GD 2017/0025

THE NATIONAL INFRASTRUCTURE STRATEGY

May 2017

Minister's Introduction

The Island's infrastructure is of paramount importance to our everyday Island life. It allows for the efficient movement of people and goods both across the Island, and off the Island. It provides us with the power and telecommunications we need for our homes and businesses. It services our buildings with fresh water and treats the sewage and waste produced. The demands on our infrastructure are forever shifting with changes to our population, our economy and technological advances. Much of our infrastructure has been constructed over a long period of time and built at a rate to support our social and economic growth.

In meeting its commitment in the Programme for Government, the Department of Infrastructure has undertaken an audit of the condition of the Island's infrastructure, and considered how it is meeting the Island's current and future social and economic needs. This National Infrastructure Strategy provides a number of broad principles and statements that are intended to guide the Island's infrastructure providers when making decisions for future investments.

There are a number of factors which will impact on both the need for, and the performance of our infrastructure; as these factors change, so too will our infrastructure.

The valuable work of the Strategic Infrastructure Group representing Island infrastructure providers will continue to provide the platform to ensure there is ongoing collaboration in providing the most right infrastructure to meet the Island's needs.

Looking to our Island's future, there are many unknowns. It is my aim to ensure we are preparing for that future in the best way we can. This Strategy will be regularly monitored to ensure that it will continue to take account of future needs. It will consider the Island's future population, future economy, emerging technologies, and climate change and will set out any known responses to these factors.

Hon. R K Harmer MHK
Minister for Infrastructure

1. Introduction

1.1.1 Resilient and reliable infrastructure is critical to ensuring that an economy can flourish. Investing in infrastructure can increase long-term economic growth while failure to can have a significant negative impact on economic growth.

1.1.2 The Island's infrastructure is generally in a good condition, having benefited from over £1 billion investment over the last 15 years along with the successful implementation of good maintenance programmes for assets. Many of the improvements that have been made in this time have ensured that the infrastructure meets both our current and future needs. However it is important that the Isle of Man identifies its future infrastructure challenges and opportunities if it is to remain a desirable place to live, work and invest in.

1.1.3 The National Infrastructure Strategy presents an audit of the Island's current infrastructure, sets out the current available capacities for each key asset and identifies any known issues with supply. It then examines a number of factors which could impact on the future provision of the Island's infrastructure, followed by an assessment of these factors against the Island's infrastructure. Finally, consideration is given to the obsolescence of each of the Island's key assets.

1.1.4 The National Infrastructure Strategy has the **overarching aim** to set out a strategy which will:

ensure there is an integrated, reliable, secure and resilient provision of Island wide infrastructure that meets the social and economic needs of the Island up to 2050.

1.1.5 In order to achieve this aim the National Infrastructure Strategy includes a number of **statements** which are intended to set out specific actions that are required. These are set out in bold throughout the document where appropriate.

1.1.6 In preparing the strategy it was apparent that there were two fundamental issues which needed consideration by all infrastructure providers when making decisions. These have been classified as **overarching principles** and if the aim is to be achieved it is essential that all infrastructure providers are guided by these principles in making decisions on future investment.

Overarching principle 1 - to look to the future:
When preparing for future infrastructure projects, there will be a forward looking, collaborative approach between infrastructure providers and Government Departments. Consideration must be given to the future social and economic needs of the Island as well as any emerging trends and technologies. Infrastructure will be designed to ensure international and national obligations are met, as appropriate.

Overarching principle 2 - to ensure value for money:
In order to ensure the full design life of each of the Island's strategic assets is met, appropriate monitoring and maintenance programmes in line with relevant valid standards for asset management should be prepared and adhered to. These should be taken into account prior to the consideration of total replacement or renewal of that asset.

1.2 The Programme for Government and how this relates to the National Infrastructure Strategy

1.2.1. The Programme for Government was published in January 2017 and includes three Strategic Objectives:

- an inclusive and caring society;
- an Island of enterprise and opportunity; and
- a financially responsible Government.

1.2.2 There are a number of outcomes included in the document which directly relate to the National Infrastructure Strategy, namely;

- we have Island transport which meets our social and economic needs;
- we have an infrastructure which supports social and economic wellbeing;
- we have utilities that support our Island communities and businesses; and,
- we have a natural and built environment which we conserve and cherish and which is adapted to cope with the threats from climate change.

1.2.3 This indicates that infrastructure has a key role to play in supporting the growth of the economy, enhancing the quality of life of our people and supporting our Island's international reputation.

1.3 Monitoring and review

1.3.1 The National Infrastructure Strategy has been prepared by the Department of Infrastructure with input from colleagues across Government Departments, the Manx Utilities Authority and infrastructure providers in the private sector (details of these are provided at Appendix 5). Additional supporting information was collated by the Department as part of the formulation of this National Infrastructure Strategy. This information can be requested from the Department. Appendix 6 contains a list of key documents used.

1.3.2 Although this strategy has been developed with a view to the future make-up of our infrastructure for the Island, there are many external factors which could make our future very different to how we currently envisage it. There are a number of trends which can be carefully watched for all sectors of infrastructure provision across the Island, and the providers will already consider these when future planning. There are however circumstances over which the Island has no direct control, for example, global politics and global economies, changes in legislation in other jurisdictions which may inadvertently impact upon the Isle of Man (e.g. UK and EU legislation and the uncertainties surrounding the UK's planned withdrawal from the EU) as well as technological developments. Consumer behaviour and consumer choice must also be taken into consideration as they have the potential to change the success (or otherwise) of these technologies and the demands placed on the Island's infrastructure.

1.3.3 It will be necessary to review the strategy periodically taking into account the ever changing social and economic requirements of the Island, as well as monitoring the external factors which could impact the Island's infrastructure provision. The timing of such a review will be dependent on the availability of baseline data. At this stage it is envisaged that a review would be carried out on an annual basis but the necessity

of this will be evaluated as the project moves forward. A monitoring report will be produced following the review.

1.3.4 This monitoring report will be available to all infrastructure providers to ensure that there is a common understanding regarding the Island's future infrastructure requirements. This will result in better programming of infrastructure improvement and maintenance works. It will also allow providers to make better long term decisions taking into account the factors influencing their sector but also with an understanding of other sectors and the challenges facing them.

1.3.5 Having a better understanding of future infrastructure requirements will also enable more certainty as to when substantial financial investment will be needed. For Government owned infrastructure this will assist greatly in forward financial planning.

Statement 1

The Department of Infrastructure will undertake a regular cycle of review of the National Infrastructure Strategy and will produce a monitoring report thereafter.

2. Overview of the Island's current infrastructure

2.1 Introduction

2.1.1 The following section of the strategy will present an audit of the Island's current infrastructure. For the purposes of this strategy, the Island's infrastructure is considered to include:-

- highways;
- ports, harbours and airport;
- energy generation and supply;
- flood and coastal defences;
- waste;
- sewerage and water supply; and,
- telecommunications.

2.1.2 For the purposes of this strategy the definition of infrastructure did not extend to the hospital, schools or houses. The justification being that they were in some ways easier to develop than the Islands integral infrastructure. It may be in future reviews of this strategy that these other items of infrastructure are also given consideration.

2.2 Highways

Background

2.2.1 The Department of Infrastructure (DOI) is responsible for the management of the highway network and has designated each adopted road into a hierarchy based on the following criteria (and shown on Map 2 in Appendix 1).

- Primary – multi-modal link[1], strategic routes linking urban centres and major routes within built up areas;
- District – multi-modal links, important cross-urban routes, key suburban routes;
- Local – multi-modal link, distributor roads linking district routes to local roads; and,
- Access roads.

2.2.2 The quality of the Island's road network is fundamental to levels of Island connectivity and as such the DOI carries out condition monitoring of the Island's roads and pavements. The Island's major roads are surveyed approximately every five years to determine the residual life of their foundation, ride quality and skid resistance. Additionally, safety inspections of all roads and footways are routinely carried out on a monthly, three-monthly, six-monthly or annual basis, depending on the type of road that it is and how busy it is.

2.2.3 The DOI uses all of this information in conjunction with the hierarchy of roads, accident statistics, utility condition and developments, private developments, footfall, local authority feedback, 'report a problem' statistics, public requests and budgetary constraints to identify its priorities for road and footway maintenance.

[1] In this context, a multi-modal link relates to the types of vehicle the road can carry (it has been designed to accommodate a bus, and therefore, should be able to accommodate most other larger vehicles)

Current situation

2.2.4 There are no indications that the current highway network is not meeting the economic and social needs of the Island in terms of capacity. The Island's roads are still operating within their design capacity with just two identified roundabouts (Quarterbridge and Governors Hill) operating at above a level considered to be at significant congestion. The DOI will continue to monitor the capacity and demand of the Island's roads.

2.2.5 In terms of quality the Department will continue to monitor this as outlined and use this information to prepare planned programmes of work which will direct resources available to support the varied needs of the Island's residents, communities and businesses.

2.3 Ports, harbours and airport

Background

2.3.1 As important as travelling around the Island is the ability to move both people and goods to and from the Isle of Man. The Island is reliant on both air and sea travel to achieve this. Both must be safe and reliable and therefore so must the infrastructure that they depend on.

2.3.2 The eight statutory harbours in the Isle of Man can generally be separated into two categories; commercial and leisure. The commercial harbours of Douglas, Ramsey, and Peel, and to a lesser extent, Port St Mary, mix essential commercial activity with leisure use; the Island's other harbours are primarily for leisure use (Castletown, Laxey, Port Erin and Derbyhaven).

2.3.3 Douglas Harbour is the main port for the Island's ferry service providing a daily passenger and freight service between the Isle of Man and the UK. This harbour manages an annual passenger through put of around 600,000.

2.3.4 The DOI has responsibility for structures and assets within the Island's harbours including the linkspan and oil berth. Some of these have been listed in Appendix 4 along with the assets expected lifetimes. It will be essential that these assets are continued to be properly maintained to ensure the safe and reliable operation of the harbours.

2.3.5 The Isle of Man Airport is wholly owned by the Isle of Man Government, and is operated by the DOI. The airport manages an annual passenger through put of around 800,000 with flights travelling to a variety of UK (and seasonal European) destinations.

2.3.6 In 2011, work was completed on the Airport runway project which refurbished the existing main runway and extended the runway end safety areas (RESAS) to international recommended dimensions.

Current situation

2.3.7 The services provided at the Island's harbours and airport meet the current social and economic needs of the Island. There is the ability at both of these to accommodate additional capacity should passenger numbers or freight volumes rise in the future. The implementation of the Tynwald agreed Strategic Sea Services Policy will ensure the continued provision of sea services that meet the social and economic needs of the Island.

2.3.8 There are areas within each harbour which could benefit from improvement works, particularly Douglas, to further enhance the services which can be provided by harbours and could create economic opportunities. Aspirations for the Island's harbours are being considered as part of the Harbours Maritime Strategy which the Department is currently preparing.

2.4 Energy generation and supply

Background

2.4.1 The Isle of Man is presently reliant on the importation of more than 97% of its total primary energy supply; predominately gas and oil products which are imported from the United Kingdom. These products are then transformed for power generation or supplied directly to consumers to meet energy demands in the form of heating oil, road fuel, mains or other gas systems. A sub-sea power cable was commissioned in October 2000 directly connecting the Isle of Man electricity infrastructure network into the UK's energy network system. The various forms of energy used on the Island are set out below.

