the communications operator may resort to the governing legislation, the Electronic Communications Code (the "Code"), which offers recourse to the County Courts and the Sheriff in Scotland.

3. In light of the role played by wayleaves in the deployment of broadband infrastructure, the Government launched a review of the Code in 2012. As part of that review, the Law Commission carried out a consultation process and published several recommendations in 2013 for the modernisation of the wayleave regime in the UK.

4. Subsequent to the Law Commission consultation the Department for Culture, Media and Sport commissioned Nordicity in August 2013 to study the economic impact of various alternative wayleave regimes. These included (i) the Law Commission proposal, (ii) the wayleave pricing regime adhered to in the UK's energy sector (the "energy regime"), and (iii) the practice of wayleave pricing in the UK's water and sewerage sector (the "water regime"). Nordicity's analysis considered the impact that each of these alternative regimes would have on the wayleave costs for four types of broadband infrastructure: (i) wireless-communications masts ("masts"), (ii) overhead cables ("overhead"), (iii) underground cables/ducts in rural areas ("underground-rural"), and (iv) underground cables/ducts in urban areas ("underground-urban").

[1] These rights can also take the form of leases (mobile operators) or easements (common in the energy and water sectors). For the purposes of this study, all of these forms of agreement have been grouped under the single term, *wayleave*.

5. The adoption of alternative wayleave regimes is likely to result in a reduction in wayleave costs for communications operators. Our analysis suggests that the Law Commission proposal would result in a moderate decrease of 10% in wayleave costs. Our research of the electricity sector leads us to conclude that the costs of communications wayleaves would decrease by 40% under the energy regime. Under the water regime, we estimate that wayleave costs would drop by 62% compared to those under the existing regime.

6. Because wayleave costs represent only a portion of the total cost of deploying and operating new broadband infrastructure, the impact of these reductions in wayleave costs is much smaller relative to communications operators' total infrastructure costs. Our analysis indicates that the adoption of the Law Commission proposal would result in a decrease of 0.4% to 1.3% in the 15-year present value (PV) of infrastructure costs[2]. The adoption of the energy regime would result in a decrease of 1.4% to 3.6%, and the adoption of the water regime would result in a decrease in infrastructure costs of 2.2% to 5.3%.

7. Infrastructure costs themselves represent only a portion of communications operators' total costs and turnover. Our research indicates that network capital expenditures represent 10% of total turnover. In our estimate, operating costs would add another 10% to the PV of the overall infrastructure costs. Therefore, even if competitive forces in the broadband market compelled communications operators to pass on 100% of their cost savings to customers, the impact on average consumer prices would be only one-fifth of the impact on total broadband infrastructure costs. For example, under the water regime, the maximum potential decrease in average consumer prices would be no more than 1.05% (i.e. 5.3% ÷ 5 ≈ 1.05%). Under the Law Commission proposal, the decrease in average consumer prices could be as little as 0.07% (i.e. 0.4% ÷ 5 ≈ 0.07%).

8. These small decreases in the consumer prices for broadband services – than would have otherwise occurred – still have the potential to increase subscriptions to standard broadband and superfast broadband services. Recent empirical analyses show that higher levels of broadband penetration and average achieved broadband speed can have a positive impact on an economy's gross domestic product (GDP). This GDP impact arises

[2] Given that broadband communications infrastructure can have a useful life of approximately 15 years, all of the cost calculations and analysis in this report have been conducted on the basis of a 15-year discounted PV. In accordance with HM Treasury *Green Book* guidelines, a discount rate of 3.5% has been used to calculate the PV.

not only from the economic activity associated with network construction, but more importantly, from the broader indirect and spill-over effects that accompany the use of broadband by consumers, businesses and governments. In particular, the positive GDP impact is experienced through increased productivity and higher GDP per capita.

9. Our modelling of the impact of a decrease in consumer prices for broadband services indicates that the economic benefits (measured in terms of 15-year PV) of the Law Commission proposal would be £349.1 million. The energy regime would generate economic benefits of £982.1 million. The water regime would generate economic benefits of £1,484.2 million (Exhibit 1).

10. The adoption of any of the alternative wayleave regimes, however, also has the potential to slow the build-out of standard and superfast broadband networks. The prospect of lower wayleave rates is likely to result in landowners bringing forward disputes that will be costly and time-consuming – either in terms of reaching a settlement or in terms of rerouting the building of broadband infrastructure. Using the same empirical research for the economic impact of broadband penetration and average speed, we also modelled the impact that potential build-out delays could have on GDP.

11. Our analysis found that the adoption of the **Law Commission proposal** would generate an economic cost of £122.6 million and thereby result in a **net GDP impact of £226.5 million** (Exhibit 1). The adoption of the **energy regime** would generate economic cost of £490.6 million and thereby result in a **net GDP impact of £491.5 million**. The adoption of the **water regime** would generate an economic cost of £760.5 million and result in a **net GDP impact of £723.7 million**.

12. These levels of incremental economic activity, in turn, provide the basis for the creation of employment. Using the general relationship between GDP growth and job creation implied by forecasts published by the Office for Budget Responsibility, we estimate that the adoption of the **Law Commission proposal** would generate an estimated **1,000 new jobs** in the UK over the next 15 years (Exhibit 1). The adoption of the **energy regime** would generate an estimated **2,300 new jobs** over the next 15 years. And the adoption of the **water regime** would generate an estimated **3,300 new jobs** over the next 15 years.

Exhibit 1 Summary of economic impact of alternative wayleave regimes

	Law Commission proposal	Energy regime	Water regime
GDP impact (£ million) [1]			
Benefits from lower prices	349.1	982.1	1,484.2
Cost of build-out delays	(122.6)	(490.6)	(760.5)
Net impact	**226.5**	**491.5**	**723.7**
Employment impact [2]			
Number of new on-going jobs	1,000	2,300	3,300

Source: Nordicity analysis based on data from Rohman et al., Ofcom, Office for Budget Responsibility and Office for National Statistics.

Notes:
1. See Section 7.1.4.
2. Based on the ratio of 4.6 jobs created for every £1m of additional GDP in the UK economy. The employment impact is measured in terms of on-going jobs, rather than person years or full-time equivalents. The GDP and employment impact estimates are based on the PV of a 15-year stream of benefits.

13. It is important to note, however, that these estimates of the net GDP and employment impacts assume a scenario where all of the savings from reduced wayleave costs are passed on to customers – something that is not assured in a broadband Internet access market characterised by imperfect competition.

14. Our research also indicates that there is merit in landowners' arguments regarding the transfer of income to multinational communications companies. Such a transfer is likely to have a negative impact on the UK balance of payments in the short run, given the agricultural sector's low direct import ratio. However, this balance of payments impact must be weighed against the increased economic efficiency that is likely to accompany the import of foreign equipment, services and capital.

15. We also note that broadband plays an important role in research and development (R&D) and innovation. These endeavours tend not be price-sensitive and flourish in countries with advanced broadband networks and highly qualified researchers. Thus, any delays in the build-out of broadband infrastructure brought on by the uncertainty surrounding wayleave costs could potentially delay or even jeopardize R&D and innovation in the UK economy.

1. Introduction

16. Broadband is widely recognised as an important element in economic development and social wellbeing. Statistics published by Ofcom indicate that 98.7% of households in the UK have access to broadband Internet[3]; 90% have broadband connections with speeds of 2 Mbps or higher[4]; and 65% have access to superfast broadband (connections of 30 Mbps or higher)[5].

17. In recognition of the importance of broadband to the economy and society, the Government has set a policy objective of ensuring that at least 99% of households in the UK have access to a broadband connection by 2017 and that 90% of households have access to superfast broadband by 2018[6].

18. In order to achieve this objective, the Government has committed £1.6 billion to initiatives that will stimulate the build-out of reliable broadband networks in rural and urban areas in the UK[7]. The Government is also committed to making broadband infrastructure easier to deploy, by addressing red tape, and planning and legal barriers that may slow or prevent the construction of broadband infrastructure[8].

19. Communications operators often require access to land in order to install networks. Since the 1850s, such operators have been able to install their cables and equipment along public roads. When an operator wishes to pass over or under privately owned land, however, it must obtain the right to do so from the landowner. This right to land access may take a variety of forms, such as a wayleave (fixed line communications operators), a lease (mobile communications operators) or an easement (common in the energy and water sectors)[9]. For the purposes of this study, all of these forms of agreement have been grouped under the single term "wayleave".

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[3] Ofcom, 2012, *Infrastructure Report: 2012 Update*, p. 10.
[4] Ofcom, 2012, p. 12.
[5] Ofcom, 2012, p. 14.
[6] Department for Culture, Media and Sport, 2013. *Connectivity, Content and Consumers: Britain's Digital Platform for Growth*, July 2013, p. 15.
[7] Department for Culture, Media and Sport, 2013, p. 17.
[8] Department for Culture, Media and Sport, 2013, p. 20.
[9] Hutchinson et al., 2000, p. 9. An easement is a legal interest in land by which the burdens and benefits are tied directly to the land and typically bind successors to the title. In contrast, a wayleave is an agreement between two parties and is not tied to the land.

20. A wayleave is an agreement between a landowner and communications operator or utility that is essentially a licence granting the latter party a right to install, access and maintain cables or other equipment on private land. Wayleaves are typically terminable after a period of time or when new infrastructure is installed[10]. Wayleave compensation can be in the form of a capital payment, but often involves an annual payment. Because communications operators must obtain wayleaves and then make payments in accordance with them before they can install broadband cables and equipment, wayleaves represent a potential barrier to faster deployment of broadband infrastructure.

21. In light of the role played by wayleaves in the deployment of broadband infrastructure, the Government launched a review of the legislation governing them. This legislation is the Electronic Communications Code (the "Code"). As part of this review, the Law Commission carried out a consultation process and published several recommendations in 2013 for the modernisation of the Code and the wayleave regime in the UK.

22. Subsequent to the Law Commission consultation, the Department for Culture, Media and Sport (DCMS) commissioned Nordicity in August 2013 to study the economic impact of alternative wayleave regimes. These included (i) the Law Commission proposal, (ii) the wayleave pricing regime adhered to in the UK's energy sector (the "energy regime") and (iii) the practice of wayleave pricing in the UK's water and sewerage sector (the "water regime"). The following report presents the results of Nordicity's analysis.

23. The report is divided into nine sections. **Section 2**, *Background*, provides the context for the analysis of the four wayleave pricing regimes – the existing regime and three alternative ones. **Section 3**, *Approach and methodology*, provides an overview of the research and modelling approaches used for the analysis. **Section 4**, *Wayleave costs*, assesses how wayleave costs will change under the three alternative regimes. **Section 5**, *Broadband infrastructure costs*, assesses how lower wayleave costs would affect overall broadband infrastructure costs. In **Section 6**, *Broadband pricing, adoption and usage*, we analyse how lower infrastructure costs are likely to translate into lower consumer pricing and higher adoption and usage of broadband services. In **Section 7**, we analyse the impact on gross domestic product (GDP) and employment. In **Section 8**, we discuss other types of economic impacts associated with changes in the wayleave costs that were not quantified for this particular analysis. In **Section 9**, *Summary of key findings*, we document the key

[10] Hutchinson et al., 2000, p. 9.

findings of the analysis and discuss the implications for the Government's broadband policy.

2. Background

24. In this section we describe the background and context for this study. First, we review the current state and structure of the UK's broadband communications sector. This is followed by a description of the proposed wayleave regimes that form the basis of our analysis.

2.1 UK broadband communications market

25. Broadband is widely recognised as an important element in economic development and social wellbeing. Over the past decade, broadband has become indispensable to businesses large and small. Businesses use broadband to manage their product development and supply chains. The proliferation of e-commerce means that broadband has become a vital channel for marketing to new customers and managing relationships with existing ones.

26. For many years, consumers have used the Internet for search, news and e-commerce. Broadband communications have enhanced these traditional activities and also quickly established the Internet as a platform for enhanced voice and video communications (e.g. Skype) and entertainment (e.g. BBC iPlayer and LOVEFiLM Instant).

27. Broadband communications are now quickly transforming the Internet into a channel for mass education. And with fast and reliable broadband, the Internet may one day deliver e-health applications that will permit greater use of distance medicine.

28. The UK has one of the world's most advanced communications networks. Virtually all households can access current generation broadband services. According to Ofcom, 98.7% of households in the UK had access to broadband Internet services in 2012[11]. Approximately 90% of households had access to fixed broadband connections with speeds of 2 Mbps or higher[12], while 65% had access to superfast broadband (i.e. connections of 30 Mbps or higher)[13].

[11] Ofcom, 2012, p.10.
[12] Ofcom, 2012, p.12.
[13] Ofcom, 2012, p.14.

29. In rural areas of the UK, however, the availability of superfast broadband is significantly lower. Ofcom reports that only 19% of rural households in the UK had access to superfast broadband in 2012[14].

30. The wide availability of fixed broadband infrastructure in the UK has translated into high penetration rates for broadband services. As of the first quarter of 2013, 75% of UK households were subscribed to some type of broadband service[15].

31. Wireless and mobile broadband services are also playing a greater role in the connected economy and society. As of 2012, 99.1% of UK households and 75.7% of the land mass had 3G coverage from at least one mobile phone operator[16]. In rural areas, however, the rate of coverage was lower. As of 2012, 3G coverage was available to 94.7% of households – 6.3% of households had no 3G coverage[17].

32. The UK's extensive 3G network has helped to provide the foundation for the proliferation of mobile broadband services, although mobile broadband use has diminished in recent years. It peaked at 17% of households in 2011 but has since dropped to 5%[18]. The recent auctioning of additional spectrum and the introduction of 4G services may encourage more mobile broadband use in the future.

2.2 Broadband infrastructure and wayleaves

33. The UK's broadband infrastructure has so far come about through communications operators' on-going investments in network infrastructure as well as regulation targeted at specific monopoly bottlenecks. The UK's largest fixed line broadband operator, BT Openreach (a subsidiary of BT Group plc), is extending superfast broadband to 100,000 new homes and businesses per week[19], by implementing VDSL[20] technology on fibre-to-the-cabinet (FTTC) and fibre-to-the-premises (FTTP) lines[21]. Local loop unbundling regulations mean that other communications companies, such as TalkTalk and Sky, can

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[14] Ofcom, 2012, p. 16.
[15] Ofcom, 2013, p. 272.
[16] Ofcom, 2012, p. 29.
[17] Ofcom, 2012, p. 31.
[18] Ofcom, 2013, p. 272.
[19] BT Group plc, 2013, "Results for the Third Quarter and Nine Months to 31 December 2012", press release, 1 February 2013.
[20] Very-high-bit-rate digital subscriber line.
[21] Ofcom, 2012, pp. 9-10.

access this network and resell the services to their own customers. Virgin Media, the UK's largest cable television operator, is completing a major upgrade of its network, which will allow it to offer speeds of up to 100 - 120 Mbps to homes and businesses.[22]

34. While these market-driven investments are quickly improving the broadband infrastructure in many parts of the UK, there remain gaps – particularly in rural areas – where private financial returns are unlikely to provide a high enough incentive to stimulate investment. The Government's broadband policy is designed to address these coverage gaps in 2 Mbps broadband and superfast broadband services.

35. The vast majority of broadband cabling follows public roads. However, in certain situations, communications operators must traverse or access private land in order to implement efficient networks. For example, much of the wireless infrastructure (e.g. towers, masts, transceivers and base stations) are located on private land – either greenfield sites or rooftops (including church steeples). For wireline infrastructure, the cost of traversing private land may be much less than resurfacing public roads.

36. As noted in Section 1, when a private communications operator wants to traverse or access private land it must obtain a wayleave. Industry sources report that the payments associated with wayleaves in the UK total approximately £300 million per annum (p. a.). Given that private land plays a much more prominent role in the situating of wireless infrastructure (e.g. masts) than wireline infrastructure[23], it is not surprising that the former accounts for the vast majority of wayleave payments. According to industry sources, the wayleave payments for masts total £250 million, or 83% of the estimated total annual wayleave payments.

2.3 Proposed wayleave regimes

37. For this study, Nordicity considered four different wayleave regimes, including the existing regime and three alternative ones. These alternative regimes included the **Law Commission proposal**, the **energy regime** and the **water regime**. All four regimes are discussed in more detail below.

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[22] BBC News, 2012, "Virgin Media to double the speed of customer broadband", accessed 7 October 2013, http://www.bbc.co.uk/news/technology-16491614.

[23] Communications operators often have the option of using public roads for laying wireline infrastructure, although this option may not be the most cost-efficient.

2.3.1 Existing regime

38. Under the existing regime, landowners and communications operators have, by and large, entered into voluntary wayleave agreements. Indeed, in certain cases, national rate cards have been established. Nevertheless, there is a wide variation in actual wayleave payments, with some at nominal levels and others at market lease rates. The length of wayleave agreements also varies.

39. Since the vast majority of wayleaves have resulted from voluntary agreements between landowners and communications operators, there has been very little litigation under the existing regime. However, should disputes arise, communications operators that are also Code Operators (as per the Code) may resort to the Code, which offers recourse to the County Courts and the Sheriff in Scotland.

2.3.2 Law Commission proposal

40. In Law Commission No. 336, the Law Commission made several proposals regarding legislative and regulatory changes to govern the Code. With respect to wayleave payment rates, the Law Commission found that there was already a functioning market for communications wayleaves. Among other things, it found that there was a sufficient base of comparable transactions to guide price-setting and that there had been few disputes.[24]

41. This being the case, the Law Commission recommended that wayleave pricing continue to be determined by voluntary agreement and thereby be based on market value. The Law Commission did qualify its recommendation, however, by noting that the market value of communications wayleaves should reflect situations where there was "more than one suitable property available to the Code Operator"[25]. It added that the market value should also reflect a scenario where the Code Operator is not entitled "to upgrade or share apparatus, or to assign Code Rights"[26].

42. In effect, the Law Commission proposal preserves the existing regime, but calls for safeguards that prevent landowners from exercising ransom pricing. Ransom pricing occurs in situations where a payee controls some unique asset or location, and so there is no market per se, because there are no other sellers. In such situations, the payee or

[24] This, however, is disputed by some of the Code Operators.
[25] Law Commission, 2013, ¶5.83.
[26] Law Commission, 2013, ¶5.83.

landowner could hold out for a price that is equal to the payer's expected increase in profit[27]. Ransom pricing is often considered synonymous with a demand for a share of profits.

2.3.3 Energy regime

43. Private companies in the UK that provide electricity or natural gas can also enter into wayleaves with landowners, in order to locate towers, overhead wires, buried cables, conduits, pipes or other equipment on private land. Unlike Code Operators, energy companies may obtain a wayleave that "reflects only the [economic] loss to the landowner"[28]. This economic loss value goes beyond just the value of the land, however; it includes compensation for disturbance and elements of the value of the land. In general, wayleave prices in the energy sector should be lower than those in the communications sector, because they do not include an element of consideration – i.e. a payment in excess of compensation for loss or disturbance. However, where land access is a result of commercial negotiation, higher wayleave prices can occur and thereby result in payment in excess is simply compensation.

2.3.4 Water regime

44. Water and sewerage companies in the UK operate under a regime where they have statutory rights to conduct works or lay pipes after providing reasonable notice[29]. Landowners may not object[30]. In exchange for the right to lay pipes, landowners are entitled to compensation equal to the depreciation in value of the land caused by the pipes.

45. The compensation is calculated not only on the basis of the land directly affected by the pipes but also the "land held with that land"[31]. In addition there are provisions for landowners to be compensated for any "disturbance attributable to carrying out works"[32]. Under the water regime, any compensation for the depreciation in land value is offset,

[27] Law Commission, 2012, ¶6.13.
[28] Law Commission, 2013, ¶1.23.
[29] Law Commission, 2013, ¶1.23 and ¶4.11.
[30] Law Commission, 2013, ¶1.23.
[31] Hutchinson and Rowan-Robinson, p. 18.
[32] Hutchinson and Rowan-Robinson, p. 18.

however, by any enhancement in the value that may come from improved water or sewerage service[33].

46. As with the energy regime, the provisions under which the water regime operates suggest that wayleave rates should be lower than those occurring in the market for communications wayleaves. In particular, the emphasis on the principle of compensation under the water regime and the lack of explicit provision for consideration would likely result in lower wayleave rates than those observed under the existing regime. However, when a water company does not invoke the statutory provisions and wayleaves emerge from commercial negotiation, it is possible for the rates to be higher than those that simply reflect compensation for disturbance and the depreciation in the value of the land value.

[33] Hutchinson and Rowan-Robinson, p. 18.

3. Approach and methodology

47. Nordicity's analysis was based on a combination of literature review, secondary research and financial and economic modelling.

48. Nordicity reviewed the relevant material supplied by DCMS, including the Law Commission consultation proposals and *UK Broadband Impact Study: Literature Review*, which was produced for DCMS by SQW Consulting in February 2013.

49. This literature review was supplemented by secondary research. In particular, Nordicity conducted desk research of broadband infrastructure costs in the UK, the US, Australia, New Zealand, Canada and European countries. A complete list of the documents reviewed and the secondary research resources can be found in the References section at the end of this report.

50. The quantification of the economic impact of the wayleave pricing regimes was based on both financial and economic modelling. This modelling followed the five-stage process outlined in Exhibit 2.

Exhibit 2 Summary of modelling process

51. The financial modelling was based on a 15-year present value (PV) model of the capital and operating costs that communications operators would face when installing new broadband infrastructure. The assumptions incorporated into the financial modelling were based on secondary research and information obtained from industry sources. The economic modelling entailed the development and application of simple estimation models that were based on the secondary research of the relationships between broadband deployment, adoption, pricing, bandwidth, and GDP and employment.

4. Wayleave costs

52. In this section we establish the *typical* wayleave costs under all four regimes. These typical costs form the basis of the economic impact analysis. For each regime, we estimate wayleave costs for four different types of broadband infrastructure: (i) wireless-communications masts ("masts"), (ii) overhead cables ("overhead"), (iii) underground cables/ducts in rural areas ("underground-rural") and (iv) underground cables/ducts in urban areas ("underground-urban").

4.1 Existing regime

53. Wayleave costs in the existing regime are generally based on voluntary agreements. Nordicity has been able to establish typical costs on the basis of certain rate schedules, comments submitted to the Law Commission consultation and other published information.

4.1.1 Masts

54. Various reports provide data points for rental rates for masts. Batcheller-Monkhouse reports an average of £8,000 per mast p. a. for its sample of masts (4,077 out of a total of 52,000 in the UK)[34].

55. A report prepared by Strutt & Parker indicates rental rates for masts of £5,057 to £5,846 p.a. for greenfield sites, and £11,678 to £11,817 p.a. for urban rooftops (Exhibit 3)[35]. These rates are based on arbitration awards. Strutt & Parker also reports the 2010 arbitration guideline rates for greenfield and urban-rooftop mast sites. They indicate a range of £3,500 to £10,750 p.a. (Exhibit 3).

Exhibit 3 Annual mast rental rates, arbitration guideline rates and awards (£ per mast p.a.)

	Arbitration guideline rates				Arbitration awards
	Rural	Population < 100,000	Population >100,000	City	All locations 2009-2012
Greenfield	3,500 - 4,250	--	--	--	5,057 - 5,846
Rooftop	--	5,000 - 5,750	7,500 - 8,750	9,750 - 10,750	11,678 - 11,817

Source: Strutt & Parker, 2012.

[34] Batcheller-Monkhouse, 2012, response to Law Commission Electronic Communications Code Consultation, p. 1477.
[35] Strutt & Parker, *Telecommunications Survey 2012*, accessed 18 September 2013, http://www.struttandparker.com/media/332351/telecoms%20survey%202012.pdf, p. 5.

56. The broadest sample of rental rates for masts was provided by industry sources (on a confidential basis), which accounted for approximately one-half of the total number of masts in the UK. **These rates point to an average mast rental rate of £5,570 p.a.** We use this rate to represent the typical rental rate for a mast in the UK.

4.1.2 Overhead

57. A Memorandum of Understanding (MOU) between BT Openreach and NFU/CLA/NFUS/SRPBA[36] provides reference rates to assist agricultural landowners in reaching an agreement with Code Operators. These rates, summarised in Exhibit 4, came into effect on 2 March 2010 for a period of three years, so they are still applicable.

Exhibit 4 Per pole wayleave rates implied by BT Openreach - NFU/CLA/NFUS/SRPBA MOU (£ per pole p.a.)

Category of agricultural land	Poles	Poles with stay/strut
Arable	23.36	33.07
Pasture	11.77	14.52
Hedgerow	10.70	13.11

Source: Country Land and Business Association, "BT Openreach: New Wayleave Payments and Memorandum of Understanding from 2nd March 2010", p. 3.

58. Based on an assumption of 25 poles per kilometre, these per-pole rates imply annual wayleave rates ranging from £268 per km to £827 per km (Exhibit 5).

Exhibit 5 Overhead wayleave rates implied by BT Openreach-NFU/CLA/NFUS/SRPBA MOU (£ per km p.a.)

Category of agricultural land	Poles	Poles with stay/strut
Arable	584	827
Pasture	294	363
Hedgerow	268	328

Source: Nordicity estimates based on data from Country Land & Business Association, "BT Openreach: New Wayleave Payments and Memorandum of Understanding from 2nd March 2010", p. 3.
Note: Based on an assumption of 25 poles per km.

59. Whilst we do not have a breakdown of overhead wayleaves across the six categories listed in Exhibit 5, if we assume a 50-50 split between poles and poles with stay/strut, and a 50-50 split between arable land and pasture, we arrive at a rate of £517 per km p.a.[37]

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[36] National Farmers' Union of England and Wales (NFU), Country Land & Business Association (CLA), NFU Scotland (NFUS), Scottish Rural Property & Business Association (SRPBA, recently renamed Scottish Land & Estates).

[37] A 50-50 split between arable land and pasture is consistent with data published by UK Agriculture for agricultural land use in the UK in 2010 (see http://www.ukagriculture.com/statistics/farming_statistics.cfm?strsection=Land%20Use).

60. National Grid's schedule of wayleave rates for the communications infrastructure operated by Vodafone Group plc ("Vodafone")[38] provides another source of data for estimating overhead wayleave rates. The Vodafone rates schedule includes rates for wayleaves based on the number of towers on a landowner's property. These imply wayleave rates of £963 to £1,155 per km p.a. for overhead cables[39]. The simple average of these two rates is £1,070 per km p.a.