Electricity

2.4.2 The Manx Utilities Authority is responsible for the generation and supply of electricity on the Isle of Man. The Island's generation mix largely comprises the gas fired combined cycle gas turbine power plant at Pulrose (installed generation capacity of 80MW), ultra-low sulphur diesel fired generation (installed generation capacity of 90MW), renewable generation from the Sulby hydro plant (installed generation capacity of 1MW) and the output from the Energy-from-Waste plant (installed generation capacity of 5MW). These are supplemented by the sub-sea power cable connection to the UK which enables the import and export of wholesale electricity (capacity of 60MW). In terms of the Island's security of supplies, the Island has a very attractive generation capacity well in excess of that in the UK and other Island jurisdictions. Moreover the Island is well served with flexible generation options with immediate backup should any major generation component fail to operate. Up until December 2016, 86% of electricity produced on the Isle of Man was produced by the Combined Cycle Gas Turbine (CCGT) facility at Pulrose, Douglas. Imported electricity made up 7% of the generation mix, with renewable sources such as hydro power and the output from the Energy-from-Waste plant, making up the remaining 7%.

Renewable Energy

2.4.3 In terms of renewable energy projects, the major established schemes for Manx Utilities comprise the hydro scheme at Sulby and the Energy from Waste plant. In addition there are around 40 customers with small scale renewable schemes –

predominantly solar PV panels and some domestic micro wind turbines - a small number of commercial bio-mass boiler systems and domestic wood chip/pellet boilers. The green electricity currently produced from the Sulby hydro plant is purchased by a small number of corporate organisations wishing to progress their sustainability agenda.

Gas

2.4.4 Manx Electricity Authority (now Manx Utilities) undertook a significant amount of work to introduce natural gas to the Island in order to support the CCGT which was completed in 2003. Manx Gas has also invested significantly in the natural gas transmission infrastructure.

2.4.5 During 2015, 299 Gigawatt hours (GWh) of natural gas, 17 GWh of Liquefied Petroleum Gas (LPG) mains gas and 19 GWh of LPG cylinder and mini bulk sales were consumed. In 2015, 2,680 tonnes of LPG were imported (Source – The Isle of Man in numbers 2016, Cabinet Office). Both LPG and natural gas are imported to the Island and delivered to Douglas.

Natural gas

2.4.6 Natural gas is the cleanest of all the fossil fuels. It is transported through the offshore pipeline system between Scotland and Ireland (SIPS II) with a sub-sea spur which ends at Glen Mooar where a pressure reduction station is located. It is then transported through a cross-Island high pressure pipeline owned by Manx Utilities (approximately 20km, completed in December 2002) to the Pulrose power station for use as part of the electricity generation for the Island. Natural gas is also distributed by Manx Gas via a local distribution network to houses in Douglas, Onchan, Braddan, Glen Vine, Crosby, Union Mills, Kirk Michael, Ballaugh, Ballasalla Castletown, Port St Mary, Port Erin, Ramsey and Peel.

LPG

2.4.7 Manx Gas imports LPG to the Island and stores it, mainly in Douglas. It is available via an underground mains system in Foxdale, Laxey, Andreas, Santon, Jurby, Maughold and St Johns and also available in bulk and cylinders.

Petroleum

2.4.8 In terms of petroleum products, the Island is well served by two companies importing fuel operating oil storage depots and supporting retail distribution. A third company provides retail distribution only.

2.4.9 In 2015, 76,303 tonnes of oil were imported, an average of 1,372 litres consumed per household. In 2014/15 there was an average of 697 litres of road fuel was consumed per licenced vehicle on the Island (road fuel includes both petrol and diesel sales). Overall fuel sales are fairly static whereas the number of licenced vehicles has decreased[2].

[2] https://www.gov.im/media/1350838/2016-02-19-isle-of-man-in-numbers-2016-report-final.pdf

Current situation

2.4.10 Since 2009, there has been a decrease in demand for energy with an average annual decline of 1% per annum. In 2015/16, a total of 367 million units[3] of electricity were supplied to 40,000 households and 5,000 businesses. An additional 87 million units were supplied to the UK with £3.2million generated from export trading profits[4]. This indicates that there is the capacity not only to meet the Island's energy needs, but to export either surplus energy generated or to fulfil export opportunities to the UK. Manx Utilities' annual retail sales volume continues to decline slowly as all sectors embrace energy efficiency best practices. Electrical demand peaked on the Island at 395 GWh in 2008-09 but is currently anticipated to drop to only 363 GWh for 2016-17 (a decline of 8%) and this negative trend is expected to continue until at least 2020.

2.4.11 The gas supply needs of the Island are currently being met by Manx Gas either by direct connection or by portable gas tanks.

2.5 Flood and Coastal Defences

Background

2.5.I Recent flood events have led Government to undertake detailed consideration of the requirements of the Island in order to provide appropriate, proportionate and effective measures to manage and mitigate the effects. A number of reports have been produced detailing both the flood events and the recommended response to these. The National Strategy on Sea Defences, Flooding and Coastal Erosion was produced in 2016. Within its supporting Evidence Report consideration was given to the impact of predicted flood and coastal erosion risk to roads and railways across the Isle of Man.

Current situation

2.5.2 Across the locations identified in the National Strategy on Sea Defences, Flooding and Coastal Erosion, the potential economic damages that could result from flood and coastal erosion risk totals just under £900 million (over 100 years). In addition, there were 180 critical assets identified as being at risk (of which 63 are highly vulnerable), just over 4,000 residential properties, 32km major (A and B) roads, 39km minor roads and 6km railway.

2.5.3 The December 2015 heavy rainfall led to widespread flooding. In Douglas, the flooding affected a number of key assets including the National Sports Centre, Douglas Fire Station, Banks Circus bus depot and Douglas Railway Station. It also reached the Pulrose Power Station but did not inundate this site significantly. There was also concern about the ability of the Pulrose Bridge, which carries critical infrastructure, to cope with a repeat event in this location. Pulrose Bridge is planned for replacement in 2019-2020.

[3] A unit is a kWh of electricity, therefore 367 million units is the same as 367 GWh
[4] https://www.manxutilities.im/media/1380/annual-report-and-financial-statement-2015-16.pdf

2.5.4 The National Strategy on Sea Defences, Flooding and Coastal Erosion sets out that relevant Departments in the Isle of Man Government currently have over £50m allocated to infrastructure projects within their remits. These investments started April 2016 and will continue over the next 30 years.

Fluvial flooding

2.5.5 Manx Utilities has permissive powers to maintain the Island's 85km of designated watercourses. The Flood Risk Management Act 2013 also includes a consenting regime for works affecting flood risk and emergency powers, the Manx Utilities' powers (general and remedial).

Coastal flooding

2.5.6 The DOI is responsible for providing the protection against flooding and wave overtopping in harbours and on sea fronts across the Island.

2.5.7 The Department commissioned JBA Consulting Ltd in 2014 to develop a number of technically viable concept solutions to address still water level flooding in harbour environments and wave overtopping[5]. Within each of the seven sites (Castletown, Douglas, Laxey, Ramsey, Peel, Port St Mary and Gansey), a number of technically viable solutions were considered along with the current provision of defences and presented within the Isle of Man Flooding and Wave Overtopping Study: Concept Design Report (2014)[6]. The defences proposed for each of these sites have been designed to reduce the risk of coastal processes during the design storm event, specified as the 1 in 200-year event (including climate change to the year 2115) with a design life of 120 years.

Coastal erosion

2.5.8 The Coastline Management Act 2005 makes provisions for the management of designated coastline zones by regulating development. In 2015, the Transfer of Planning and Building Control Functions Order 2015 transferred functions to DEFA, including the Coastline Management Act, 2005. The purpose of the Coastline Management Act is to provide for:

- the sustainable management of designated parts of the coastline that may be subject to change;
- functions that may be exercised in the public interest and intended to be of social and environmental benefit, while balancing economic cost; and,
- ensuring the respect of coastline management and decisions about planning policies are taken on an informed basis.

2.5.9 The National Strategy on Sea Defences, Flooding and Coastal Erosion Evidence Report considered the risk of coastal erosion occurring now and in the future by assessing and analysing the movement of the coastline over the past 150 years and projecting forward this trajectory over the next 100 years in the form of a coastal

[5] Swell waves used the 1.0m allowance to offshore swell wave conditions, which was subject to wave transformation modelling to determine the change in wave height at each individual site.
[6] https://www.gov.im/media/1346565/executive-summary-concept-design-report-coastal-flooding-and-wave-overtopping.pdf

erosion contour. It was necessary to understand the current rate and expected future rate.

2.5.10 The assessment of risk for coastal erosion at Kirk Michael concluded that there was only a risk of coastal erosion impacting properties between 2065 and 2115 (3 residential properties and a commercial fish farm). However, the assessment is based on projecting forward historic rates that may underestimate the risk and local community concerns are high. There is a need for a better understanding of the level of risk however climate change sensitivity assessment suggests a significant increase in the number of properties at risk.

2.5.11 The Department of Environment, Food and Agriculture will continue to review the coastline at Kirk Michael and consider when best to implement the recommendations from the National Strategy.

2.6 Waste

Background

2.6.1 There are a number of ways in which waste is dealt with on the Island. Some of the waste is recycled on Island, some is exported off Island for recycling or disposal, some is landfilled and some used to fuel the Energy from Waste plant. The Department is currently preparing a waste strategy which will cover these issues in detail.

Energy from waste facility

2.6.2 The Richmond Hill Energy from Waste facility (EfW) was designed with the capacity to handle the level of combustible residual waste generated by the island's homes and businesses over a 25 year period. The facility was completed in 2004, and is designed for maximum efficiency and environmental protection as well as safety. The facility is operated under contract from the DOI. The current contract expires in August 2029, however, with regular maintenance and repair works when required, the Plant is capable of operating beyond this date.

2.6.3 The facility has two incinerators. The primary incinerator (with a capacity of 60,000 tonnes per annum) uses a water-cooled grate allowing shredded end of life tyres to be included with the municipal, commercial and industrial waste stream. Waste is burned and the resultant bottom ash is cooled with water. The cooled ash is discharged and is collected in the ash pit following ferrous metal recovery by the over band magnet before being transported to landfill.

2.6.4 The secondary incinerator was designed to process up to 5,000 tonnes of clinical and animal waste. However animal waste was subsequently diverted through a bespoke Animal Waste Processing Plant which was developed in 2007.

2.6.5 Energy from the process is harnessed to produce renewable electricity for the Island. During 2014/2015, 34,474 tonnes of domestic waste and 13,404 tonnes of commercial waste were processed at the plant (Source – The Isle of Man in numbers 2016, Cabinet Office).

Current situation

2.6.6 The current provision of waste services adequately cater for the Island's needs in that all waste is collected and is disposed of. However, this would be greatly affected if the Isle of Man was no longer permitted to export some or all of its material to the UK, who permit the export of the more difficult wastes and recyclables. There is currently sufficient capacity at the EfW plant to consider the option of importing Refuse Derived Fuel (RDF) to supplement the current EfW waste stream but this may require a change in regulations.