Exhibit 6 Calculation of overhead wayleave rates

Category of agricultural land	Electricity wayleave compensation payment (£) [A]	Vodafone wayleave payment (£) [B]	Combined wayleave payment (£) [C=A+B]	Number of poles per km [D]	Total wayleave payment per km (£) [E=C×D]
Grassland	178	143	321	3	963
Arable	242	143	385	3	1,155
				Average	1,070

Source: Nordicity calculations based on data from National Grid and Vodafone.

61. Given that BT Openreach accounts for the vast majority of the overhead infrastructure in the UK, we gave the BT Openreach MOU a higher weighting than the Vodafone data when arriving at a typical rate. We gave BT Openreach a 90% weighting and Vodafone 10%. **These weightings yield a typical rate of £571 per km p.a. for overhead wayleaves, or approximately £600 per km p.a.[40].**

$$£517 \times 90\% + £1,060 \times 10\% = £571 \approx £600$$

4.1.3 Underground-rural

62. According to evidence submitted by NFU/CLA to the Office of Fair Trading (OFT), wayleave rates for high-capacity fibre lines crossing rural areas to connect conurbations are in the range of £440 to £700 per km p.a.[41]. These are consistent with the rates implied by

[38] This communications infrastructure consists of cables originally laid by Energis Communications Ltd and subsequently owned and operated by Cable & Wireless Communications plc (C&W). As of April 2013, Vodafone Group plc assumed control of C&W and this cable infrastructure.

[39] To arrive at these rates, we have added the value of the electricity wayleave rate to Vodafone's communications wayleave rates. This approach reflects the fact that without the existing towers, there would be no apparatus for the cables. In effect, if Vodafone had to construct the overhead infrastructure from scratch, it would have to erect the towers and compensate landowners for these as well.

[40] We note that although there is a certain degree of imprecision in deriving wayleave rates for overhead wires, this type of infrastructure accounts for a very limited share of the overall wayleave market in the UK.

[41] Office of Fair Trading, 2012, "Rural Broadband Wayleave Rates: Short-form Opinion, Annexe B", accessed 7 October 2013, http://www.oft.gov.uk/shared_oft/SFOs/annexe-b.pdf, p. 11.

Vodafone's rate schedule[42]. The latter indicates a wayleave rate of £693 per km p.a. for underground cables. This is based on £1.15 per 50-metre section for the electricity right plus 67p per metre for Vodafone's communications right.

$$£1.15 \times (1{,}000/50) + £0.67 \times 1{,}000 = £693$$

63. The NFU/CLA evidence submitted to OFT also indicates that BT Openreach expects to pay £320 per km p.a. for underground-rural wayleaves, in accordance with the reference rates in the MOU between BT Openreach and NFU/CLA/NFUS/SRPBA. That MOU indicates the following reference rates for underground-rural cables: (i) exchange to cabinet: 0.47p per metre (£470 per km); (ii) cabinet to distribution point: 0.32p per metre (£320 per km); and (iii) distribution point to end-user premises: 0.16 p per metre (£160 per km)[43].

64. According to NFU/CLA, a significant portion of the overall broadband route subject to wayleaves will be for backhaul (i.e. cabinet to distribution point), so this implies a typical rate of £320 per km[44].

65. Added to this is the rate of £30 per jointing box p.a. Assuming there are 1.2 jointing boxes per km[45], the overall wayleave rate is £356 per km p.a. This rate of £356 per km p.a. reflects the market rate for the commercial deployment of underground-rural fibre by BT Openreach.

$$£320 + 1.2 \times £30 = £356.$$

66. As is the case with overhead infrastructure, BT Openreach most likely accounts for the vast majority of underground fibre infrastructure and wayleaves in the UK. Therefore we give the rates in the BT Openreach MOU a 90% weighting when deriving an estimate of the typical rate for underground-rural infrastructure. We apply a 10% weighting to the Vodafone rate.

67. The weightings applied to the BT Openreach and Vodafone rates **yield a typical wayleave rate of £390 per km p.a., or approximately £400 per km p.a., for underground-rural.**

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[42] Office of Fair Trading, 2012, p. 11.
[43] Country Land & Business Association, "BT Openreach: New Wayleave Payments and Memorandum of Understanding from 2nd March 2010", p. 3.
[44] Office of Fair Trading, 2012, p. 18.
[45] Industry research indicates that rural fibre lines have an average of 1.2 jointing boxes per km.

$$£356 \times 90\% + £693 \times 10\% = £390 \approx £400$$

4.1.4 Underground-urban

68. Data on wayleave rates for underground-urban cables was not available. A comparison of wayleave rates for rural masts and urban rooftop masts would point to an urban-rural ratio of 2:1. However, an underground-urban cable is much more valuable than an urban mast because it has the capacity to carry much more data and connect many more customers. For example, an urban conduit may contain a 192-strand fibre, whereas a rural one is more likely to contain a 24-strand fibre – a factor of eight. In contrast, the relative capacities of rural and urban masts are not very different.

69. In 1993, the *Mercury Communications Ltd. v. London and India Dock Investments Ltd.* case resulted in a wayleave of £9,000 p.a. for a 230-metre stretch of cable duct[46].This was equivalent to £39,000 per km p.a. in 1993 currency and £67,000 per km p.a. in 2012 currency[47]. The latter rate is 167 times the typical rate for underground-rural (£400 per km p.a.) established in Section 4.1.3.

70. Even the Mercury Communications rate expressed in 2012 currency may understate the current value of underground-urban wayleaves because it was established well before the proliferation of the Internet. That being said, the Mercury Communications rate is most certainly above the average rate for all urban areas in the UK because it applies to land in one of London's financial districts.

71. In lieu of accurate data for underground-urban cables, we derived the ratio of gross value added (GVA)[48] per square kilometre ("GVA per km^2") in urban and rural areas of England, and applied that ratio to the wayleave rate derived for underground-rural in order to estimate a rate for underground-urban[49]. Combining statistics from the Department for Environment, Food and Rural Affairs (Defra)[50] and the Office for National Statistics (ONS)[51]

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[46] Office of Fair Trading, 2012, p. 6.

[47] Data from the Office for National Statistics indicate that retail price index (RPI) inflation between 1993 and 2012 was 72.5%.

[48] Gross value added (GVA) measures the contribution that an industry or region makes to the overall UK economy, which is measured in terms of GDP. The sum of GVA across all industries plus taxes on products less subsidies on products equals GDP.

[49] Although the calculation of the GVA per km^2 ratio is only based on England, it can still be considered a reasonable approximation of the ratio for the whole of the UK.

[50] Department for Environment, Food and Rural Affairs, 2013, "Statistics: Rural Productivity", February 2013, accessed 18 September 2013, p. 2.

indicates that GVA per km^2 in London was 52.1 times that of rural regions of England in 2010 (Exhibit 7). In other urban areas of England, GVA per km^2 was 5.4 times that of rural regions. Across all urban areas in England, GVA per km^2 was 8.1 times that of rural regions.

Exhibit 7 Calculation of GVA per km^2 ratio, 2010

	GVA (£ millions)	Total land area (km^2)	GVA per km^2 (£ millions)	Ratio (to rural)
London	277,180	1,572	176.3	52.1
Other urban	474,173	25,811	18.4	5.4
Total urban	751,353	27,383	27.4	8.1
Rural	348,358	103,012	3.4	1.0
Total	1,099,711	130,595	8.4	--

Source: GVA statistics from Defra and ONS; statistics for total land area from Pateman, 2010.

72. We round up the ratio of 8.1:1 to a ratio of 10:1 and apply it to the underground rural rate of £400 per km p.a. to obtain a rate of **£4,000 per km p.a. for underground-urban wayleaves**.

4.1.5 Summary

73. Exhibit 8 summarises the typical wayleave costs that communications operators are likely to face under the existing regime.

Exhibit 8 Wayleave rates, existing regime (£ p.a.)

	Wayleave rate
Masts	5,570 per mast
Overhead	600 per km
Underground-rural	400 per km
Underground-urban	4,000 per km

Source: Nordicity analysis.

4.2 Law Commission proposal

74. The Law Commission proposal essentially calls for market-value wayleave rates that reflect the voluntary agreements reached by landowners and communications operators (i.e. the existing regime), with safeguards to prevent ransom pricing[52]. These safeguards include

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/226750/Productivity_Aug2013.pdf .

[51] GVA for London from Office for National Statistics, 2011, "Statistical Bulletin: Regional, Sub-regional and Local Gross Value Added 2010", 14 December 2011, accessed 18 September 2013, http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=Regional+GVA, p. 2.

[52] Ransom pricing occurs in situations where a payee controls some unique asset or location, and so there is no market per se, because there are no other sellers. In such situations, the payee or landowner could hold

guidance stipulating that wayleave rates arising from dispute-resolution decisions reflect market value where there was "more than one property available to the Code Operator"[53].

75. To determine the wayleave rates under the Law Commission proposal, we must assess the likelihood and degree of ransom pricing under the existing regime. The evidence submitted to the Law Commission review and to DCMS suggests masts and underground segments may be susceptible to ransom pricing.

76. Whilst agricultural landowners argued that only underground access could be subject to ransom pricing[54], Code Operators contend that competition among them for the best mast sites also generates ransom pricing.

77. The nature of cable infrastructure – overhead, underground-rural and underground-urban – means that it could be susceptible to ransom pricing in certain situations because specific cabling routes are likely to be optimal. Similarly, the fact that tall buildings, church steeples and high ground are ideal for masts suggests that there is a hierarchy of locations that could indeed lead to competition among mobile phone networks for the best sites. However, the increase in site-sharing among mobile phone networks in recent years may have moderated the extent of ransom pricing in the mast market.

78. Cell:cm Chartered Surveyors reports that ransom pricing situations are characterised by a premium of 15% - 20% above market value[55]. The extent to which ransom pricing situations occur in the communications wayleave market is unknown, however. Nevertheless, given that some portion of existing wayleaves may be subject to ransom pricing, then an average premium would be some fraction of the premium reported by Cell:cm Chartered Surveyors. On that basis, we discount existing wayleave rates by 10% to reflect the extent and degree of ransom pricing. The fact that, under the Law Commission proposal, Code Operators would have recourse to dispute-resolution mechanisms that would dismiss instances of ransom pricing would, in the long run, put downward pressure on rates.

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out for a price that is equal to the payer's expected increase in profit (Law Commission, 2012, ¶6.13). Ransom pricing is synonymous with a demand for profit share (Law Commission, 2012, ¶6.13).

[53] Law Commission, 2013, ¶5.83.

[54] Strutt & Parker, 2012, response to Law Commission Electronic Communications Code Consultation, at p. 1315.

[55] Cell:cm Chartered Surveyors response to Law Commission Consultation, at p. 1614.

79. Under the Law Commission proposal, therefore, we assume that there will be a **10% reduction** in the wayleave rates for all four broadband infrastructure types. Exhibit 9 summarises the wayleave rates expected under the Law Commission proposal in relation to the existing regime.

Exhibit 9 Wayleave rates, Law Commission proposal (£ p.a.)

	Law Commission proposal*	Existing regime
Masts	**5,013 per mast**	5,570 per mast
Overhead	**540 per km**	600 per km
Underground-rural	**360 per km**	400 per km
Underground-urban	**3,600 per km**	4,000 per km

Source: Nordicity analysis.
* Equal to 90% of the rates under the existing regime (i.e. a 10% discount).

4.3 Energy regime

80. To estimate the wayleave rates for communications infrastructure that could prevail under the energy regime, we examined the ratio of wayleave rates implied by the rate schedule published by National Grid[56]. When we compare the wayleave rates for the *communications right* with those for the *electricity-transmission right* on its own, we find that the latter is equivalent to between 55% and 63% of the former (Exhibit 10). In other words, the electricity-transmission right is subject to a discount of between 37% and 45% compared with the communications right.

Exhibit 10 Ratio of wayleave rates for electricity-transmission and communications rights (£ p.a. unless indicated otherwise)

Category of agricultural land	Electricity wayleave compensation payment A	C&W communications wayleave payment B	Total communications wayleave C=A+B	Electricity wayleave as a percentage of total communications wayleave D = A÷C
Grassland	178	143	321	55%
Arable	242	143	385	63%

Source: Nordicity calculations based on data from National Grid.

81. Based on this comparison of National Grid's electricity-transmission and communications wayleave rates, we apply a 40% discount (i.e. approximately the midpoint of 37% and 45%)

[56] The National Grid schedule contains wayleave rates for 13 different tower heights. Since the National Grid transmission network is comprised predominantly of towers over 40 metres high, our analysis focused on the wayleave rates for Tower 13 (18.3 metres or higher).

to the wayleave rates under the existing regime to estimate the typical rates that would prevail under the energy regime. The estimated wayleave rates for all four types of infrastructure under the energy regime are summarised in Exhibit 11.

Exhibit 11 Wayleave rates, energy regime (£ p.a.)

	Energy regime*	Existing regime
Masts	**3,342 per mast**	5,570 per mast
Overhead	**360 per km**	600 per km
Underground-rural	**240 per km**	400 per km
Underground-urban	**2,400 per km**	4,000 per km

Source: Nordicity analysis.
* Equal to 60% of the rates under the existing regime (i.e. a 40% discount).

4.4 Water regime

82. According to Hutchinson et al., privately owned water companies in England and Wales make capital payments equal to 50% of the agricultural land value in exchange for wayleaves[57]. As noted in Section 2.3.4 of this report, wayleaves under the water regime are meant to provide compensation to landowners for disruption and the depreciation of the value of their land. According to Hutchinson et al., however, a wayleave equal to 50% of the agricultural land value would appear to be greater than any actual economic loss experienced by the landowner, and therefore, would include some element of consideration[58]. Hutchinson et al. argue that it is rational for water companies to pay this element of consideration, since it allows them to "establish a good working relationship with the landowner"[59].

83. Hutchinson at al. also point out that in 2000, the wayleave rates in place between BT and agricultural landowners were equal to 1.33 times the value of the land, even though the rates were actually set as a function of the additional paving costs avoided by BT by routing through private land rather than public roads[60]. The analysis by Hutchinson et al. implies that wayleave rates under the water regime would be equivalent to 38% of rates negotiated under the existing regime – i.e. a discount of 62%.

$$0.5 \div 1.33 = 38\%$$

[57] Hutchinson et al., 2000, p. 27.
[58] Hutchinson et al., 2000, p. 27.
[59] Hutchinson et al., 2000, p. 27.
[60] Hutchinson et al., 2000, p. 28.

84. We apply this 62% discount to the wayleave rates for overhead, underground-rural and underground-urban infrastructure under the existing regime in order to estimate the typical wayleave rates that would be likely to prevail under the water regime. Even though the legislation under the water regime would only require Code Operators to compensate for disruption and land depreciation, we believe that they would follow the same approach as water companies and pay some consideration in exchange for good relations with landowners.

85. With respect to masts, Batcheller-Monkhouse argued in its Law Commission submission that on a no-scheme basis, where wayleaves were based on the market value of land, rates would drop significantly. The rates projected by Batcheller-Monkhouse are listed in Exhibit 12. For our analysis, however, we assume that wayleave rates in the masts market would parallel those in the other infrastructure markets, and thereby drop by 62% in relation to rates under the existing regime.

Exhibit 12 Impact of no-scheme valuation on mast rates (£ p.a.)

	Current market value	**No-scheme value (land market value only)**
Rural greenfield site	4,000	5
London greenfield site	6,000	1,600
Provincial rooftop	9,000	nil
London rooftop	20,000	nil

Source: Batcheller-Monkhouse.

86. To derive the typical wayleave rates under the water regime, therefore, we multiply the rates under the existing regime by 38% (i.e. a 62% discount). The estimated wayleave rates under the water regime are summarised in Exhibit 13.

Exhibit 13 Wayleave rates, water regime (£ p.a.)

	Water regime*	**Existing regime**
Masts	**2,116 per mast**	5,570 per mast
Overhead	**228 per km**	600 per km
Underground-rural	**152 per km**	400 per km
Underground-urban	**1,520 per km**	4,000 per km

Source: Nordicity analysis.
* Equal to 38% of the rates under the existing regime (i.e. a 62% discount).

4.5 Summary

87. Exhibit 14 summarises the wayleave rates for each type of broadband infrastructure under all four regimes. The Law Commission proposal would result in a 10% discount on rates

under the existing regime. The energy regime would generally result in a 40% discount, and under the water regime, the discount would be 62%.

Exhibit 14 Summary of wayleave rates under existing and alternative regimes (£ p.a., unless indicated otherwise)

	Existing regime	Law Commission proposal	Energy regime	Water regime
Annual rates				
Masts	5,570 per mast	5,013 per mast	3,342 per mast	2,116 per mast
Overhead	600 per km	540 per km	360 per km	228 per km
Underground-rural	400 per km	360 per km	240 per km	152 per km
Underground-urban	4,000 per km	3,600 per km	2,400 per km	1,520 per km
Percentage decrease vs. existing rate (i.e. discount)				
Masts	--	10.0%	40.0%	62.0%
Overhead	--	10.0%	40.0%	62.0%
Underground-rural	--	10.0%	40.0%	62.0%
Underground-urban	--	10.0%	40.0%	62.0%

Source: Nordicity analysis

5. Broadband infrastructure costs

88. In Section 4, we estimated how wayleave costs would decrease under each of the three alternative regimes. In this section, we assess how those decreases in wayleave costs could affect overall costs for each of the four types of broadband infrastructure.

5.1 Masts

89. Benchmarking data from the UK, US, Australia and New Zealand indicates that the capital costs of building and equipping communications masts is in the range of £65,000 to £259,000 per mast, depending on the type of location (Exhibit 15).

Exhibit 15 Benchmarking research of capital costs for masts (£)

Country	Description	Capital cost
UK	New street works	65,000
UK	New greenfield site	85,000
UK	New rooftop mast	100,000
UK	Analysys Mason estimate	111,990
Australia	Telecommunications Journal of Australia, Wi-Max example	117,504
US	Quora estimate (low)	128,688
New Zealand	Rural cell tower cost (low)	155,585
US	Quora Estimate (high)	160,860
US	*HCP Live* estimate	193,032
New Zealand	Rural cell tower cost (average)	248,936
New Zealand	Rural cell tower cost (high)	259,308

Source: Nordicity research; see *Benchmarking Data Sources* Section at the end of report for a list of sources.

90. Industry sources indicate that average capital costs in the UK are in the range of £65,000 to £112,000. Based on this information, we use **a rate of £100,000 for our analysis.**

91. Exhibit 16 summarises the impact of the three alternative regimes on the PV of the overall cost of building and operating a mast over a 15-year period. The calculations reflect a capital cost of £100,000 per mast[61] and the wayleave rates presented in Section 4. **The results of the impact analysis indicate that total mast infrastructure costs would decrease by 1.3% under the Law Commission proposal, 3.6% under the energy regime and 5.3% under the water regime.**

[61] No adjustment for consumer price index (CPI) inflation has been applied to this amount.

Nordicity

Exhibit 16 Impact on mast costs (cost per mast in £ millions in 2013 prices; PV 2014-2019)

	Existing regime	**Law Commission proposal**	**Energy regime**	**Water regime**
Capital cost [1]	0.100	0.100	0.100	0.100
Rental [2]	**0.0642**	**0.0576**	**0.0385**	**0.0244**
Maintenance [3]	0.2879	0.2879	0.2879	0.2879
Additional ancillary costs [4]	--	0.0025	0.0097	0.0151
Site search and acquisition [5]	0.0338	0.0338	0.0338	0.0338
Planning [6]	0.0019	0.0019	0.0019	0.0019
Backhaul [7]	0.0909	0.0909	0.0909	0.0909
Total cost per mast	**0.5753**	**0.5679**	**0.5547**	**0.5451**
Change in total cost	**--**	**(0.0075)**	**(0.0206)**	**(0.0302)**
Percentage change in rental cost	--	(10.0%)	(40.0%)	(60.0%)
Percentage change in total cost	**--**	**(1.3%)**	**(3.6%)**	**(5.3%)**

Source: Nordicity research and industry sources.

Notes:
1. Average capital cost of £100,000 from industry sources.
2. See research in Section 4.1.
3. Equal to 25% of capital cost, as per industry sources (i.e. 30% less 5% for wayleave costs).
4. Legal and other costs associated with rate disputes are assumed to be 20% of the difference between PV of the wayleave rates and are applied to the first two years of the 15-year term.
5. Assumed to be a one-off cost of £35,000.
6. Assumed to be £2,000 as per industry sources.
7. Assumes a cost of £58,000 to build 1 km of rural underground fibre. Operating costs equal to 5% of initial capital costs: also includes wayleave costs applicable under each regime (see Section 5.3).

5.2 Overhead

92. Benchmarking data from the UK, US and Australia indicates that the capital costs of building overhead communications lines can range from as little as £5,000 per km to £40,000 per km, depending on the terrain (Exhibit 17).

93. Information posted on user group websites suggests a range of £12,000 per km to £17,000 per km for overhead lines in the UK. Analysys Mason reports an average rate of £25,000 per km for the UK[62], but this estimate was from a study published in 2008. If this rate is adjusted for CPI (consumer price index) inflation of 13% between 2008 and 2012, **the rate is approximately £28,000 per km**. We use this rate in our analysis.

[62] Analysys Mason, 2008, *The Costs of Deploying Fibre-based Next-generation Broadband Infrastructure*, Report for Broadband Stakeholder Group, 8 September 2008, accessed 10 September 2013, http://broadband.cti.gr/en/download/BSG-The%20costs%20of%20deploying%20FB_NG_BI.pdf, p. 61.

Exhibit 17 Benchmarking research of capital costs for overhead (£)

Country	Description	Capital cost
US	Columbia Telecommunications Corporation estimate using overlash (best case)	5,198
Australia	Telecommunications Journal of Australia estimate, rural	5,875
US	Columbia Telecommunications Corporation estimate using overlash (worst case)	7,996
US	Columbia Telecommunications Corporation estimate (best case)	9,995
UK	Estimate from Google user group (low)	12,000
US	Columbia Telecommunications Corporation typical case estimate	16,888
UK	Estimate from user group (high)	17,000
Australia	Telecommunications Journal of Australia estimate, urban	17,626
UK	Analysys Mason	25,000
US	Columbia Telecommunications Corporation estimate (worst case)	39,982

Source: Nordicity research; see *Benchmarking Data Sources* Section at the end of report for a list of sources.

94. Exhibit 18 summarises the impact of the three alternative regimes on the PV of the overall cost of building and operating overhead cables over a 15-year period. **The results indicate that total costs would decrease by 0.8% under the Law Commission proposal, 3.3% under the energy regime and 5.1% under the water regime.**

Exhibit 18 Impact on overhead costs (cost per km in £ millions in 2013 prices; PV 2014-2019)

	Existing regime	Law Commission proposal	Energy regime	Water regime
Capital cost [1]	0.0280	0.0280	0.0280	0.0280
Wayleaves [2]	**0.0069**	**0.0062**	**0.0041**	**0.0026**
Maintenance [3]	0.0322	0.0322	0.0322	0.0322
Additional ancillary costs [4]	--	0.0001	0.0005	0.0008
Planning [5]	0.0019	0.0019	0.0019	0.0019
Total cost per km	**0.0681**	**0.0676**	**0.0659**	**0.0647**
Change in total cost	**--**	**(0.0007)**	**(0.0022)**	**(0.0035)**
Percentage change in rental cost	--	(10.0%)	(40.0%)	(62.0%)
Percentage change in total cost	**--**	**(0.8%)**	**(3.3%)**	**(5.1%)**

Source: Nordicity research.

Notes:
1. Average capital cost of £28,000 in 2011 prices as per Analysys Mason.
2. See research in Section 4.1.
3. Assumed to equal 10% of capital cost.
4. Legal and other costs of rate disputes; assumed to be 20% of the difference between the PV of existing and alternative wayleave rates.
5. Planning costs assumed to be £2,000 per km.

5.3 Underground-rural

95. Benchmarking data from the UK, US and Canada indicates that the capital costs of building underground-rural fibre can range from £17,600 per km to £51,000 per km (Exhibit 19).

Exhibit 19 Benchmarking research of capital costs for underground-rural fibre (£)

Country	Description	Capital cost
US	Rural Broadband Project, Maryland	17,592
US	Columbia Telecommunications Corporation estimate for rural installs	27,987
Canada	MacKenzie Valley average	29,977
US	Alaska benchmarking cost	39,990
UK	Analysys Mason	51,000

Source: Nordicity research; see *Benchmarking Data Sources* Section at the end of report for a list of sources.

96. We note that the data point for Analysys Mason[63] was based on Nordicity's own modelling for underground fibre, with a duct cost of £49 per metre plus £2 per metre for a 24-strand fibre cable. In other words, the Analysys Mason report implies an average capital cost of £51 per metre. Since this cost estimate is from a 2008 study, the equivalent rate today (after taking into account 13% CPI inflation) is £58 per metre. **We therefore use a rate of £58,000 per km in our analysis**, or approximately twice the cost of overhead cabling.

97. Exhibit 20 summarises the impact of the three alternative wayleave regimes on the PV of the overall cost of building and operating underground-rural fibre over a 15-year period. **The results indicate that total costs would decrease by 0.4% under the Law Commission proposal, 1.4% under the energy regime and 2.2% under the water regime.**

[63] Analysys Mason, 2008, p. A-3.

Exhibit 20 Impact on underground-rural (cost per km in £ millions in 2013 prices; PV 2014-2019)

	Existing regime	**Law Commission proposal**	**Energy regime**	**Water regime**
Capital cost [1]	0.0580	0.0580	0.0580	0.0580
Wayleaves [2]	**0.0004**	**0.0041**	**0.0028**	**0.0018**
Maintenance [3]	0.0334	0.0379	0.0379	0.0379
Additional costs [4]	--	0.0001	0.0004	0.0006
Cabinets [5]	0.0058	0.0058	0.0058	0.0058
Jointing boxes [6]	0.0017	0.0017	0.0017	0.0017
Planning [7]	0.0017	0.0017	0.0017	0.0017
Total cost per km	**0.1033**	**0.1029**	**0.1018**	**0.1010**
Change in total cost	**--**	**(0.0004)**	**(0.0015)**	**(0.0023)**
Percentage change in rental cost	--	(10.0%)	(40.0%)	(62.0%)
Percentage change in total cost	**--**	**(0.4%)**	**(1.4%)**	**(2.2%)**

Source: Nordicity research.