2.7 Water and Sewerage

Background

Water

2.7.1 Manx Utilities is responsible for the public water supply under the 1991 Water Act. Water is collected in five impounding reservoirs and conveyed by approximately 66km of raw water mains for treatment at water treatment works located in Douglas and Sulby. There are approximately 1,500km of treated water mains and a series of service reservoirs and pumping stations.

2.7.2 The Douglas Water Treatment Works provides treated water to Douglas, Onchan and the south of the Island. West Baldwin, Clypse and Kerrowdhoo Reservoirs supply raw water to the works. It is designed to treat up to 37 megalitres[7] of water a day (MLD), supplying 70% of the Island's population. The Sulby Water Treatment works provides treated water to the north of the Island and is designed to treat up to 21 MLD.

Sewerage

2.7.3 Manx Utilities is also responsible for the collection and disposal of sewage in the Island's public sewerage systems under the 1999 Sewerage Act. Manx Utilities operate 17 sewage treatment works, over 600km of public sewers and 72 sewage pumping stations.

2.7.4 In 2006/2007 a review was undertaken to ascertain the suitability of continuing the IRIS (Integration and Recycling of the Island's Sewerage) scheme to deal with the sewage produced by the remaining towns and villages not covered up to this point. The review concluded that given the advances in sewage treatment technology and increase in energy costs it would be more cost effective and sustainable to move to a regional treatment approach. The aim of this approach is to facilitate economic development and improve water quality through improvements to local sewage treatment works and the provision of first-time treatment at regional sewage treatment facilities. This was supported in Tynwald in October 2007[8].

[7] 1 mega litre (MLD) is equal to 1000 cubic metres
[8] http://www.tynwald.org.im/business/hansard/20002020/th17102007.pdf

2.7.5 The Regional Sewage Treatment Strategy (RSTS) phase 1[9] programme allowed for the steady progression of design, construction and commissioning of the new and replacement plant taking into account the differing timescales for planning approval, analysis and detailed design and construction at each location. Completion of RSTS phase 1 (May 2017) provides first-time sewage treatment for the Ramsey and Andreas catchments, in line with modern environmental and bathing water quality standards.

2.7.6 Manx Utilities continue to extend the public sewerage network, through adoption of sewerage infrastructure associated with new developments, and is also continuing to maintain and rehabilitate historic public sewerage systems on the Island. The RSTS programme is designed such that the Meary Veg sludge treatment facility is available to treat the sludge from all of these settlements and thus is of key importance to the success of the overall strategy.

2.7.7 The RSTS Phase 2 covers Peel, Laxey and Baldrine. Sewage generated in the Peel catchment is collected by the sewer network which drains by gravity to the Peel pumping station. The Peel pumping station was constructed in 2001 and pumps sewage against the high tide through a sea outfall to a discharge point in Peel Bay, located just to the east of the breakwater. Manx Utilities is working to provide a first-time sewage treatment solution for the Peel catchment, and first-time sewage treatment is also needed at Laxey and Baldrine. Works are scheduled for completion in 2021, subject to acquisition of suitable sites for sewage treatment facilities.

Current situation

2.7.8 The water supply infrastructure presently meets the Island's demand and capacity of the impounding reservoirs provides a level of resilience during drought conditions. The two water treatment plants were designed with the capacity to serve a population of 90,000 by 2021, assuming all systems remain serviceable. The water treatment works design capacity included an allowance for growth in water consumption, which has not materialised. Average daily demand for water over the past five years is fairly steady at approximately 28MLD (peaking at 37MLD), compared with a maximum combined water production capacity from both treatment works of 58MLD. The majority of demand for water is in the south and east of the Island, whereas the major water resource is in the north (Sulby reservoir). There is a transfer pipeline and pumping station to convey water from Sulby to West Baldwin reservoir, to maintain supplies to Douglas and the south during drought conditions.

2.7.9 In some areas there is limited storage capacity of treated water and/or water transmission capability in the event of a major unplanned supply interruption. This risk will become increasingly critical as the population grows.

2.7.10 In terms of the current needs of the Island for the treatment of continuous discharges of sewage from the public sewerage network, Manx Utilities is adequately meeting them or has investment planned. There are a number of projects which are either currently underway, or are planned to commence in the near future including:

[9] RSTS Phase 1 now provides modern day sewage treatment to the existing sewage treatment works at Booilushag, Bride, Corony, Dalby, Glen Maye, Glen Mona, Jurby, Kirk Michael, Maughold, Patrick and Port Lewaigue

- RSTS (phase 2) Peel, Laxey and Baldrine;
- upgrade of existing local sewage works at Ballaugh and Sulby; and,
- upgrade of existing local sewage works in the central valley, i.e. St. John's, Crosby, Glen Vine and Ballagarey.

2.7.11 Once these works have been completed, the Island's sewage will be treated at Meary Veg and within local catchments where practicable, which is in line with the regional strategy. Critical investment will continue to be required to ensure the future needs of the Island for sewage are met.

2.8 Telecommunications

Background

2.8.1 Telecommunications infrastructure has been growing in prominence for several decades, given its importance to business and for general communications. The growth of the internet has revolutionised many parts of our lives and in order to remain competitive, the Isle of Man must retain a reliable high quality infrastructure in this area. This requires substantial investment to be made by all providers to improve the business to business connectivity and better services which will assist with furthering economic growth.

2.8.2 The Isle of Man has advanced and diverse telecoms networks and services. Manx Telecom operates the fixed-line network, providing voice and broadband services, and a 4G mobile network. Sure also operates a 4G mobile network, and provides fixed-line voice and broadband services. Wi-Manx, Manx Telecom, Sure and e-llan Communications hold full telecoms licences. While BlueWave Communications, Continent 8 Technologies and Domicilium are licensed to provide internet-related services. Schedule 1 of the Telecommunications Act 1984 gives certain network operators the rights to install and maintain their apparatus on public and private land. Both Manx Telecom and Sure have been afforded these code powers.

2.8.3 In terms of fixed line broadband, to ensure provision is adequately meeting the needs of the Island's businesses and domestic customers, there are two components which need to be taken into consideration;

- capability of the delivery infrastructure (cables) (and improvements to); and,
- capability of the upstream capacities of the service (and improvements to).

2.8.4 There are currently five off-Island fibre cables – Vodafone (UK – Isle of Man – Ireland), BT (UK – Isle of Man – Ireland) and e-llan Communications (UK – Isle of Man). The obsolescence of the e-llan Communications cable is included in Appendix 4. Further clarification is required to understand the obsolescence of the Vodafone and BT cables. The Island's telecommunications infrastructure uses fibre optic cables, supplemented by copper cabling where fibre is not available. Fibre optic cables have many advantages over copper cabling including faster transmission speeds, less signal loss, less electromagnetic interference and longer life. The Island still uses copper cabling for areas where fibre is not available. However, it may be advantageous to encourage all new developments to include provision for fibre directly into the properties to further enhance the services they can receive.

2.8.5 Services being delivered will be limited by the upstream capacity of the service, so it is essential to ensure there is adequate bandwidth to deliver more data per second. Currently, there is a limit to the information superhighway systems which are limiting the capacity of the broadband offering. However, e-llan Communications has recently undertaken an infrastructure refreshment with substantial investment on its infrastructure to provide up to 100 GB service, or multipliers thereof, to other licensed operators. This is an improved broadband offering with further investment upstream. e-llan Communications has also invested in building new products which will assist in servicing the commercial sector, and will enable others to use them to further enhance their service offering. This improved connectivity will assist with driving the economy, and the Island's prosperity, making it a more attractive location for businesses seeking to relocate to.

Current situation

2.8.6 The current provision of telecommunications services across the Island could be greatly improved with substantial investment by the providers in order to ensure the demands of all current and future business and domestic customers are being met. Both the upstream capacities and the delivery through the cables need to be enhanced.

2.8.7 While there may be some more rural locations where access to high speed broadband is limited, it is probable that demands for these services can be met by the Island's providers, but there may be cost implications for both the providers and users in order to do so.

2.8.8 The Isle of Man is committed to ensuring that the telecommunications network is operating at a level sufficient to meet the needs of both business and residents. This is recognised in the Programme for Government which included the statement to ensure that "we are a digital Island, ready for new technologies like 5G so we remain competitive now and in the future". This is enhanced with an action to consult on a minimum 10mb universal service obligation for broadband. A more aspirational target will be needed in future to increase this minimum obligation for broadband to be in line with targets in Europe.

2.8.9 The importance of telecommunications to the vitality of the Island has been recognised, and as such, a Council of Ministers sub-committee has been established.

2.9 Summary

2.9.1 The audit of the Island's infrastructure has shown that while the current provision may presently meet much of the Island's strategic economic and social needs, there are improvements and enhancements to both the delivery and upstream capacity which would significantly advance the services available.

2.9.2 The Island's infrastructure providers will keep the capacity and performance of their assets under review, and will, where appropriate, work to identify any gaps in their service provision. Many of these short term projects are already either underway, or are being planned for in the near future. Where there are any known future deficiencies these are recognised by the providers and plans should be in place to rectify these shortfalls.

3. Factors affecting the provision of the Island's infrastructure

3.1 Introduction

3.1.1 Whilst it is clear that the provision of infrastructure is meeting current needs there are a number of factors which will affect how we provide or what we provide in terms of the Island's infrastructure. These factors include the following:

- The Island's population and age structure;
- The spatial distribution of development;
- The economic situation of the Island;
- Climate change;
- Technological change; and,
- Meeting national and international obligations and regulations.

3.2 The Island's Population and Age Structure

3.2.1 The number of people living on the Island will have an impact on infrastructure. As will the demographic profile of that population as in some instances the age of those using the infrastructure may have to be taken into account in forward planning and design. It will also be important to give some consideration in this analysis of the rate of household formation and average household size which may impact but to a lesser degree on infrastructure requirements.

3.2.2 The Isle of Man Government carries out a regular census of population. The latest interim census was undertaken in April 2016. The results showed that the resident population of the Isle of Man stood at 83,314. This represented a decrease of 1.4% on the 84,497 population recorded in the 2011 Census. The number of private households increased by 0.5% between 2011– 2016. This has resulted in a continuation of the downward trend in average household size from 2.33 to 2.28[10].

3.2.3 However, the Programme for Government includes an objective to grow the economically active population and the Island's Strategic Development Plan which sets out the future development requirements up to 2026 has planned for a future where the population increases year on year to a total of around 93,500. This represents a total number of households of around 40,500.

3.2.4 In terms of the age profile of the Island's population the 2016 census data showed that the average age has risen by over a year from 41.1 in 2011 to 42.5. In that same time period the over 50 population has increased by 9% while the under 50 population has fallen by 8%.

3.2.5 This is coupled with falling birth rates on the Island which peaked in 2010 at 1,023 but have since fallen sharply to 758, the lowest number of births on the Island since 1987 and a 25.6% decline in the last six years.

3.2.6 These two factors indicate that the Island, like many countries, has an ageing population. This will be an important consideration when planning future infrastructure projects to ensure that the needs of that element of the population are met.

[10] https://www.gov.im/categories/home-and-neighbourhood/census/

Statement 2

The Department of Infrastructure will continue to consider the population of the Island and will consider how infrastructure may be required to change in order to meet any short term fluctuations and longer term changes in overall population.

3.3 The Spatial Distribution of Development

3.3.1 Alongside how many people and the age profile of those people it is also important to consider where those people live and work and the future spatial distribution of development. The Isle of Man Strategic Plan 2016 sets out the broad spatial development requirements up to 2026. This defines the Island's main settlements and directs development to occur within or in close proximity to these settlements.

3.3.2 In line with the Strategic Plan, the existing settlement hierarchy focussed on existing towns and villages will be the focus of any new development. This is important for the provision of infrastructure as it gives a level of certainty with regards to where future demands are likely to be located on the Isle of Man. Future reviews of the Strategic Plan will assess the settlement hierarchy and its ability to accommodate future growth. This will take into consideration infrastructure requirements.

3.3.3 The Island Spatial Strategy Key Diagram contained within Appendix 1 shows the key transport links which coincide with Strategic Routes and Secondary Routes and the settlement hierarchy they serve.

3.3.4 Future reviews of the Strategic Plan will assess the settlement hierarchy and its ability to accommodate future growth. This will take into consideration infrastructure requirements and sustainability criteria.

Statement 3

The Department of Infrastructure will continue to recognise the spatial distribution as set out in the Island Spatial Strategy of the Isle of Man Strategic Plan 2016 (or any update to this document) and will continue to monitor the impact on the Island's infrastructure.

3.4 The Island's Economy

3.4.1 The Island's economy relies on there being high quality, reliable and affordable infrastructure. Having this in place will enhance, retain and attract business to the Island. Being unable to meet demands or having an unreliable infrastructure will be a fundamental factor in business decisions regarding expansion or relocation. Therefore it is crucial to have the right infrastructure in place.

3.4.2 Alongside infrastructure which is important to business operations there is also a need to ensure that the infrastructure provided meets social needs as the Island needs to remain attractive to the working population.

3.4.3 Whilst it is impossible to predict precisely the future needs of business the provision of reliable high quality telecommunications will be essential. Given the constraints of being an Island and the future importance of data manipulation the cost of bandwidth and capacity required for the future success of the financial services

industry and also the burgeoning data and technology based industries on the Isle of Man is crucial. Whether this is delivered through cable, optical fibre, or microwave will be defined by technological requirements. It will be important to monitor what is likely to be required and develop ways of being able to deliver this. Coupled to this need is the ability to access a secure supply of energy. The audit of Island's infrastructure has already indicated that there could be improvements made by providers to assist with the delivery of enhanced telecommunication services whilst maintaining that security of supply.

3.4.4 There is also a need to consider the ability to access high speed data at home for both working and entertainment needs. It is likely in the future that data connectivity will be seen as a utility akin to water, electricity or gas. If the Island is to remain attractive and competitive economically it should provide for this need in order to satisfy the requirements of the working population.

3.4.5 How people work may also change on the Island in the future and as such the infrastructure requirements could change. It is expected that there will be more remote working away from the primary place of employment and a greater requirement for combined leisure, retail and working spaces. This could reduce traffic on the Island's roads during peak hours as there could be fewer commuters. Again this will be reliant on the provision of high quality reliable telecommunications.

3.4.6 Good transportation links across the Island are also very important in facilitating economic growth, for the efficient movement of people and goods. The Island's main roads have been designed to accommodate larger vehicles (albeit with a weight limit) facilitating the movement of large loads. It will be important to ensure that the strategic routes are maintained to be able to support these traffic movements in future.

3.4.7 As important as what happens on the Island is the ability to move people and goods to and from the Island. For both economic and social requirements the ability to access affordable and reliable sea and air travel remains a high priority for supporting the Island's community. Key travel routes to the UK remain London and surrounding airports, other UK major cities and regional centres as well as having a daily sailing between the Island and the UK.

3.4.8 Tourism is likely to remain an important element of the Island's economy and consideration may need to be given to what infrastructure might be required to accommodate this. This may include enhanced harbour and marina facilities to broaden the appeal of the Island.

3.4.9 In order to attract new business to the Island there may be a need to consider the ability to create clusters to attract new sectors. This may require the designation of zones with the necessary infrastructure supplied. Whilst it is clear from the audit of the Island's infrastructure that the broad strategic requirements are being met it may be there are individual sites which require infrastructure provision to support development. In such circumstances an assessment will be required as to the cost of the infrastructure needed, the resultant level of economic growth from the development, the overall viability of the scheme and how the proposal aligns to the overall economic growth strategy of the Island. Should it be determined after this assessment that there is merit in the provision of infrastructure then consideration

will be given by the infrastructure provider to meeting this requirement at no cost or a subsidised cost to the developer.

3.4.10 On occasions whereby a developer seeks Government assistance with the cost of infrastructure provision, they should prepare a business case / viability study outlining the costs of both the project and the infrastructure component. They should set out why they are seeking assistance with the cost and why they believe it warrants Government financial support. It should also clearly set out how the Island can benefit from their development, particularly any financial benefits. This should then be considered and a determination made as to whether it is possible to support their infrastructure requirements. There are a number of mechanisms which can be explored in order to seek contributions from the developers which are detailed in Appendix 3 of this report. It is likely that these mechanisms will be explored further under the Government's current review of planning.

Statement 4

When considering a request for assistance with funding infrastructure for development, consideration will be paid to the resultant economic benefits to the Island's economy in order to determine whether it is a scheme that could benefit from financial support. There may be occasions when the proposed provision of infrastructure will be of strategic importance to the national economy, and in those circumstances, consideration will be given as to how best to support the project. If it is determined not to support the project, the cost to provide infrastructure for that site will be met by the developer proposing the development.

3.5 Climate Change

3.5.1 The Isle of Man, like many other places, has started to experience the direct impacts from climate change. Predictions suggest that climate change will result in an increased occurrence of weather related events, such as more intense rainfall and increased threat of tidal storm surge flooding. Together with the predicted sea level rises, this could result in the Island being subjected to an increased likelihood and severity of coastal, river, and surface water flooding. Being an Island there is a long history of providing infrastructure to limit the impacts of flood events. This approach will continue in line with the agreed National Strategy on Sea Defences, Flooding and Coastal Erosion. It is also important to consider how the wider infrastructure takes future climate change impacts into account. This will either be in terms of how that infrastructure is designed or where new infrastructure is located.

Statement 5

The Department of Infrastructure recognises that climate change does, and will continue to have an impact on the Island, including an effect on the Island's infrastructure. Therefore, the Department will continue, where planned, to carry out mitigation or adaption works and will consider the impact of climate change for any major future infrastructure works.

Statement 6

The Department of Infrastructure will continue to invest in sea defences and in reducing flooding and coastal erosion risks for those areas identified as high risk in the national strategy on sea defences, flooding and coastal erosion 2016.

Statement 7

When an asset (such as Pulrose power station) is located within a known floodplain, or in an area of known flood risk reaches the end of its functional life, or if considerable investment is required to enable the continued delivery of service it provides, consideration must be given to its relocation to an alternative site out of the flood risk area.

3.6 Technological Changes

3.6.1 In recent decades extraordinary technological changes have penetrated into everyday lives. This includes advances in car technology, the ease by which household chores are now completed with increasing reliance on machines, the use of technology in the medical and research fields, the advancement of mobile technology (phones and tablets) and the internet of things[11]. Manufacturing sectors are changing to become more efficient using machines, and smart technology. The manner in which children are taught has changed, and these technological advances will continue to infiltrate our lives. Futurologists predict the reliance on technology will remain for future decades, and may become even smarter, and more integrated into our lives. As such, it is essential for the Isle of Man to continue to monitor these emerging technologies and the advances being made in all sectors to ensure it is best able to prepare and make full use of any opportunities to introduce them here.

3.6.2 Technology will not only impact on the demands for infrastructure but it will also bring about changes in the infrastructure itself. The Island's infrastructure providers continually monitor advances in technology in their sectors, and this should continue. As part of the regular review of the National Infrastructure Strategy, the Department will ensure there is information sharing about these technologies amongst providers in a collaborative manner. The Strategic Infrastructure Group as an association of Island infrastructure providers will continue to provide the platform to ensure there is ongoing collaboration in providing the most efficient infrastructure the Island needs.

Statement 8

The Department of Infrastructure will facilitate, through the Strategic Infrastructure Group, information sharing amongst infrastructure providers regarding advances in technology in all sectors to determine how best to prepare and optimise opportunities for the introduction of such technologies on the Isle of Man.

[11] The 'internet of things' is a network of internet-connected objects able to collect and exchange data using embedded sensors.

3.7 Meeting National and International Regulations and Obligations

3.7.1 One of the drivers for change in the way that infrastructure is provided or operated will be in relation to meeting both international and national obligations and regulations.

3.7.2 The obligation most likely to impact on infrastructure relates to reducing the contribution the Island makes to climate change. In recent years, Tynwald has approved a number of reports and policies relating to climate change. The most recent, "Greater efficiency, cleaner energy and resilient economy"[12] describes the sectors in which it is believed greenhouse gas emissions can be most significantly reduced between now and 2050. The first of a series of 5 year action plans is included within the Strategy, which will start the Isle of Man on the path to delivering Tynwald's 2050 target of reducing greenhouse gas emissions per person by 80%, compared to 1990 levels.

3.7.3 This report follows on from a May 2015 Report by the Council of Ministers setting out "Policy on Sustainable Development and Mitigating Climate Challenges"[13]. The report agreed a number of policies, the one most relevant for the National Infrastructure Strategy is "to deliver the agreed scale of emissions reduction, it will be necessary to ensure that total greenhouse gas emissions from electricity generated on Island will be close to zero by 2050". Achieving this policy would assist in meeting the near zero emissions targets.

Statement 9

The Department of Infrastructure will continue to monitor any legislative requirements to reflect the enactments of its international and national obligations.

3.7.4 Summary

3.7.5 Whilst there is uncertainty with regards to the future it is possible to identify the broad factors which will influence infrastructure provision in the future. As stated in the overarching principle the Department is committed to look to the future and to monitor these factors on a regular basis to ensure that the providers of infrastructure are able to consider, plan and react to any changes.

[12] https://www.gov.im/media/1354417/a-climate-challenge-mitigation-strategy-2016-2020.pdf
[13] https://www.gov.im/media/1349306/policy-on-sustainable-development-and-mitigating-climate-challenges-comin-report.pdf

4. What is likely to impact the Island's infrastructure in the future?

4.1 Introduction

4.1.1 All of the factors detailed previously are likely to have some direct or indirect impact on the identified elements of the Island's infrastructure. It is possible at this stage to provide some level of prediction as to the likely scope of some of these impacts. The Island has benefitted over the years from the ability to have considered some of these factors, for instance population change. This means that in many areas consideration has been given to future requirements already and this has been factored into future work programmes.

4.2 Highways

4.2.1 The main drivers for change for the Island's road network will be changes in population (including population size, the distribution of population and increased congestion that could result from that) and to a lesser extent, the demographics of that population (particularly if it is an ageing population). Highway designs are evolving taking into account the requirements of older drivers (such as improved markings and signage, improved junctions and intersections).