Notes:
1. Average capital cost of £58,000 per km in 2012 prices as per Analysys Mason.
2. See research in Section 4.1.
3. Assumed to equal 5% of capital cost.
4. Legal and other costs of rate disputes; assumed to be 20% of the difference between the PV of existing and alternative wayleave rates.
5. One cabinet installed for every 5km of duct installed. Cabinet cost assumed to be £30,000 each.
6. 1.2 jointing boxes installed in each km of fibre laid, costing £1,500 each.
7. Planning costs assumed to be £2,000 per km.

5.4 Underground-urban

98. Benchmarking data from the UK, US and Spain indicates that the capital costs of building underground fibre in urban areas can range from £36,000 per km to £200,000 per km (Exhibit 21).

Exhibit 21 Benchmarking research of capital costs for underground-urban fibre (£)

Country	**Description**	**Capital cost**
US	Columbia Telecommunications Corporation study urban (best case)	35,983
Spain	Andalusia estimate	38,329
US	Federal Communications Commission, joint build scenario	64,987
US	Columbia Telecommunications Corporation study urban (typical case)	69,168
UK	Analysys Mason	73,000
US	Federal Communications Commission, noted fibre deployment costs (full)	92,655
UK	Analysys Mason (worst case)	106,000
US	Columbia Telecommunications Corporation study urban (worst case)	159,926
US	US-based estimate for dense urban (high)	200,547

Source: Nordicity research; see *Benchmarking Data Sources* Section at the end of report for a list of sources.

99. If one focuses on the data from the Analysys Mason 2008 study, then a rate of £90,000 per km may be most appropriate for the UK[64]. After taking into account CPI inflation of 13% (2008 to 2012), **a rate of £100,000 per km was arrived at for this analysis**.

100. Exhibit 22 summarises the impact of the three alternative regimes on the PV of the overall cost of building and operating underground-urban fibre over a 15-year period. **The results indicate that total costs would decrease by 0.8% under the Law Commission proposal, 3.1% under the energy regime and 4.8% under the water regime.**

Exhibit 22 Impact on underground-urban (cost per km in £ millions in 2013 prices; PV 2014-2019)

	Existing regime	Law Commission proposal	Energy regime	Water regime
Capital cost [1]	0.1000	0.1000	0.1000	0.1000
Wayleaves [2]	**0.0461**	**0.0415**	**0.0276**	**0.0175**
Maintenance [3]	0.0576	0.0576	0.0576	0.0576
Additional costs [4]	--	0.0009	0.0035	0.0054
Cabinets [5]	0.1739	0.1739	0.1739	0.1739
Jointing boxes [6]	0.0870	0.0870	0.0870	0.0870
Planning [7]	0.0232	0.0232	0.0232	0.0232
Total cost per km	**0.4843**	**0.4806**	**0.4694**	**0.4612**
Change in total cost	**--**	**(0.0037)**	**(0.0149)**	**(0.0231)**
Percentage change in rental cost	--	(10.0%)	(40.0%)	(62.0%)
Percentage change in total cost	**--**	**(0.8%)**	**(3.1%)**	**(4.8%)**

Source: Nordicity research.

Notes:
1. Average capital cost of £100,000 per km in 2012 prices as per Analysys Mason.
2. See research in Section 4.1.
3. Assumed to equal 5% of initial capital cost.
4. Legal and other costs of rate disputes; assumed to be 20% of the difference between the PV of existing and alternative wayleave rates spread over two years.
5. Assumes 6 cabinets per km at a cost of £30,000 each.
6. Assumes 6 jointing boxes installed in each km of fibre laid, costing £1,500 each.
7. Planning costs assumed to be £4,000 per km.

5.5 Summary

101. Exhibit 23 summarises the impact of the three alternative wayleave regimes in terms of their impact on the overall cost (measured by the 15-year PV) of deploying and operating broadband infrastructure. The results demonstrate that, although the alternative regimes would lead to significant reductions in wayleave costs, the impact on overall costs of broadband infrastructure are much less, ranging from 0.4% to 5.3%.

[64] Analysys Mason, 2008, p. A-3.

Exhibit 23 Summary of impact of wayleave rates on overall broadband infrastructure costs (percentage change in 15-year PV)

	Law Commission proposal	Energy regime	Water regime
Masts	(1.3%)	(3.6%)	(5.3%)
Overhead	(0.8%)	(3.3%)	(5.1%)
Underground-rural	(0.4%)	(1.4%)	(2.2%)
Underground-urban	(0.8%)	(3.1%)	(4.8%)

Source: Nordicity analysis.

102. A comparison of the impact of the three alternative regimes on wayleave costs and total broadband infrastructure deployment costs can be found in Exhibit 24.

Exhibit 24 Comparison of impact on wayleave costs and total broadband infrastructure costs

	Law Commission proposal		Energy regime		Water regime	
	Way-leave	Total costs	Way-leave	Total costs	Way-leave	Total costs
Masts	(10.0%)	(1.3%)	(40.0%)	(3.6%)	(62.0%)	(5.3%)
Overhead	(10.0%)	(0.8%)	(40.0%)	(3.3%)	(62.0%)	(5.1%)
Underground-rural	(10.0%)	(0.4%)	(40.0%)	(1.4%)	(62.0%)	(2.2%)
Underground-urban	(10.0%)	(0.8%)	(40.0%)	(3.1%)	(62.0%)	(4.8%)

Source: Nordicity analysis.

6. Broadband pricing, adoption and usage

103. In Section 5 we established that the reduction in wayleave costs expected under the alternative regimes would also lead to a reduction in overall infrastructure costs. However, because wayleave costs represent only a small portion of communications operators' overall infrastructure build-out costs, the percentage impact is much lower than the percentage decrease in wayleave costs.

104. In this section, we assess the degree to which the lower infrastructure costs under the alternative wayleave regimes would affect communications operators' consumer pricing. Infrastructure costs – capital and operating – represent only a portion of communications operators' overall operating costs and turnover. We will examine the relationship between the potential reductions in infrastructure costs, and total operating costs and turnover. On the basis of this relationship, we assess the ultimate impact on consumer pricing.

6.1 Communications operators' cost structure

105. Financial data from a sample of UK communications operators – including fixed and mobile communications operators – indicates that total capital expenditures account for approximately 9% to 19% of total turnover (Exhibit 25). Where network capital expenditures are isolated, we find that they account for approximately 10% of total turnover[65].

Exhibit 25 Financial data for turnover and capital expenditures, selected communications operators (£ millions, 2012 fiscal year; share of total turnover in parentheses)

	Turnover	Total capital expenditures	Network capital expenditures
BT Group plc	18,253	2,438 (13%)	1,377 (8%)
Virgin Media	4,101	7,83.2 (19%)	4,36.5 (11%)
Vodafone UK	5,397	575 (11%)	n.a.
EE	6,657	606 (9%)	n.a.

Source: Company financial statements.

106. We also need to account for the operating costs of infrastructure. No reliable data was available for these costs. However, given that fixed line infrastructure operating costs typically represent 5% to 10% of capital costs, then the PV of a 15-year stream of operating

[65] These capital expenditures exclude the on-going operating costs of infrastructure (e.g. power and maintenance).

expenditures would be equivalent to between 60% and 115% of the upfront capital costs. The mid-point of this range is 88%.

107. Industry sources indicate that operating costs associated with mobile phone infrastructure are equal to 30% of capital costs. The PV of a 15-year stream of operating expenditures is, therefore, equivalent to 3.5 times the capital expenditures.

108. To convert these two operating-cost ratios – for fixed and mobile infrastructure – into an overall operating-cost ratio, we derive weights for each technology based on its respective share of broadband subscribers. Ofcom statistics indicate that the number of households with fixed broadband accounted for 94% (i.e. a 0.94 weighting) of all households with broadband Internet access in 2012; mobile broadband accounted for the other 6% (i.e. 0.06 weighting). When we apply these weights to the operating-cost ratios, we find that the weighted average PV of operating costs is equivalent to 105% of capital costs, or approximately 100%.

$$88\% \times 0.94 + 350\% \times 0.06 = 105\% \approx 100\%$$

109. Based on this result **we conclude that the PV of operating costs is also equivalent to 10% of total turnover. Therefore overall infrastructure costs are equivalent to approximately 20% of communications operators' total turnover.**

6.2 Impact on consumer prices

110. This data indicates that any impact on broadband infrastructure deployment costs should be deflated by a factor of five when assessing the overall impact on consumer pricing. **For example, a 5% reduction in broadband infrastructure deployment costs would be equivalent to 1% of total turnover, and therefore offers the potential for a maximum decrease of 1% in consumer pricing.**

111. The maximum potential impact on consumer pricing under each alternative regime and for each type of broadband infrastructure is summarised in Exhibit 26. Under all scenarios, the maximum potential impact is no higher than 1.05%.

Exhibit 26 Summary of maximum potential impact on consumer prices

	Law Commission proposal	Energy regime	Water regime
Masts	(0.26%)	(0.71%)	(1.05%)
Overhead	(0.16%)	(0.65%)	(1.01%)
Underground-rural	(0.07%)	(0.29%)	(0.45%)
Underground-urban	(0.15%)	(0.62%)	(0.96%)
Weighted average*	**(0.24%)**	**(0.68%)**	**(1.01%)**

Source: Nordicity analysis.
* A weighting of 83% was applied to masts and a weighting of 17% was applied to each of the other infrastructure types. These weightings reflect the fact that masts account for 83% of total wayleave payments (£250 million out of £300 million) according to industry sources.

6.3 Impact on consumer adoption

112. Based on the potential impact on consumer pricing determined in Section 6.2, we can also model the potential impact on consumer adoption of superfast broadband services.

113. Another way to view the impact on consumer prices is from a counterfactual perspective. That is to say the existing wayleave regime has led to an increase in prices that would have otherwise not occurred. The impact of wayleaves can then be equated to a price increase, and empirical research of the price elasticity of demand (PED) of broadband can be used to model the impact on (i.e. reduction of) consumer adoption. The counterfactual measurement of consumer adoption can then be used to derive the economic benefit of a particular scenario.

114. A variety of recent empirical studies suggest that the PED for broadband Internet is relatively inelastic. In other words, subscribers view broadband as a necessity, and therefore will "find a way to pay for any price increases"[66].

115. Cadman and Dineen estimate a PED of 0.43 for broadband[67] . That is to say a 1% increase in price would lead to a 0.43% decrease in subscribers. Dutz et al. also found the PED of broadband to be inelastic: they estimate it to be 0.69[68]. **For our analysis, we use a PED of 0.5**.

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[66] SQW Consulting, 2013, *UK Broadband Impact Study: Literature Review*, a report prepared for DCMS, February 2013, ¶4.35.
[67] Cadman, Richard and Chris Dineen, 2008, "Price and Income Elasticity of Demand for Broadband Subscriptions: A Cross-Sectional Model of OECD Countries", 7 February 2008, accessed 8 September 2013, http://spcnetwork.eu/uploads/Broadband_Elasticity_Paper_2008.pdf, p. 3.
[68] Dutz, Mark, Jonathan Orszag, and Robert Willig, 2009, "The Substantial Consumer Benefits of Broadband Connectivity for US Households", commissioned by the Internet Innovation Alliance, July 2009, accessed 8

116. Exhibit 27 presents the results of an analysis of consumer adoption of broadband services, both standard and superfast. The results can be interpreted as follows. The current number of broadband subscribers in the UK, 19,800,000 (or 75% of 26,400,000 households), is 23,531 lower than it would have been under the Law Commission proposal. There are 67,551 fewer subscribers than there would have been under the energy regime, and 100,040 fewer than there would have been under the water regime.

Exhibit 27 Calculation of impact on broadband adoption

	Existing regime	Law Commission proposal	Energy regime	Water regime
Average price change	--	0.24%	0.68%	1.11%
Elasticity of demand (PED)	--	0.5	0.5	0.5
Change in demand	--	0.12%	0.27%	0.59%
Baseline number of subscribing households	19,800,000	19,800,000	19,800,000	19,800,000
Change in number of subscribers	--	23,531	67,551	100,040
New number of subscribers	--	19,823,531	19,867,551	19,900,040
Penetration rate – fixed broadband	75.0%	75.09%	75.26%	75.38%
Change in penetration rate	--	0.09%	0.26%	0.38%

Source: Nordicity analysis based on data from Ofcom.

117. These impact estimates are small in comparison to the overall number of broadband subscribers. Later, in Section 7, we use these estimates of adoption to also estimate the economic impact.

6.4 Impact on adoption of superfast broadband

118. We also estimate the impact of the lower consumer prices on superfast-broadband adoption. However, because superfast broadband could be considered less of a necessity than standard broadband, we look to older estimates of the PED for broadband when its penetration rate was more comparable to that of superfast broadband today.

September 2013. http://internetinnovation.org/files/special-reports/CONSUMER_BENEFITS_OF_BROADBAND.pdf., p. 24.

119. Superfast broadband had a penetration rate of 7.3% of households in 2012[69]. That is equivalent to 3% of the population, and would be comparable to the broadband penetration rate in the US at the turn of the millennium.