4.2.2 In striving to meet national obligations in relation to climate change, particularly the manner in which vehicles could be operated (for example, autonomous vehicles), there could be implications for highways. Autonomous vehicles will drive along the same track which will eventually wear away the surface at that point. Additional infrastructure is required along the route to ensure the technology can interact with the autonomous vehicles, so highways need to be designed to accommodate this. There may be a modal shift or changes in working patterns, thereby reducing congestion and extending life of roads due to accommodating a much lower capacity that it was designed for.

4.2.3 Technological changes and advances could account for a partial modal shift in terms of both the types of cars, as mentioned above, or as an alternative to the conventional means by which goods are transported. If deliveries by flight are introduced on a wider, commercial scale, it could render the way in which today's deliveries are handled, further reducing traffic on roads. Whatever technology is developed it is likely that people will still need to move around the Island and that this will only be possible through ensuring that this occurs in a controlled manner possibly via designated corridors. Therefore whether there are cars, rapid light transport or some other means of moving between places the highways and the railways should be viewed as crucial corridors to facilitate this.

Population Growth in accordance with the existing settlement hierarchy

4.2.4 The biggest impact on highways is likely to be changes in population (both overall level and distribution). If there is an increase in population then car usage is likely to increase. If this is linked to a period of economic growth the effect is greater as this is likely to result in increased car ownership. Increase in car use will cause additional stress onto the network. Initial work to forecast the effects of this have been carried out to support the preparation of the Isle of Man Strategic Plan. This work assumes a level of growth consistent with the identified settlements and determines how the highway network would react to that growth.

4.2.5 A report first commissioned in preparation for the 2007 Strategic Plan and revised for the 2016 Plan shows that the following junctions would be the most impacted on as a consequence of additional housing;

- Quarterbridge;
- Mountain Road / Governors Road;
- Glencrutchery Road / Victoria Road;
- A5/A7 junction Ballasalla; and,
- Parliament Square Ramsey.

4.2.6 The 2007 JMP Report predicted a general increase in traffic of 6.8% and 9%. This traffic growth was attributed to the housing allocations within the Strategic Plan from 2006 – 2016. This would result in an overall increase in traffic growth of 15.8% by 2016. A route assessment on each of the roads was undertaken and this identified congestion usually arose at road junctions rather than on the links. The average capacity of a one lane in each direction single carriageway road is typically 3,600 vehicles per hour and significant congestion typically occurs when the traffic flow exceeds 85% of this capacity. The report concluded that the link flows on the strategic links were less than 3,060 vehicles per hour in each direction and the Quarterbridge and Governors Hill were identified as the only two locations on the defined strategic links at which traffic flows were presently regularly greater than 85% of capacity[14].

4.2.7 The revision of the data for the 2016 Strategic Plan showed that:

- the traffic growth forecasted previously in 2007 had not occurred;
- the strategic links are, and should continue to operate within their 3,060 vehicles per hour capacity (85%) up to 2026 (duration of the Strategic Plan); and,
- the Quarterbridge and Governors Hill junctions continue to operate at greater than 85% capacity and the increased traffic flows predicted in all the assessments will increase congestion at these locations.

4.2.8 This shows that currently, the Island's needs for road transportation are currently being adequately met and are likely to be met to at least 2026. In terms of road infrastructure (road and junction capacities), there is acknowledgement that some of the main junctions (Quarterbridge, Mountain Road / Governor's Road and Glencrutchery Road / Victoria Road) experience regular traffic congestion during peak hours. Whilst drivers may suffer some congestion and delay at these junctions, these junctions are still able to accommodate this level of traffic, and there is some spare capacity to accommodate more traffic. Should the population of the Island increase, improvement works may be required to upgrade these junctions to accommodate additional traffic. This assumes that the car will still be the most used form of transportation, that commuters will still be travelling through these junctions into Douglas at peak times to work, and that the roads remain the main arterial routes in and out of Douglas.

[14] https://www.gov.im/media/1348723/the-draft-isle-of-man-strategic-plan-2015-paper-3-future-housing-requirements-recommended-policy-change.pdf

What may be required in the future to address this change:

- improvements at existing congested junctions if required (either in response to population increases or increased traffic or decreasing levels of driver tolerances[15]).
- the consideration of improvements to the existing TT access Road to make it 2 way or the development of a new TT access route to ease congestion on the existing one during the TT races (depending on the location of a second access road, it could assist with opening up land located within the course); and,
- the introduction of park and ride schemes to offer as an alternative mode of travel for commuters to help ease congestion should population numbers continue to increase / traffic growth / a decrease in driver tolerance at congested junctions.

Demographics - the ageing population

4.2.9 As the population ages it will be important to consider how people move around the Island. It is essential for the older people's well-being that they remain well connected to vital services and also social networks. There is likely to be an increase in lone living in this sector and therefore an increased need to leave the house for social interaction.

4.2.10 Much of this requirement will likely be met by the Island's public transport and there is acknowledgement that the bus service across the Island may be the only means of transport for a lot of people. The continuance of this service is essential for these people. The DOI is working on a socially inclusive project, Demand Responsive Transport, to assist the community living in rural areas in the north of the Island to access onward travel from Ramsey. The software to assist with this is currently being developed and a small number of tests have been carried out. It is hoped that the service will collect passengers at their properties which are either not close to bus stops or within rural areas which are not currently served by a regular bus service. There is a commitment in the Programme for Government to "Put a demand responsive transport service into place". Should this prove successful it is envisaged that this model will be used across the Island.

4.2.11 In the longer term it may be appropriate to consider the needs of the ageing driver so that individuals retain their personal mobility to later on in life. This will include factors such as highway design as well as parking and other facilities to accommodate the older driver.

Technological changes

4.2.12 There are number of advances in technology which will impact on highways in the future. These emerging technologies could further enhance future journeys.

[15] Driver tolerances on the Isle of Man may be lower than those in the UK, where drivers are regularly accustomed to longer waiting and queueing times during their journeys. As such, while there may be some level of congestion experienced at a number of junctions on the Island, they are proportionate to the population / traffic on these roads, which are still operating within their design tolerances.

4.2.13 As with all forms of technological advances, there is an element of consumer choice / behaviour and price which will impact on their uptake. As a Government, it is possible to somewhat influence choice by providing subsidies or tax incentives for such schemes, but it is likely that there will be limited opportunities to do this.

4.2.14 The ability to facilitate the introduction of electrical vehicles including automated or autonomous vehicles across the Island (and the necessary infrastructure required to support this) will likely be required in the future. However greater clarity is required on how this will be accommodated.

Reaction to the obligation to meet Carbon Reduction Targets

4.2.15 In order to meet the Tynwald approved carbon reduction targets there will be a requirement to investigate how people travel around the Island and attempt to encourage a modal shift from the use of the private car to other forms of transport.

4.2.16 The future for the use of the highway is likely to involve more active travel and the Department is currently preparing a strategy for this. This could be coupled with increased usage of public transport which will either carry people for their entire journey or be used as an intermediary between more active forms of travel.

4.2.17 Both using active travel and increased use of buses may have an impact on how highways are designed and the life of this asset.

4.2.18 There is also a likelihood that there will be a move towards different ways of fuelling vehicles to remove the dependency on fossil fuels. This could include the consideration of the replacement of current stock of buses for "green" buses (either electric or fuel cells when they become more affordable / competitively priced) or possibly the development of a tramway / light rail system either as an alternative option for public transport or to supplement the existing rail service (any such developments would aim to use either existing tracks or previously used railway corridors e.g. Douglas to Peel).

4.2.19 In the shorter term it is likely that there will be the wider promotion and provision of incentives for the encouragement of uptake of electric vehicles for private and commercial uses (such as the wider accessibility to vehicle charging points across the Island, access to a favourable electric tariff or other financial incentives if they can be provided). Currently, annual car tax for electric cars is charged at a much reduced rate, and the DOI is hoping to review this further in the near future.

4.3 Ports

4.3.1 The most likely driver for change at the Islands ports, harbours and airports is the on-Island economy. Off Island travel is essential for economic success whether it is bringing goods to and from the Island, people flying for business or those coming to visit the Island on holiday there is a need to be able to accommodate this.

4.3.2 Recognising the strategic importance of Douglas Harbour in particular, the Department of Infrastructure is considering a number of options for further improvements to Douglas Outer Harbour which will provide more economic development opportunities. This will form part of the Harbours Maritime Strategy which is currently being prepared.

4.3.3 There is a commitment in the Programme for Government to "Prepare a Harbours Maritime Strategy for the Island to include the exploration of the feasibility for a deep water berth and the ability to bring forward a non-tidal marine by end 2026". This report will consider each of the Island's harbours in terms of their constraints and opportunities / aspirations which could be realised at each harbour in the future. In terms of Douglas this will also consider the future infrastructure to ensure it remains fully operational. This may require a significant level of investment in the future.

4.4 Energy

4.4.1 The factors most likely to impact on the Island's energy supply in the future are the Island's population and age structure, the spatial distribution of that development, technological change and meeting national and international obligations and regulations.

Population Growth and Spatial Distribution of that Growth

4.4.2 Whilst it is likely that all the energy providers will be able to supply a growing population researchers have suggested that future electricity demand could double or treble with the changes in our lifestyles and the environment (particularly if the substitution of fossil fuels is to be pursued)[16] [17]. It is possible to mitigate against these increased demands by introducing measures such as new tariff structures, demand reduction incentives and nurture changes in customer energy behavioural patterns.

4.4.3 There are other measures which could assist in addressing any increased demand. These include smart metering, the offer of attractive cheaper overnight tariffs for electricity to reduce the demand during peak times, increasing excess electricity storage capacity. There is also the ability to use demand side response where customers are incentivized financially to lower or shift their electricity use at peak times. This will help manage load and voltage profiles on the electricity network[18].

4.4.4 With an increasing population and a demand for more land to be developed there is a need to consider the impact of that new development on the existing infrastructure. Given the importance of our strategic infrastructure, and the need to protect it, a safety buffer area is enforced in the area key assets. These should be respected should any developments be proposed in close proximity to them, (including over or under), as these are of strategic importance.

4.4.5 Manx Utilities has proposed that buffers to be applied for Manx Utilities electricity assets on virgin development land - details of this are included within Appendix 2.

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[16] http://www.energy.manchester.ac.uk/research/climate-change/resnet/

[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486362/Towards_a_smart_energy_system.pdf

[18] http://innovation.ukpowernetworks.co.uk/innovation/en/research-area/demand-side-response/

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In circumstances where development works are proposed within close proximity to strategic infrastructure assets, regard must be paid to the protective buffers associated with each of these assets to ensure they are not compromised during building works. Early consultation should take place with the owner of the asset.

Technological Change

4.4.6 A significant transition to technologies such as electric vehicles, heat pump technologies and additional data centre growth will create an increase in demand for electricity. Manx Utilities anticipate the effects of the latter could come into effect from 2020 with moderate growth forecast until 2035. This modest demand growth is envisaged to be comfortably accommodated without requiring any major expenditure on transmission/distribution network reinforcements.