120. Dutz et al. found a PED of 1.53 for broadband in 2005[70]. Rappoport found a PED of 0.6 for cable broadband and 1.46 for digital subscriber line (DSL) broadband in 2000[71]. Goolsbee's analysis of data from a 1999 household survey found that the PED for cable broadband ranged from -2.8 to -3.5[72]. **Based on this empirical research, we use a PED of 2.0 in our analysis**. In other words a one percentage point increase in the price of superfast broadband is assumed to result in a 2% decrease in the number of subscribers.

Exhibit 28 Calculation of impact on adoption of superfast broadband

	Existing regime	Law Commission proposal	Energy regime	Water regime
Average price change	--	0.24%	0.68%	1.01%
Elasticity of demand (PED)	--	2.0	2.0	2.0
Change in demand	--	0.48%	1.36%	2.02%
Baseline number of subscribing households	1,927,200	1,927,200	1,927,200	1,927,200
Change in number of subscribers	--	9,161	26,300	38,949
New number of subscribers	--	1,936,361	1,953,500	1,966,149

Source: Nordicity analysis based on data from Ofcom.

121. Here we are less interested in the impact on the penetration rate, and more in how the average broadband speed across all subscribers is affected by the increased number of superfast broadband subscribers. Ofcom statistics indicate that the average modem sync

69 As of Q1 2013, the penetration of superfast broadband was equal to 17.5% of total fixed broadband connections, or 12.6% of total households (17.5% × 72% = 12.6%) (Ofcom, 2013, p. 25).

70 Dutz et al., 2009, p. 24.

71 Rappoport, P., Kridel, D., Taylor, L., Duffy-Deno, K., and Alleman, J., 2002, "Residential Demand for Access to the Internet", In Madden, G. (ed.) *The International Handbook of Telecommunications Economics: Volume II*, Cheltenham: Edward Elgar Publishers.

72 Goolsbee, A., 2006, "The Value of Broadband and the Deadweight Loss of Taxing New Technologies", *Contributions to Economic Analysis & Policy* (B.E. Press Journals), Vol. 5 No. 1, accessed 15 September 2013, http://business.illinois.edu/finance/papers/2001/goolsbee.pdf, p. 13.

speed[73] for standard broadband subscribers in the UK is 9.2 Mbps[74], and for superfast-broadband subscribers it is 45 Mbps[75].

122. The results of this analysis are presented in Exhibit 29. Under the Law Commission proposal, the average speed would increase from 12.700 Mbps to 12.717 Mbps, an increase of 0.130%. Under the energy regime, the average speed would increase by 0.374% to 12.748 Mbps. And under the water regime, the average speed would increase by 0.554% to 12.770 Mbps. In Section 7, we use these increases in average speed to derive the impact on GDP.

Exhibit 29 Calculation of impact on average speed

	Existing regime	Law Commission proposal	Energy regime	Water regime
Standard subscribers	17,872,800	17,863,639	17,846,500	17,833,851
Superfast subscribers	1,927,200	1,936,361	1,953,500	1,966,149
Total subscribers	19,800,000	19,800,000	19,800,000	19,800,000
Average speed (Mbps)	12.700	12.717	12.748	12.770
Percentage change		0.130%	0.374%	0.554%

Source: Nordicity analysis based on data from Ofcom.

6.5 Delayed build-out of broadband and superfast broadband infrastructure

123. Thus far we have investigated how reduced wayleave costs could lead to lower consumer prices, and therefore higher subscriber numbers and average download speeds. However, the alternative wayleave regimes could also have a negative impact on the build-out of broadband infrastructure and superfast broadband services, and thereby put a drag on growth in subscriber numbers and average speeds.

124. Because landowners would be subject to lower rates under the alternative wayleave regimes, there is likely to be an increase in the number of disputes, or the necessity to

[73] Throughout this report, any references to broadband speed correspond with modem sync speed.
[74] The rate of 9 Mbps was deduced by Nordicity from data reported to Ofcom: an overall average broadband speed of 12.7 Mbps and an average superfast broadband speed of 45 Mbps.
[75] Ofcom, 2012, p. 17.

reroute or redesign networks. Both situations would introduce delays as well as additional costs to the build-out of broadband infrastructure.

125. In this subsection, we model the potential impact that each of the alternative regimes could have on the timing of network build-outs and the subsequent impact on subscriber levels and average speeds.

6.5.1 Reduced adoption of 2 Mbps broadband due to infrastructure delays

126. We assume that the proportion of wayleaves that would be subject to delay would be equal to the percentage drop in wayleave rates. In other words, under the Law Commission proposal, 10% of wayleaves for new infrastructure would be delayed for one year[76]; under the energy regime, 40% of wayleaves would be delayed for one year; and under the water regime, 62% of wayleaves would be delayed for one year[77]. We assume that the aggregate impact of the delay is spread over a four-year period of 2014 to 2017.

127. As of 2012, 8% of UK households had broadband of less than 2 Mbps. Government policy intends to reduce this figure to virtually zero **by 2017**. Exhibit 30 presents the scenarios for closure of the 2 Mbps coverage gap under each of the four wayleave regimes, given the assumptions for disputes and delays noted above. In all four scenarios, the 2 Mbps coverage gap is reduced to virtually zero by 2017; however, the process is slower than would have been under the existing regime.

Exhibit 30 Percentage of UK households without 2 Mbps broadband, scenarios for each wayleave regime

	2011	2012	2013	2014	2015	2016	2017
Existing regime	9.80%	8.00%	6.00%	4.000%	2.000%	1.000%	0.000%
Law Commission proposal	9.80%	8.00%	6.00%	4.050%	2.050%	1.025%	0.025%
Energy regime	9.80%	8.00%	6.00%	4.200%	2.200%	1.100%	0.100%
Water regime	9.80%	8.00%	6.00%	4.310%	2.310%	1.155%	0.155%

Source: Nordicity analysis based on data from Ofcom.

128. If one assumes that 75% of households that receive broadband coverage will adopt 2 Mbps broadband service[78], then one can estimate the annual shortfall in 2 Mbps broadband subscribers under each wayleave regime. The results are presented in Exhibit

[76] This reflects an average in which half the disputes are settled quickly and half are settled within two years.
[77] Since we are only dealing with wayleaves for new infrastructure, the 15-year adjustment does not apply.
[78] Statistics published by Ofcom indicate that the household penetration of broadband in rural areas is comparable to that or urban areas – 78% (rural) vs. 76% (urban) in 2012. Source: Ofcom, 2012a, *Internet Use and Attitudes: 2012 Metrics Bulletin*, 18 July 2012, p.9.

31 and show that in 2014 the shortfall would range from 10,049 to 62,316 households. In other words, under the water regime, 62,316 fewer households would be able to subscribe to 2 Mbps broadband than under the existing regime.

Exhibit 31 Shortfall in 2 Mbps broadband subscribers (i.e. households) due to build-out delays

	2011	2012	2013	2014	2015	2016	2017
Existing regime	0	0	0	0	0	0	0
Law Commission proposal	0	0	0	10,049	10,099	5,075	5,100
Energy regime	0	0	0	40,197	40,398	20,300	20,401
Water regime	0	0	0	62,316	62,628	31,470	31,628

Source: Nordicity analysis based on data from Ofcom.

129. Exhibit 32 indicates how these shortfalls in subscribers would translate into shortfalls in the broadband penetration rate. In Section 7, we use this negative impact on the penetration rate to model the impact on GDP and employment.

Exhibit 32 Impact on penetration rate

	2011	2012	2013	2014	2015	2016	2017
Existing regime	--	--	--	--	--	--	--
Law Commission proposal	--	--	--	(0.038%)	(0.038%)	(0.019%)	(0.019%)
Energy regime	--	--	--	(0.150%)	(0.150%)	(0.075%)	(0.075%)
Water regime	--	--	--	(0.233%)	(0.233%)	(0.116%)	(0.116%)

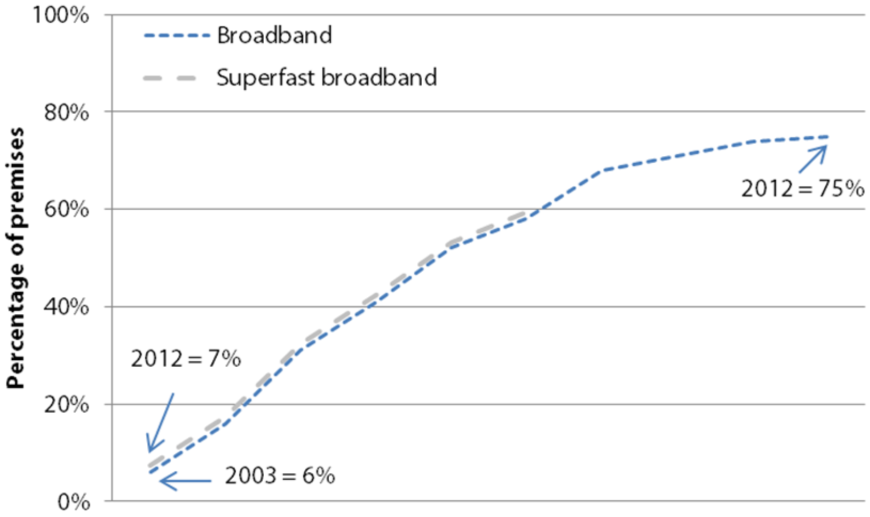
Source: Nordicity analysis based on data from Ofcom.

6.5.2 Reduced adoption of superfast broadband in rural areas due to infrastructure delays

130. A delay in the build-out of broadband infrastructure would also slow down the deployment and adoption of superfast broadband in rural areas.

131. Exhibit 34 summarises our calculation of the potential shortfall in superfast broadband subscribers in rural areas under the assumption that the penetration rate for superfast broadband in rural areas will match the national average over the next few years. This shortfall is relative to our own projection of superfast broadband subscribers, which assumes that the adoption rate will mirror that of standard broadband (Exhibit 33).

Exhibit 33 Projection of penetration rate for superfast broadband



Source: Nordicity forecast based on data from Ofcom.

132. The calculation of the shortfall in rural superfast broadband subscribers assumes that the portion of new infrastructure delayed by wayleave disputes would be proportional to the wayleave cost reduction. For example, under the Law Commission proposal, we assume that 10% of the infrastructure build-out would be delayed. This delay and the ensuing impact on the annual number of superfast broadband subscribers are spread out over four years, 2014 to 2017. So, for example, under the Law Commission proposal, the number of superfast broadband subscribers in rural areas in 2014 would be 2.5% lower (10% ÷ 4 years = 2.5%) than it would have been under the existing regime.

Exhibit 34 Shortfall in superfast broadband subscribers in rural areas

	2011	2012	2013	2014	2015	2016	2017
Existing regime	0	0	0	0	0	0	0
Law Commission proposal	0	0	0	43,063	56,678	71,774	80,253
Energy regime	0	0	0	172,254	226,711	287,095	321,010
Water regime	0	0	0	267,040	351,463	445,074	497,652

Source: Nordicity analysis based on data from Ofcom.

133. These shortfalls in superfast broadband subscribers would result in a lower average speed across all broadband subscribers because fewer subscribers would be on superfast broadband. For example, under the water regime, the average speed would drop from 28.6 Mbps to 28.0 Mbps in 2015 (Exhibit 35). In Section 7, we use this drop in average speed to model the impact of the build-out delay on GDP and employment.

Exhibit 35 Impact on average speed (Mbps)

	2012	2013	2014	2015	2016	2017
Existing regime	12.7	17.4	24.2	28.6	33.4	35.7
Law Commission proposal	12.7	17.4	24.2	28.5	33.2	35.6
Energy regime	12.7	17.4	23.9	28.2	32.9	35.2
Water regime	12.7	17.4	23.8	28.0	32.6	34.9

Source: Nordicity analysis based on data from Ofcom.

7. Impact on GDP and employment

134. In Section 6, we assessed how a reduction in broadband infrastructure costs and pricing would affect the adoption of broadband and superfast broadband, and therefore the average broadband speed. In this section we use the impact on broadband adoption and average broadband speed to estimate the potential impact on GDP and employment.

7.1 Impact on GDP

135. We first calculate the impact on GDP from the change in broadband adoption, and then the impact on GDP due to the change in average speed.

7.1.1 Broadband adoption

136. Over the past decade, there have been several studies of the impact of broadband on economic performance. Koutroumpis studied the relationship between broadband penetration rates and economic performance between 2003 and 2006 in 15 European countries[79].

137. Czernich et al. analysed the relationship between broadband penetration rates and economic performance in Organisation for Economic Cooperation and Development (OECD) member countries between 1997 and 2007[80]. The authors found that every ten percentage point increase in broadband penetration added between 0.9% and 1.5% to GDP per capita[81].

138. A study conducted in 2010 by Ericsson et al. found that a ten percentage point increase in broadband penetration (based on percentage of inhabitants) added one percentage point to a country's GDP growth[82]. For the purpose of our analysis, we use Ericsson et al.'s result, which is approximately equal to Czernich et al.'s lower bound. **Therefore we assume that a ten percentage point increase in broadband penetration (based on percentage of inhabitants) would add one percentage point to a country's GDP.** We use this

[79] Koutroumpis, Pantelis, 2009, "The Economic Impact of Broadband on Growth: A Simultaneous Approach", *Telecommunications Policy*, Vol. 33 No. 9: 471–485.
[80] Czernich, Nina, Oliver Falck, Tobias Kretschmer, and Ludger Woessmann, 2011, "Broadband Infrastructure and Economic Growth", *The Economic Journal*, Vol. 121 No. 552: 505–532.
[81] Czernich et al., 2011, p. 506.
[82] Ericsson and Arthur D. Little, 2011, *Traffic and Market Data Report*, November 2011, accessed 18 September 2013, http://hugin.info/1061/R/1561267/483187.pdf, p. 21.

empirical relationship to model the impact that increased broadband adoption would have on GDP (Exhibit 36).