Meeting national and international obligations and regulations including emissions targets

4.4.7 If the Island wants to actively pursue the Tynwald commitment to ensure that total greenhouse gas emissions from electricity generated on Island will be close to zero by 2050", action will be required. However it is acknowledged that de-carbonisation of electricity generation will be an expensive option given the hundreds of million pounds of investment already made in new generation capacity, power cable and gas pipeline infrastructure. A more cost effective option could be to focus on reducing the carbon content of the heating and transportation sectors on the Island given the significantly shorter asset life/replacement cycle of conventional boiler systems and motoring vehicles. This would provide time for the development of more price competitive renewable/energy storage systems, evaluate the impact of co-mingling bio-methane within the natural gas feedstock for the combined cycle gas turbine (CCGT) and eventually considering steam reforming to convert natural gas to hydrogen as an initial step to developing a hydrogen fuelled economy.

4.4.8 There are a number of renewable energy technologies which could be used to generate the Island's energy including onshore and offshore wind power, solar panels, biomass, tidal arrays as well as other hydro schemes at rivers and dams (including using rainfall). More green electricity could be generated by renewable means firstly to offer customers the choice of purchasing green electricity, and secondly, to begin to contribute towards a reduction in fossil fuel electricity generation, and sell the resultant green energy to a larger customer base. Consumers are becoming more and more conscious of what they purchase, and many may prefer to buy green electricity over conventional generation should that be available to them, although this needs to be evidenced by strong customer interest which currently is not being demonstrated.

4.4.9 Estimates for the implementation of renewable energy generation have been considered as part of the evidence gathering exercise. These scenarios include provision for the failure of two elements of the supply chain in order to deliver approximately 80MW power, as required by the Island's demand. It should be noted however that these estimates are based on the current electricity demand of

approximately 80MW[19], and if current demand continues, there will still be an oversupply.

4.4.10 In terms of petroleum, capital investment may be required if the Island continues to import its transportation fuel from the UK if the UK market implements the EU Directive regarding bio-components in road fuel. Consideration will need to be given to the future transportation of fuels in relation to the importation and distribution should fuel continue to be purchased directly from the UK.

4.4.11 The UK has a Renewable Transport Fuel Obligation which sets out that the UK will meet 10% of its transport fuel by renewable means by 2020 and likely achieve it using E10 (a fuel composed of 90% petrol and 10% bioethanol). However, there are issues with its volatility. It is generally best to blend all fuels at the refinery but petrol containing Ethanol cannot be shipped through multi-product pipelines. It may be more appropriate for the Island to blending at the terminal, where the road tankers are loaded. Although this adds cost, it is the lowest risk option as it minimises water pick-up and exposure of the fuels distribution infrastructure to ethanol.

4.5 Waste

4.5.1 The Department is committed to preparing an Island Waste Management Strategy by April 2018 and this will give a clearer indication for how waste will be dealt with in the future. The factors which are most likely to impact on the Island's waste infrastructure are changes in population and the Island economy which will directly affect both the amount of waste produced but also the type of waste. However the biggest factor that will drive change in this sector will be compliance with national and international standards or regulations. This will especially relate to the transfer of waste, the meeting of emission targets or adherence to environmental standards. These changes will in turn drive technological changes as the industry across the board aims to meet the changing standards.

4.5.2 By aiming to meet these national and international obligations there will be a requirement to explore alternative ways to deal with waste products by:

- the increased development of/use of (strategic or local regional) processes for biodegrading organic wastes streams (food, sewerage, farm waste, industry wastes such as hops/creamery waste);
- the primary dismantling of electronic goods to recover higher value parts for sale – although this may only apply for lower value electrical goods and the higher end market is moving to recycle by design/closed loop where parts can be disassembled for refurbishment and reuse; and,
- more investment in research and development for use of locally sourced products such as wood, secondary aggregates, and the wider use of recycled materials in the construction process.

4.5.3 In addition to these possible initiatives should it be determined that the Energy from Waste plant should cease operation at the end of its current contract (August 2029), there are a number of options which could be considered. Decisions would have to take into consideration the relevant standards and obligations in operation at that

[19] The MW demand is indicating the fastest rate at which electricity is being consumed

time. It should be noted however that the Plant can continue to operate beyond the 2029 date with regular maintenance and repair works.

4.5.4 Future options for dealing with the waste including that which is currently dealt with at the Energy from Waste Plant include:

- export as refuse derived fuel (RDF) - based on current legislation and assuming trade in RDF is still permitted, the Island would need to invest in materials recovery facilities to remove recyclable materials from the waste stream prior to export. Investment may also be needed in segregated organics collections;
- develop alternative facilities which could include pyrolysis or gasification. This technology is as yet unproven long term;
- implement and fund an Island wide policy shift towards waste minimisation, reuse and recycling – this would require substantial investment in infrastructure and encourage local industry to utilise materials recovered from waste stream (although there would still be material which could not be reused or recycled) there would still be a requirement to deal with residual waste; and,
- the application of a disposal levy on items such as cars, packaging/goods that cannot be disposed of on island to assist with the funding of their export/end of life management of those goods. The Isle of Man Government cannot access the current producer responsibility scheme in the UK and Europe or seek to pay/negotiate with the UK to access their compliance schemes.

4.5.5 The Department is committed to exploring ways to deal with the Island's problematic waste, which includes harbour dredging, whilst still fulfilling its statutory obligations. There is a fine balance between meeting the social and economic needs of the Island in relation to the Island's harbours and marinas, whilst ensuring the Island's maritime environment is protected and not exposed to harmful wastes.

4.5.6 As part of the Peel harbour and marina dredging exercise in 2014, a site at Rockmount near Poortown Quarry was used as a temporary storage facility for the dredged material. A series of engineering measures were put in place to control any potential risk to the environment. The DOI has entered into a covenant with German Parish Commissioners to restrict use of the site as a silt store to no longer than five years.

4.6 Water and Sewerage

4.6.1 Most likely to impact on the water and sewerage infrastructure is the changing population and spatial distribution of this and meeting national and international obligations and regulations.

Population Growth and Spatial Distribution of that Growth

4.6.2 The Island's population and where it is located will have an impact on the water and sewerage infrastructure. There are already identified risks in the resilience of the water supply should the population increase. This may result in the need to increase the storage capacity of our water to plan for a major unplanned supply interruption to accommodate such growth.

4.6.3 In broad terms, the spatial distribution of growth up to 2026 can be accommodated by the current water and sewerage network and Manx Utilities will continue to engage with the Development Plan process in terms of more detailed allocation of land for development.

4.6.4 It may be necessary to investment in the pipeline transmission and distribution systems depending on the location of new housing/industrial development zones. Similarly, any new high demand industry (e.g. food/drink manufacturers or industries with high flow requirements for fire-fighting purposes) is likely to require some system reinforcement. If the frequency and severity of extreme weather events increases, resilience will decrease, possibly to unacceptable levels.

4.6.5 There is an acknowledgment that there is limited capacity at Meary Veg for additional waste although additional headroom can be created with a modest investment in operational upgrades, and this will provide capacity for residential and domestic waste.

Meeting national and international obligations and regulations

4.6.6 In addition to the impact of any population increase on the Island's sewerage provision, there is the reputational aspect of the Island's compliance with EU bathing water directives to be considered[20]. At the March 2016 Tynwald sitting, it was resolved that '…*Tynwald is of the opinion that the EU Bathing Water Standards of 2006 should be considered as an objective to bring the Island into parity with neighbouring countries for the protection of public health and in particular for those who wish to use the Island's beaches and bathing waters for recreation.*'[21]

4.6.7 Further investment is likely to be needed to improve intermittent discharges from public combined sewer systems (e.g. from combined sewer overflows and emergency overflows), which may have an effect on achievement of these standards. There are other sources of pollution (e.g. industrial waste, farm run-off, leachate) which may influence achievement of bathing water quality standards at the beach water sampling points. There is limited headroom at Meary Veg for 'strong' (i.e. high biochemical oxygen demand) business or commercial waste 'trade effluent'. Should there be occasion for significant additional industrial waste to be disposed of through the public sewerage network, Meary Veg may struggle to accommodate it. Sewerage catchments served by local and new regional treatment plants do not have the capacity to treat significant additional quantities of trade effluent.

4.6.8 There are currently limited operational plans to improve or increase the provision at Meary Veg, although there is land adjacent to the treatment works which could be used to extend the treatment process if necessary. There is currently no charge for trade effluent, however there may be a need to consider the option to charge for trade effluent in the future ('polluter pays principle') to incentivise the pre-treatment of strong trade effluents, and to recover the additional costs of treating non-domestic sewage[22].

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[20] For further information, see https://www.gov.im/about-the-government/departments/environment-food-and-agriculture/isle-of-man-government-laboratory/bathing-water-quality/

[21] http://www.tynwald.org.im/business/hansard/20002020/t160315.pdf#search="EU Bathing water"

[22] https://www.manxutilities.im/media/1273/manx-utilities-cromwall-energy-report-review-of-charging-regimes_final.pdf

4.7 Telecommunications

4.7.1 The provision of high quality, reliable and affordable telecommunications infrastructure will be crucial to developing the Island's economy. As such there will be a need for the telecommunication provision to be both up to date and quick to react to business needs. As highlighted earlier in this document, the future demand for high speed data in the home will be seen as a utility akin to water electricity or gas and this will need to be taken into consideration in the future planning of the Island. This is likely to lead to a need to increase the provision of Wi-Fi connectivity and speed / download capacity of Wi-Fi across the Island as well as increased uses of telecommunications in the commercial sector.

4.7.2 Island providers will be following the global advances being made in relation to the 5G technology, and could consider the possible implementation of a 5G wireless network across the Island if the technology and installation is financially viable for them to do so. The implementation of such a 5G high speed wireless network around the Island will increase the speed at which data can be transferred, increase the capacity for download and increase the connectivity of devices. It may also facilitate the wider development of the internet of things which is estimated to consist of 50 million objects by 2020[23]. The 'internet of things' is a network of internet-connected objects able to collect and exchange data using embedded sensors.

4.7.3 However, the roll-out of a 5G network around the Island will require substantial investment from the providers. It will require additional transmitters and receivers to be installed Island wide, and will also rely on the goodwill of many landowners and property owners in order to do so. Market forces will also impact on the delivery of 5G, both in terms of consumer behaviour to pay for it, but also, should one provider pursue the implementation of 5G, it is then likely that others will follow.

4.7.4 Fixed line broadband is also essential to the Island's economy. The offer of better, affordable services and improved connectivity from business to business is essential to economic growth.

4.7.5 In terms of aspirations in this sector, the Programme for Government identifies the following in relation to telecommunications–

- ensure we are a digital Island, ready for new technologies such as 5G, so we remain competitive now and in the future;
- set out a more active role for the Communication Commission in the pricing and quality of our telecoms provision;
- continue our drive to transform Government services through the use of digital technology;
- introduce new legislation for national telecommunications which creates a more effective regulatory framework in this area;
- consult on a minimum 10MB universal service obligation for broadband; and,
- continue to support the Digital Strategy.