Exhibit 36 Impact on GDP of change in broadband adoption

	Existing regime	Law Commission proposal	Energy regime	Water regime
GDP impact parameter (based on per-inhabitant penetration rate) [1]	1.0%	1.0%	1.0%	1.0%
GDP impact parameter (based on per-household penetration rate) [2]	0.04%	0.04%	0.04%	0.04%
Percentage change in the number of household subscriptions (i.e. change in demand) [3]	--	(0.12%)	(0.34%)	(0.51%)
Impact on GDP per capita [4]	--	0.003714%	0.010661%	0.015789%
Initial GDP (£ billions) [5]	1,504.78	1,504.83	1,504.94	1,505.01
Single-year impact on GDP (£ millions) [6]		**55.9**	**160.4**	**237.6**
15-year present-value impact on GDP (£ millions) [7]		**315.8**	**906.7**	**1,342.8**

Source: Nordicity analysis based on data from Ericsson et al., Ofcom and ONS.

Notes:
1. The parameter estimate in the Ericsson et al. paper was based on a per-inhabitant penetration rate. That is to say, for every ten percentage point increase in the ratio of broadband connections to total inhabitants, GDP increases by 1%.
2. Since the penetration rates published by Ofcom and used in the analysis are based on per-household penetration, the Ericsson et al. parameter estimate must be converted. Given that UK households contain on average 2.4 persons, the parameter estimate needs to be divided by 2.4 before it can be applied.
3. See Section 6.3.
4. Equal to (GDP impact parameter) × (Percentage change in the number of household subscriptions)
5. Real GDP for 2012; source ONS
6. Equal to (Impact on GDP per capita) × £1,504.78 billion.
7. The assumption is that this GDP impact persists for 15 years. By looking at a period of 15 years, the calculations correspond to the wayleave cost analysis, based on a 3.5% discount rate. The impact has been gradually introduced over a 15-year period to take into account the lag associated with new wayleave agreements and renewal of existing agreements. In other words the full impact is not experienced until year 15.

7.1.2 Broadband speed

139. Recent research has started to focus on the role that broadband speed can play in economic performance. Rohman et al. investigated the relationship between GDP and

download speeds in OECD countries between 2008 and 2010[83]. The authors found that a doubling of average *achieved* Internet speed – as opposed to advertised speed – added 0.3% to GDP[84]. We use this empirical relationship to model the impact that increased use of superfast broadband would have on the economy (Exhibit 37).

Exhibit 37 Impact on GDP of change in adoption of superfast broadband

	Existing regime	Law Commission proposal	Energy regime	Water regime
GDP impact parameter [1]	0.003%	0.003%	0.003%	0.003%
Baseline speed (Mbps) [2]	--	12.7	12.7	12.7
Increase in speed (Mbps) [3]	--	0.0166	0.0475	0.0704
Percentage increase in average download speed [4]	--	0.130%	0.374%	0.554%
Impact on GDP [5]		0.000391%	0.001123%	0.001663%
Single-year impact on GDP (£ millions) [6]		**5.9**	**16.9**	**25.0**
15-year present-value impact on GDP (£ billions) [7]		**33.3**	**75.4**	**141.4**

Source: Nordicity analysis based on data from Rohman et al., Ofcom and ONS.

Notes:
1. For every 1% increase in the average achieved download speed, GDP increases by 0.003%.
2. The current average speed.
3. See Section 6.4.
4. Equal to (Increase in speed) ÷ (Baseline speed)
5. Equal to (Share of doubling threshold) × (GDP impact parameter)
6. Equal to (Impact on GDP) × £1,504.78b.
7. The assumption is that this GDP impact persists for 15 years. By looking at a period of 15 years, the calculations correspond to the wayleave cost analysis, based on a 3.5% discount rate. The impact has been gradually introduced over a 15-year period to take into account the lag associated with new wayleave agreements and the renewal of existing agreements. In other words the full impact is not experienced until year 15.

7.1.3 Build-out delays

140. As noted in Section 6.5, the economic benefits of greater broadband adoption and speed may be offset by delays in the build-out of the network. The economic relationships presented in Sections 7.1.1 and 7.1.2 can also be used to quantify the economic impact of the build-out delays modelled in Section 6.5. Unlike the benefits from faster adoption and

[83] Rohman, Ibrahim K., Erik Bohlin, 2012, "Does Broadband Speed Really Matter for Driving Economic Growth? Investigating OECD countries", *International Journal of Management and Network Economics*, Vol. 2, No. 4.

[84] Rohman et al., 2012.

speed, the costs of delays do not persist. They can disappear after one or two years, depending on the length of the delay; however, the economic output is lost permanently.

141. In Exhibit 38 we summarise the impact on the broadband penetration rate from a delay in build-out of infrastructure. Based on the empirical relationships presented earlier in this chapter (Section 7.1.1), we convert this penetration-rate impact into estimates of lost GDP.

Exhibit 38 Impact on penetration rate and GDP from delay in broadband build-out

	2012	2013	2014	2015	2016	2017
Impact on penetration rate [1]						
Law Commission proposal	--	--	(0.038%)	(0.038%)	(0.019%)	(0.019%)
Energy regime	--	--	(0.150%)	(0.150%)	(0.075%)	(0.075%)
Water regime	--	--	(0.233%)	(0.233%)	(0.116%)	(0.116%)
GDP impact (£ millions) [2]						
Law Commission proposal	--	--	23.5	23.5	11.8	11.8
Energy regime	--	--	94.0	94.0	47.0	47.0
Water regime	--	--	145.8	145.8	72.9	72.9

Source: Nordicity analysis based on data from Ofcom and Ericsson.

Notes:
1. See Section 6.5.1
2. Equal to (Impact on penetration rate) ÷ 24% × 1% × £1,504.78 billion

142. In Exhibit 39 we present the PV of the impact on GDP of delays in broadband adoption.

Exhibit 39 Impact on GDP of delay in broadband adoption (£ millions)

	Existing regime	Law Commission proposal	Energy regime	Water regime
PV of GDP impact [1]	--	65.5	262.1	406.3

Source: Nordicity analysis based on data from Rohman et al., Ofcom and ONS.

Notes:
1. All amounts discounted to 2013 using a 3.5% discount rate.

143. A similar approach can be used to estimate the economic cost of a slower average broadband speed. In Exhibit 40 we summarise the impact on the average broadband speed derived in Section 6.5.2 and then use the empirical relationship discussed in Section 7.1.2 to translate the lower average speed into an estimate of lost GDP.

Exhibit 40 Impact on average speed and GDP from a delay in build-out of superfast broadband in rural areas

	2012	2013	2014	2015	2016	2017
Percentage change in average speed [1]						
Law Commission proposal	--	--	(0.31%)	(0.34%)	(0.36%)	(0.37%)
Energy regime	--	--	(1.24%)	(1.36%)	(1.45%)	(1.48%)
Water regime	--	--	(1.92%)	(2.10%)	(2.24%)	(2.30%)
GDP impact (£ millions) [2]						
Law Commission proposal	--	--	14.0	15.3	16.3	16.8
Energy regime	--	--	55.9	61.2	65.3	67.0
Water regime	--	--	86.7	94.9	101.3	103.9

Source: Nordicity analysis based on data from Ofcom and Ericsson.

Notes:
1. See Section 6.5.2
2. Equal to (Percentage change in average speed) × 0.3% × £1,504.78b

144. In Exhibit 41 we present the PV of the GDP impact from lower average speeds due to build-out delays.

Exhibit 41 Impact on GDP of delay in build-out of superfast broadband (£ millions)

	Existing regime	Law Commission proposal	Energy regime	Water regime
Present value of GDP impact [1]	--	57.1	228.5	354.3

Source: Nordicity analysis based on data from Rohman et al., Ofcom and ONS.

Notes:
1. All amounts discounted to 2013 using a 3.5% discount rate.

7.1.4 Summary and net impact

145. We can bring together each of the elements estimated in this section to determine the *net impact* on GDP (Exhibit 42).

146. Under the **Law Commission proposal**, the economic benefits of lower prices total £349.1 million. This is partially offset by the economic cost of build-out delays, which totals £122.6 million. The resulting **net impact on GDP is £226.5 million.**

147. Under the **energy regime**, the economic benefits of lower prices total £982.1 million. This is partially offset by the economic cost of build-out delays, which totals £490.6 million. The **net impact on GDP is £491.5 million.**

148. Under the **water regime**, the economic benefits of lower prices total £1,484.2 million. This is partially offset by the economic cost of build-out delays, which totals £760.6 million. The **net impact on GDP is £723.7 million.**

Exhibit 42 Summary of net GDP impact (£ million)

	Law Commission proposal	Energy regime	Water regime
Benefits from lower prices			
Faster adoption	315.8	906.7	1,342.8
Higher average speed	33.3	75.4	141.4
Total	**349.1**	**982.1**	**1,484.2**
Cost of build-out delays			
Lower adoption	65.5	262.1	406.3
Slower average speed	57.1	228.5	354.3
Total	**122.6**	**490.6**	**760.5**
Net impact	**226.5**	**491.5**	**723.7**

Source: Nordicity analysis based on data from Rohman et al., Ofcom and ONS.

7.2 Impact on employment

149. Using statistics published by the Office for Budget Responsibility (OBR), we determined the general relationship between GDP growth and job creation in the UK. The economic and fiscal outlook published by the OBR implies that the UK economy creates 4.6 new jobs for every £1 million of additional GDP[85]. We applied this relationship to our estimates of the impact on GDP derived in Section 7.1 in order to estimate the impact on employment of each alternative wayleave regime.

150. Whilst the impact on GDP from the benefits of lower prices would generate between 1,600 and 6,800 new jobs in the UK economy (depending on the wayleave regime), these potential gains are partially offset by the economic cost of build-out delays (Exhibit 43).

151. The economic benefits of the Law Commission proposal would generate 1,600 new jobs in the UK economy *over the next 15 years*. However, the potential build-out delays would cost the UK economy an estimated 600 jobs – most of which will be in the near-term. The net employment impact is therefore 1,000 new jobs over the next 15 years. The net impact of

[85] This general relationship between job creation and GDP growth makes no distinction between full-time and part-time employment. Therefore, any estimates of job creation in this report consist of a combination of full-time and part-time employment and should not be interpreted as person years or full-time equivalents (FTEs).

the energy regime would be 2,300 new jobs over the next 15 years, and the water regime would generate 3,300 new jobs over the next 15 years.

Exhibit 43 Employment impact

	Law Commission proposal	Energy regime	Water regime
Benefits from lower prices			
GDP impact (£ millions) [1]	349.1	982.1	1,484.2
Employment impact [2]	1,600	4,500	6,800
Cost of build-out delays			
GDP impact (£ millions) [1]	(122.6)	(490.6)	(760.5)
Employment impact [2]	(600)	(2,300)	(3,500)
Net impact			
GDP impact (£ millions) [1]	226.5	491.5	723.7
Employment impact [2]	**1,000**	**2,300**	**3,300**

Source: Nordicity analysis based on data from Rohman et al., Ofcom and ONS.

Notes:
1. See Section 7.1.4.
2. Based on a ratio of 4.6 jobs created for every £1 million of additional GDP in the UK economy. The employment impact is measured in terms of jobs, rather than person years or full-time equivalents. The GDP and employment impact estimates are based on the PV of a 15-year stream of benefits.

8. Other economic impacts

152. In this section we discuss other economic impacts associated with the effects of alternative wayleave regimes, which cannot necessarily be quantified, but do have a bearing on the interpretation of the economic impact results presented in Section 7.

8.1 Distribution of income

153. Several submissions to the Law Commission consultation have already noted that a reduction of wayleave payments would result in a transfer of income away from domestic landowners to, in most cases, multinational corporations with foreign shareholders and operations[86]. The implication is that this transfer would divert income away from domestic investment and lead to a reduction in the UK balance of payments, as these multinational corporations invest in foreign markets or pay dividends to foreign shareholders.

154. The Central Association of Agricultural Valuers (CAAV) estimates that masts generate approximately £250 million annually in rental payments[87] and that all communications wayleaves in the UK generate a total of approximately £300 million in annual payments[88]. As noted by the CAAV, these payments represent not an insignificant portion of income for agricultural landowners, church parishes and small businesses in rural areas[89]. However, as the CAAV also notes – and as demonstrated by the analysis in Section 6 of this study – this level of payments represents a small portion of the total turnover in the UK communications market[90]. In 2012, the communications market earned £38.8 billion in turnover; wayleave payments, therefore, represent 0.8% of the total turnover. When one considers that the reduction in wayleave rates could only materialise following a period of negotiation – say 15 years – then the annualised rate of £20 million represents only 0.05% of total turnover in the communications market[91].

155. When considering the impact of a transfer of income from one sector to another, it is useful to make reference to the input-output (I-O) tables published by the ONS. The I-O

[86] Central Association of Agricultural Valuers, 2012, "Response by the Central Association of Agricultural Valuers: Part 3 - Basis for Payment for Rights Governed by the Code", response to Law Commission consultation questions, October 2012. ¶7.2.3-7.2.4.
[87] Central Association of Agricultural Valuers, 2012, ¶7.1.5.
[88] Central Association of Agricultural Valuers, 2012, ¶7.1.7.
[89] Central Association of Agricultural Valuers, 2012, ¶7.2.3.
[90] Central Association of Agricultural Valuers, 2012, ¶7.1.8.
[91] Central Association of Agricultural Valuers, 2012, ¶7.1.8.

tables indicate that imports of goods and services comprise only 3.9% of total output in the agricultural sector[92]. This is much lower than the import ratios in the telecommunications sector (14.8%), household consumption (14.8%) and total final demand in the UK economy (9.6%). The relatively low import ratio observed for the agricultural sector reinforces the argument that a transfer of income away from landowners could have a negative impact on the UK balance of payments.

156. Furthermore, if communications operators do not pass on their savings in wayleave costs to customers in the form of lower prices, the likelihood of a negative impact on the UK balance of payments is greater, since the import ratio in the telecommunications sector is higher (14.8%). If the savings in wayleave costs flow to communications operators' profits, it is useful to note that in 2012/13, BT Group plc paid dividends of 36p for every £1 of net profit[93]. It is unclear, however, what portion of these dividends flowed to domestic shareholders versus foreign shareholders.

157. Whilst the data points presented above indicate that a transfer of income from agricultural landowners to communications operators is likely to have a negative impact on the UK balance of payments, this is not necessarily a negative outcome for the UK economy. The UK telecommunications sector's imports of foreign goods and services (i.e. imports) and foreign capital (i.e. payments to foreign investors) may permit it to improve efficiency and thereby improve the overall allocative efficiency of the UK economy.

8.2 Economic efficiency

158. Any regime that moves wayleave pricing away from market-based rates also risks encouraging a misallocation of resources in the economy. The existing wayleave regime ensures that land is put to its most productive use, whether it be agricultural use or communications use. A system that artificially suppresses the price of wayleaves could either lead to an undersupply of land for communications infrastructure, or if compulsion is present, lead communications services to *over-consume* land, thus taking it out of

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[92] Office for National Statistics, "United Kingdom Input-Output Analytical Tables, 2005", accessed 18 September 2013, http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-237341. This only takes into account the first round of supply chain purchases made directly by the agricultural sector and does not take into account the import ratios further down the supply chain, as direct suppliers re-spend their income.

[93] Calculations based on data published in BT Group plc, *2013, Summary of financial statement & notice of meeting 2013*, p. 4.

agricultural use. Such a misallocation of resources could result in the UK economy operating at less than its full potential. That is, the market value of the output produced by the UK economy would be less than its maximum level. This misallocation of resources would also mean that, instead of investing in more efficient wireless technology or cable-network routing, communications operators may develop inefficient networks that could ultimately result in higher communications costs in the future.

159. We note, however, that none of alternative wayleave regimes reduces wayleave prices to zero or even close to zero. This, combined with the fact that wayleave costs represent only a small portion of total infrastructure costs, means that the risk of inefficient infrastructure design and deployment is probably low.

8.3 R&D and innovation

160. Several economic studies have found that broadband Internet communications plays an important role in fostering innovation. For example, a study by Clayton et al. using data from the UK's Community Innovation Survey for the 2002-2004 period, found a strong link between employee Internet use and a firm's innovation outcomes[94]. In particular, Clayton et al. found that a 10 percentage point increase in the proportion of workers using broadband Internet led to a 3% increase in *innovative* sales per employee. Studies in other countries have found similar relationships between broadband Internet use and measures of innovation outcomes.

161. This report has not isolated the particular effects that alternative wayleave regimes would play in fostering innovation. The analysis notes that the various regimes have the potential to encourage higher adoption of broadband and superfast broadband through lower prices. The impact that this has on innovation is incorporated in the empirical research and modelling used in this analysis. So the increases in GDP per capita that may arise from increased broadband use are reflected in the GDP and employment impact estimates.

162. One of the channels through which broadband communications fosters innovation is by facilitating research and development (R&D), which is one of the key inputs to innovation. Broadband communications allows researchers in the public and private sectors to collaborate in new ways and make use of more powerful computing technologies. In

[94] Clayton, Tony, Mark Franklin, Peter Stam, Eric Bartelsman, Shikeb Farooqui, Simon Quantin, Yoann Barbesol, et al., 2008, "Information Society : ICT Impact Assessment by Linking Data from Different Sources".

general broadband communications can improve the efficiency of public and private researchers. More specifically it allows researchers to engage in bandwidth-intensive research. This bandwidth-intensive research may involve the need to access or transfer very large data files or it may involve high performance computing that entails numerous simultaneous computations on a distributed network of computers[95].

163. Broadband communications and a more connected society also permit businesses in the UK to stay at the leading edge of the development, market-testing and commercialisation of new products and business models. This aspect is just as important as the facilitation of R&D when it comes to fostering innovation.

164. These types of endeavours are unlikely to be highly price sensitive: the emphasis is the quality and capacity of the network. Furthermore, these are endeavours that can be located in other countries with advanced broadband networks. In that regard, the R&D and innovations goals of broadband policy may be better served by deployment that is as fast as possible. Thus, any deployment delays brought on by the uncertainty surrounding wayleave costs could potentially delay or jeopardize R&D and innovation in the UK economy.

[95] Nordicity and Bytown Consulting, 2011, *Analysis of the Economic Benefits of CANARIE*, p. 17.

9. Summary of key findings

165. The adoption of alternative wayleave regimes is likely to result in a reduction in wayleave costs for communications operators. Our analysis indicates that the Law Commission proposal would result in a moderate decrease of 10% in wayleave costs. Our research of the electricity sector indicates that wayleave costs would be likely to drop by 40% under the energy regime. And we find that the water regime would result in wayleave rates that were approximately 62% lower than those under the existing regime.

166. Because wayleave costs represent only a portion of the total cost of deploying and operating new broadband infrastructure, the impact of these wayleave cost reductions is much smaller relative to total infrastructure costs. Our analysis indicates that the Law Commission proposal would result in a decrease of 0.4% to 1.3% in the 15-year PV of infrastructure costs, the energy regime would result in a decrease of 1.4% to 3.6%, and the water regime would result in a decrease of 2.2% to 5.3%.

167. Infrastructure costs themselves represent only a portion of communications operators' total operating costs and turnover. Our research indicates that network capital expenditures represent 10% of total turnover. In our estimate, the PV of operating costs would add another 10% to the PV of the overall infrastructure costs. Therefore, even if competitive forces in the broadband market compelled communications operators to pass on 100% of their cost savings to consumers, the impact on consumer prices would probably only be one-fifth of the impact on broadband infrastructure costs. As a result, under all of the alternative regimes, the maximum potential decrease in consumer prices would be no more than 1.05% (i.e. $5.3\% \div 5 \approx 1.05\%$). Under the Law Commission proposal, the decrease in average consumer prices could be as little as 0.07% (i.e. $0.4\% \div 5 \approx 0.07\%$).

168. This small decrease in consumer prices – than would have otherwise occurred – has the potential to increase subscribership to standard and superfast broadband. Recent empirical analyses show that higher levels of broadband penetration and average achieved broadband speed can have a positive impact on GDP. This GDP impact arises not only from the economic activity associated with network construction, but more importantly, from the broader indirect and spill-over effects that accompany the use of broadband by consumers, businesses and governments. In particular, the positive GDP impact is experienced through increased productivity and higher GDP per capita.

169. Our modelling of the impact of a decrease in consumer prices for broadband indicates that the economic benefits (measured in terms of 15-year PV) of the Law Commission proposal would be £349.1 million. The energy regime would generate economic benefits in the order of £982.1 million. The water regime would generate economic benefits of £1.484.2 million.

170. The implementation of an alternative wayleave regime, however, also has the potential to slow the build-out of standard and superfast broadband networks. The lower wayleave rates are likely to result in disputes with landowners or costly and time-consuming rerouting of broadband infrastructure. Using the same empirical research of the economic impact of broadband penetration and speed, we also modelled the impact that potential build-out delays – and their effect on penetration and average speed – could have on GDP.

171. Our analysis found that the adoption of the **Law Commission proposal** would generate an economic cost of £122.6 million and thereby result in a **net GDP impact of £226.5 million**. The adoption of the **energy regime** would generate economic cost of £490.6 million and thereby result in a **net GDP impact of £491.5 million**. The adoption of the **water regime** would generate an economic cost of £760.5 million and result in a **net GDP impact of £723.7 million**.

172. These levels of incremental economic activity, in turn, provide the basis for the creation of employment. Using the general relationship between GDP growth and job creation implied by forecasts published by OBR, we estimate that the adoption of the **Law Commission proposal** would generate an estimated **1,000 new jobs** in the UK over the next 15 years (Exhibit 1). The adoption of the **energy regime** would generate an estimated **2,300 new jobs** over the next 15 years. And the adoption of the **water regime** would generate an estimated **3,300 new jobs** over the next 15 years.

173. It is important to note, however, that these estimates of the net impact on GDP and employment assume a scenario where all of the savings from reduced wayleave costs are passed on to consumers – something that is not assured in markets characterised by imperfect competition.

174. Our research also indicates that there is merit in landowners' arguments regarding the transfer of income to multinational communications companies. Such a transfer is likely to have a negative impact on the UK balance of payments in the short run, given the

agricultural sector's low direct import ratio. However, this balance of payments impact must be weighed against the increased economic efficiency that is likely to accompany the import of foreign equipment, services and capital.

175. We also note that broadband plays an important role in research and development (R&D) and innovation. These endeavours tend not be price-sensitive and flourish in countries with advanced broadband networks and highly qualified researchers. Thus, any delays in the build-out of broadband infrastructure brought on by the uncertainty surrounding wayleave costs could potentially delay or even jeopardize R&D and innovation in the UK economy.

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Benchmarking Data Sources

Masts

Country	Description	Source
UK	New street works	Analysys Mason, 2010.
UK	New greenfield site	Analysys Mason, 2010.
UK	New rooftop mast	Analysys Mason, 2010.
UK	Analysys Mason estimate	Analysys Mason, 2010.
Australia	Telecommunications Journal of Australia, Wi-Max example	Ellershaw et al., 2009.
US	Quora estimate (low)	http://www.quora.com/Telecommunications/How-much-money-would-it-cost-to-build-a-cell-tower
New Zealand	Rural cell tower cost (low)	Putt, 2012.
US	Quora Estimate (high)	http://www.quora.com/Telecommunications/How-much-money-would-it-cost-to-build-a-cell-tower
US	*HCP Live* estimate	Dean, 2012.
New Zealand	Rural cell tower cost (average)	Putt, 2012.
New Zealand	Rural cell tower cost (high)	Putt, 2012.

Overhead

Country	Description	Source
US	Columbia Telecommunications Corporation estimate using overlash (best case)	Columbia Telecommunications Corporation, 2009.
Australia	Telecommunications Journal of Australia estimate, rural	Ellershaw et al, 2009.
US	Columbia Telecommunications Corporation estimate using overlash (worst case)	Columbia Telecommunications Corporation, 2009.
US	Columbia Telecommunications Corporation estimate (best case)	Columbia Telecommunications Corporation, 2009.
UK	Estimate from Google user group (low)	https://groups.google.com/forum/#!topic/ftthuk/KeHWQTV7XQw
US	Columbia Telecommunications Corporation typical case estimate	Columbia Telecommunications Corporation, 2009.
UK	Estimate from user group (high)	https://groups.google.com/forum/#!topic/ftthuk/KeHWQTV7XQw
Australia	Telecommunications Journal of Australia estimate, urban	Ellershaw et al, 2009.
UK	Analysys Mason	Analysys Mason, 2008.
US	Columbia Telecommunications Corporation estimate (worst case)	Columbia Telecommunications Corporation, 2009.

Underground-rural

Country	Description	Source
US	Rural Broadband Project, Maryland	http://www.highdefforum.com/cables-connections/91705-how-much-does-fiber-optic-cable-cost.html
US	Columbia Telecommunications Corporation estimate for rural installs	Columbia Telecommunications Corporation, 2009.
Canada	MacKenzie Valley average	Nordicity
US	Alaska benchmarking cost	Nordicity
UK	Analysys Mason	Analysys Mason, 2008.

Underground-urban

Country	Description	Source
US	Columbia Telecommunications Corporation study urban (best case)	Columbia Telecommunications Corporation, 2009.
Spain	Andalusia estimate	Cortes, undated.
US	Federal Communications Commission, joint build scenario	Federal Communications Commission. 2010.
US	Columbia Telecommunications Corporation study urban (typical case)	Columbia Telecommunications Corporation, 2009.
UK	Analysys Mason	Analysys Mason. 2008.
US	Federal Communications Commission, noted fibre deployment costs (full)	Federal Communications Commission. 2010.
UK	Analysys Mason (worst case)	Analysys Mason. 2008.
US	Columbia Telecommunications Corporation study urban (worst case)	Columbia Telecommunications Corporation, 2009.
US	US-based estimate for dense urban (high)	http://www.highdefforum.com/cables-connections/91705-how-much-does-fiber-optic-cable-cost.html