4.7.6 Adequate telecommunications are also required to assist with any developments for connected and autonomous cars (which can use mobile phone networks or via smartphones to communicate between cars and / or pedestrians and other emitters

[23] http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

of information for example, speed limits, weather conditions, traffic updates as well as the detection of pedestrians from autonomous cars or incorporating telecommunications into infrastructure to assist with the vehicle-to-infrastructure and vehicle-to-vehicle controls). This assumes that there is Island wide coverage for telecommunications, and that there are no areas without coverage. This will require a legal and regulatory framework to ensure there are adequate controls over things such as data protection, privacy, sharing, and data ownership. Estimates suggest that the growth in data transmissions as part of connected vehicles could be as much as 12% annually until 2030[24].

4.7.7 With the advances in technology and telecommunications being used in almost every sector of our lives, it is essential that there are provisions in legislation to protect us all against cybercrime. There are elements of cybercrime which we experience already for example the hacking of email accounts, online fraudulent transactions as well as phishing scams. With the growth in the use of telecommunications globally, and with technological advances and moves to using Big Data for companies[25], it is essential to implement safeguards to protect all users. There will be more information generated by everyone through the increased use of electronic devices and this information must be protected. The UK National Crime Agency[26] has produced some guidance on cybercrime based on current usages of data. This will need to be further advanced to address protection of big data in the very near future.

4.8 Summary

4.8.1 All elements of the Island's infrastructure will be affected by future changes. Some of these impacts are easily determined and managed. However the future is unpredictable and as such the Department will continue to monitor and assess both the drivers and the possible impacts of change. This work will be shared collaboratively with the infrastructure providers through the Strategic Infrastructure Group. By working in this way all providers will be working towards a common future and any best practices, synergies and unintended consequences can be addressed. While attendance at the Strategic Infrastructure Group is currently voluntary, it may be appropriate to consider it becoming more of a formal requirement, particularly in relation to the telecommunications sector to ensure there is appropriate representation and a collaborative approach is pursued for future developments.

4.8.2 Such consideration is likely to involve the development of scenarios to test the provision of infrastructure against a range of possible futures. These possible futures will include looking at a range of different growth scenarios for the Island and ascertaining how the infrastructure will react in various different circumstances. It will be important to consider the time it takes for the Island's assets to be able to react to any significant changes and this will also be included in the development of the scenarios.

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[24] https://www.smmt.co.uk/wp-content/uploads/sites/2/CRT036586F-Connected-and-Autonomous-Vehicles-%E2%80%93-The-UK-Economic-Opportu...1.pdf

[25] Every day, 2.5 quintillion bytes of data is created. This data comes from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and cell phone GPS signals to name a few. This data is big data (https://www-01.ibm.com/software/data/bigdata/what-is-big-data.html)

[26] http://www.nationalcrimeagency.gov.uk/crime-threats/cyber-crime

5. The role of maintenance and obsolescence and how infrastructure is funded

5.1 Obsolescence

5.1.1 Whist the future may change what infrastructure we require, where we require it and how we operate it a major influencing factor in infrastructure provision is obsolescence of the Island's key assets. An overview of the infrastructure is included in Appendix 4, which includes average design life for each asset. Where possible, estimates remaining of the design life for each asset have been included as well as approximate years when the assets become obsolete.

5.1.2 As existing infrastructure ages, elements or systems may become no longer suitable for delivering current requirements. Obsolescence may occur due to various reasons either singly or in combination including, but not limited to:

- failure of non-replaceable components;
- changes in regulatory environment or legislative changes for example international rules on Health and Safety in addition to pollution;
- lack of sustainability – too expensive to maintain or operate, raw commodities are no longer available, environmental concerns;
- changes in demand so original design criteria are no longer appropriate - population size and proportion of aged, commercial development, severe weather / climate change, changes in the wider world;
- change in technologies – potential change of energy source from fossil fuels to electricity generated from green energy, move from landlines to mobile connections for telecommunications, the increased use of telecommunications into all aspects of daily lives;
- changes in the transportation of raw materials – this could change depending on the manner in which the transport industry moves to reduce reliance on fossil fuels in reducing emissions. It could also change depending on the source of the materials and where the production is going to take place. There have been shifts in recent years which have seen many manufacturing plants move to areas where they can obtain cheaper labour forces. This trend may continue particularly if the products being manufactured are significantly different to those produced today;
- changes in manufacturing and production – as technologies change, the way in which products are manufactured could change. There will be less reliance on the large scale production lines, and it is likely that there will be a growth in precision engineering and more skilled assembly. This could include the assembly of advanced robotics, which could then replace some of the current workforce; and,
- a change in global and local politics and the impact of these regimes.

5.1.3 Financial sustainability is threatened by increasing maintenance costs with age and increasing operating costs. Operating costs may escalate significantly due to increased regulatory (and legal) requirements along with energy costs. Acceptable environmental standards appear to be increasing with time and this is likely to require modifications to infrastructure assets and their operation to ensure continued compliance. Some of the modifications may not be feasible or affordable and therefore, total replacement may be the only available option.

5.1.4 Obsolescence can create significant issues not only of replacement but also in relation to decommissioning, demolition and land use (old and new sites). It should

be considered not only in relation to existing infrastructure but also with 'new build' when it should form part of full lifecycle costing.

5.1.5 Key infrastructure required

5.1.6 The table of the obsolescence of strategic assets (as included within Appendix 4) sets out the average design life of each asset as well as the life remaining in that asset.

5.1.7 There are a number of projects which are already being considered for future works including the replacement of Pulrose Bridge (scheduled for 2019) and coastal and fluvial flood works. Other notable dates include the CCGT plant (estimated design life until 2035, but with careful management, could be 2050); Meary Veg (2039 although the available capacity will be carefully monitored until this date) and the process elements of RSTS 1 and 2 (2039 – 2045). Regard must be paid to the current operating and maintenance contract at the Energy from Waste plant, as any amendments to that will have consequences for the Island.

5.1.8 All of the Island's infrastructure providers are working to ensure the design lives of their key assets are realised. They will all continue to monitor and manage their assets to ensure they achieve the best value for money in line with the overarching principle of this Strategy. For any future works, the providers will continue to review emerging technologies and consider any as part of the project design. There may be occasions when these advancing technologies may be the most cost effective option, not necessarily the cheapest. However, it may give an option to increase capacity, carry out its function in a more economical manner, and may be more adaptable to future requirements than other technologies.

5.1.9 Financing the Island's Key Infrastructure

5.1.10 Providing enabling infrastructure works can be very costly. While there are some statutory obligations which requires Government to provide specific infrastructure, there are instances when the infrastructure is required for private sector commercial reasons. In those circumstances, it would not be unreasonable to expect a developer to cover some or all of these costs associated with providing it, rather than by Government. Levels of Government capital investment have been falling over recent years; from £100 million per annum[27] to around £60 million at present. Across industrialised nations, levels of Government capital investment have fallen as greater leverage is made of private sector investment. The challenge for the Isle of Man up to 2050 is to develop and consider alternative models for funding capital investment to leverage private sector funding. Regulation and commissioning of these investment projects then becomes key skills which Government must possess to ensure that it drives maximum value for money in its negotiations with the private sector.

5.1.11 There are a number of mechanisms which can be explored in order to seek contributions from the developers which are detailed in Appendix 3 of this report. It is likely that these mechanisms will be explored further under the Government's current review of planning.

[27] Including Statutory Boards and Local Authorities

5.2 Funding of Government Infrastructure

5.2.1 There will continue to be a need for Government to invest in the provision of the Island's infrastructure. Government also acknowledges that for the provision of future infrastructure, it should:

- undertake routine maintenance and ensure the smarter use of assets;
- ensure there is sufficient funding available to support the required monitoring and maintenance programmes for each of the Island's strategic assets;
- review any stress points in networks and take corrective action to ensure these stresses are alleviated; and
- consider that significant investment in new or replacement infrastructure should only be agreed where it forms part of a clear long term strategy, is affordable and where maintenance or small scale investment will not meet future need.

5.2.2 There are also occasions where there is a need for the private financing of infrastructure projects, either by the providers in order to enhance the service they provide such as Manx Gas, Manx Telecom or Sure (amongst others), or by private developers wishing to develop sites for commercial ventures. The Isle of Man Government expects commercial developers to continue to be significant providers of a project's equity, and fund the provision of new infrastructure to the site.

Statement 11

Prior to the commencement of works within close proximity of strategic infrastructure assets, the infrastructure provider will be notified.

Statement 12

There may be occasions when the proposed provision of infrastructure will be of strategic importance to the national economy, and in those circumstances, the consideration will be given as to how best to assist the project.

6. Conclusions

6.1.1 This work has shown that, for the most part, the Island has an infrastructure to be proud of. The key assets have been designed to withstand future change and have been (and will continue to be) maintained to an appropriate standard so that they are meeting both current needs and in some cases future requirements. The infrastructure of the Isle of Man works to provide businesses and communities with all they need to flourish.

6.1.2 This has been achieved through individual infrastructure providers making appropriate decisions based on information known to them about the future. This understanding has often been enhanced by numerous strategies prepared by Government which look to the future.

6.1.3 Going forward the National Infrastructure Strategy will provide a vehicle for making these decisions collaboratively based on common information and a shared understanding of the Island's future.

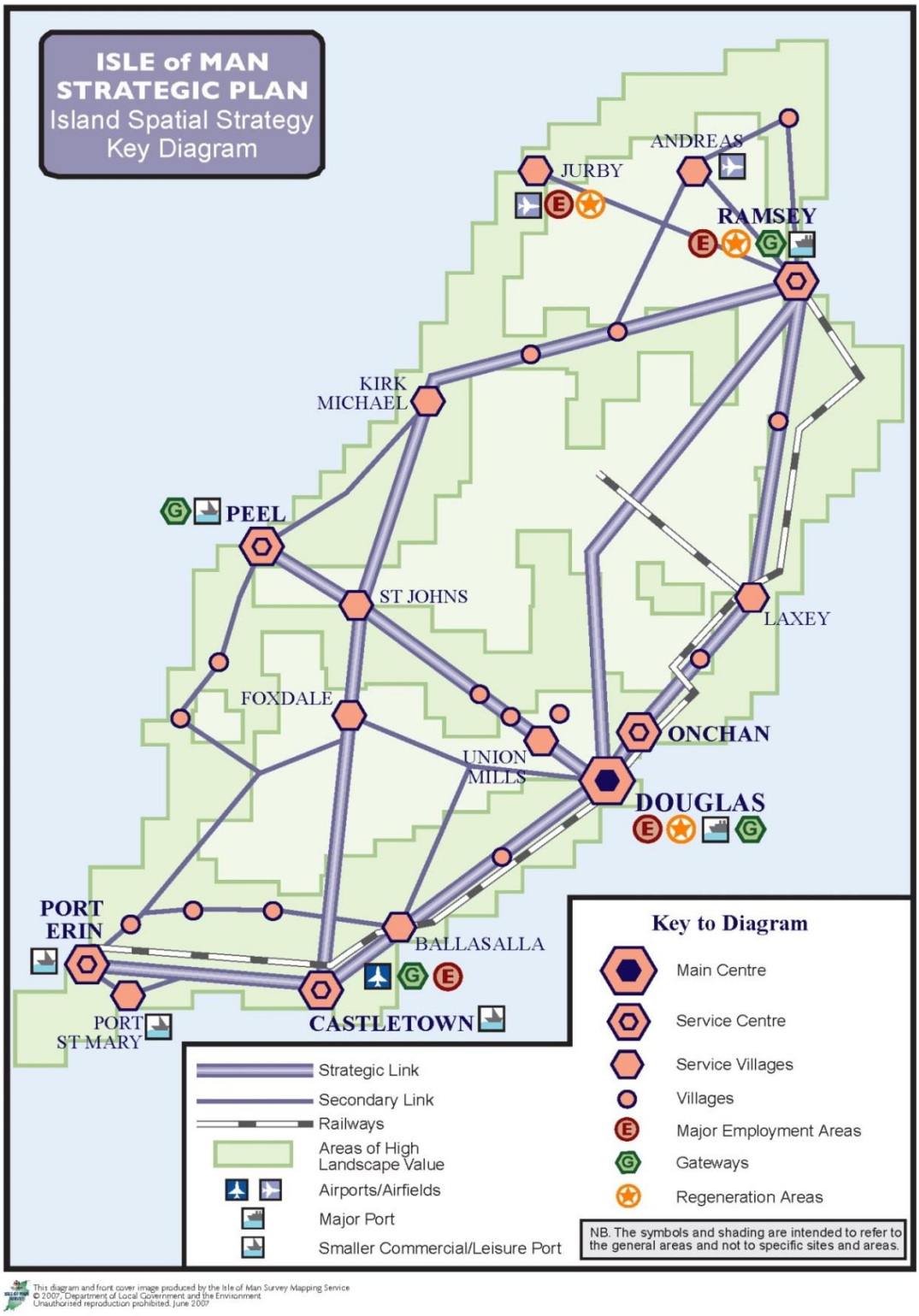
6.1.4 By working together there is an ability to learn, synergise and hopefully avoid unintended consequences.

6.1.5 The Department of Infrastructure is committed to monitoring both the Island's social and economic needs and working with providers to ensure that these needs are met. The Department recognises that the provision of infrastructure is important to economic growth and will work with others to ensure that the Island's infrastructure is best placed to meet those changing demands.

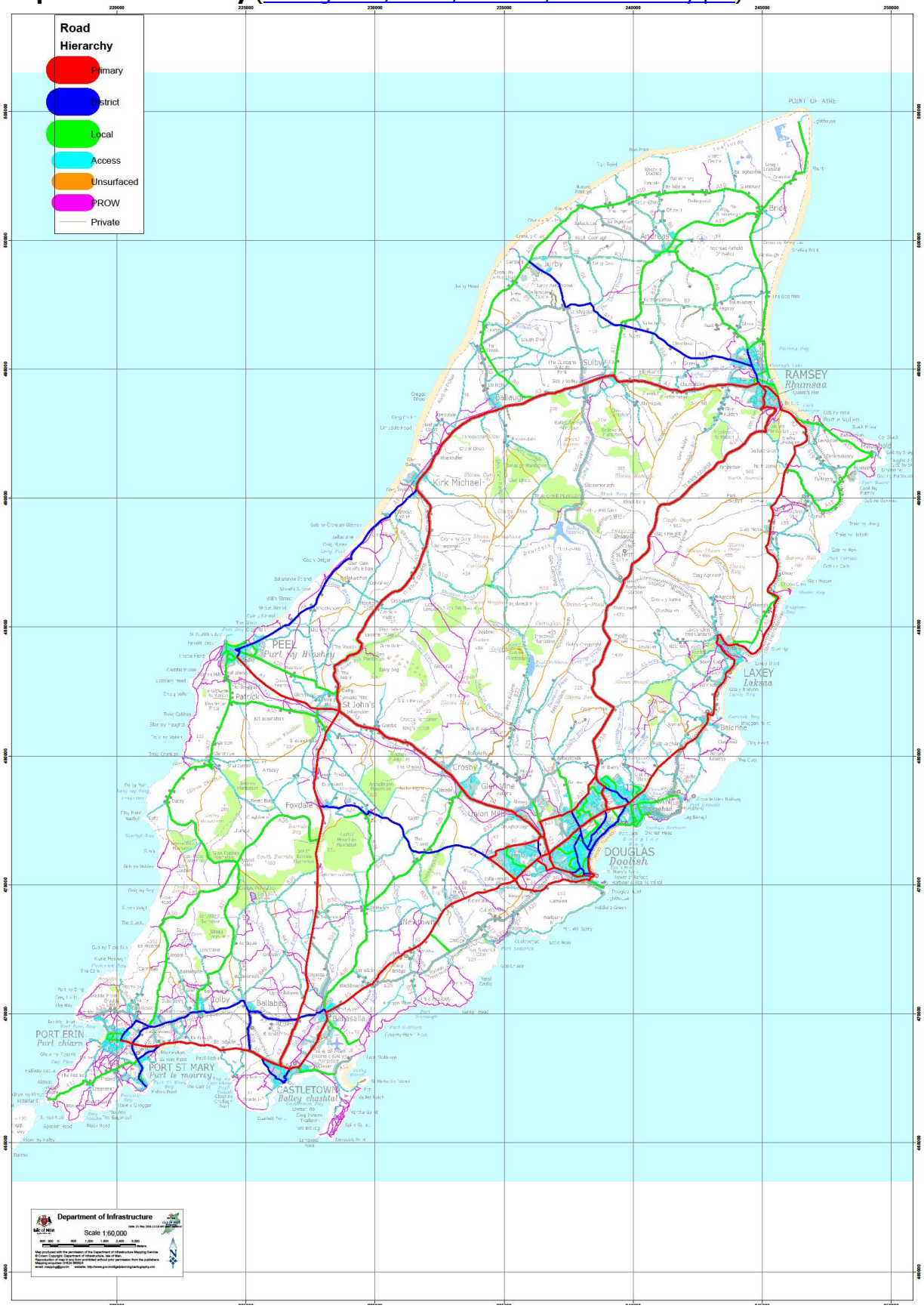
6.1.6 There is also an opportunity as this work further develops to look at what technological changes may be appropriate for consideration on the Island. At present many of these technologies are emerging and what will happen on the Isle of Man will be dependent on what happens in neighbouring jurisdictions. Some technological advances are simply not viable on the Island due to the cost of implementation and the population size. However these factors will be monitored as the technologies become more viable (and possibly affordable) in the future, at which point they may become worthy of more detailed consideration.

APPENDIX ONE
MAPS

Map 1 Island Spatial Strategy Key Diagram (Isle of Man Strategic Plan 2016)



Map 2 Road Hierarchy (www.gov.im/media/1351715/road-hierarchy.pdf)



APPENDIX TWO

Strategic Planning 'Buffer' Zones Surrounding MUA Electricity Assets

Asset	**Buffer Zone**	**Comments**
Low Voltage underground cables & overhead lines	N/A	Not considered strategic and relatively low cost to divert.
33kV Overhead Lines	20m each side of the overhead line route.	Provides a safety zone if poles or wires fail plus space for failure containment stay positions.
11kV Overhead Lines	9m each side of the overhead line route.	Provides a safety zone if poles or wires fail and consistent with the Permitted Development Order.
33kV & 11kV underground cables and fibre optic routes.	3m each side of the cable route.	Provides a minimum 6m working corridor for cable repairs or replacement.
Substations	2m outside substation perimeter fence and no restriction to HGV access.	Provides separation from substation perimeter earth.
Sewerage pipes and water transmission mains.	3m each side of the pipeline route.	Provides a minimum 6m working corridor for repairs or replacement.

APPENDIX 3

1. Mechanisms for seeking developer contributions to the provision of infrastructure

1.1 Section 13 Agreements

1.1.1 One mechanism to assist with the funding of infrastructure as part of a private sector commercial development could be the use of Section 13 Agreements under the Town and Country Planning Act 1999[28].

1.1.2 The Isle of Man Strategic Plan 2016 sets out that "where development is acceptable and in accordance with the provision of the Plan and the relevant Area Plan, but raises issues which cannot be addressed by the imposition of planning conditions, the Department will seek to conclude an Agreement with the development under Section 13 of the 1999 Town and County Planning Act"[29].

1.1.3 This gives the provision that during the determination of an application for a development, a mutual Agreement can be sought and confirmed between an applicant and the service provider. Such an agreement could set out a requirement for developer contributions to be paid to the service provider to assist with the cost of the infrastructure provision, or agree that costs could be split and proportioned. It would be possible to subject any large scale developments (whether commercial or residential) to an assessment of its economic viability to consider the proportion of profit against the cost of service provision, and calculate the contribution required from a developer before the commencement of works.

1.1.4 There are a number of other options which could be considered which may also assist with financial contributions to cover the costs of infrastructure provision across the Island. This will be discussed briefly below.

1.2 Community Infrastructure Levy

1.2.1 One such option could be to consider a similar mechanism to the Community Infrastructure Levy which operates in the UK[30]. This is a means to obtain developer contributions to projects not necessarily directly related to the development they are pursuing, but that would give an overall benefit to the local community, such as improvements to local sewage works or highway improvements.

1.3 Shared Infrastructure Levy

1.3.1 Another option to consider could be a shared infrastructure levy – this may be possible if there are a number of developers working in an area together and they split the additional costs of the infrastructure provision adjacent to their sites. This could be particularly useful if this shared investment is required in order to make the overall development viable. The costs of the required infrastructure could be considered, and proportioned to the type of proposed development, the profitability of each of the developments, and the developers would then be charged for their relevant portion. However, this approach may require and rely on collaboration between a number of developers, and should one developer determine that the

[28] https://www.gov.im/media/1349046/townandcountryplanningact1999_4.pdf
[29] https://www.gov.im/media/1350906/the-isle-of-man-strategic-plan-2016-approved-plan-15_03_16.pdf
[30] https://www.gov.uk/guidance/community-infrastructure-levy

development is no longer of commercial interest to them, and they withdraw, this could have knock on consequences for the other parties involved in the collaboration.

1.4 Proportionate Costs

1.4.1 Similarly, should one developer determine that they wish to pursue a development on a specific site, the costs for the infrastructure provision could be considered and these costs passed to them for payment. However, should a second developer determine that they wish to pursue a development in close proximity to this first and would benefit from the infrastructure already having been provided, it may be possible to operate something similar to an overage clause which would see the second developer sharing some of the cost burden from the first developer who would then receive a small proportion of their contribution back. This may assist in opening up some sites for development which are currently being perceived as lacking in infrastructure provision.

APPENDIX 4

Obsolescence of Strategic Assets

This table of obsolescence shows that with planned maintenance the asset life can be met and in some cases extended. However it should be recognised that there is a cost associated to maintenance which can be significant. Decisions on the future need to take into account the costs of maintenance when determining whether it is appropriate to continue with extending the life of the asset or if alternative means of delivery would offer better value for money.

There is also an assumption made here that these assets will be meeting known future requirements. Should these requirements change this may impact on the rate of obsolescence.

Now 2017	Asset Life	2050	Beyond 2050
Combined Cycle Gas Turbine (Manx Utilities)	Completed in 2003, the asset life of the CCGT is generally considered to be 2035.	With regular maintenance and improvement works when required, its life could be extended to 2050.	Possible with careful, continued maintenance and improvement works.
Diesel generators	These run occasionally, and act primarily as the Island's back-up generation. Their expected life is considered as "running hours". Owing to the infrequency with which they operate, it is not possible to give an accurate end of life date.	With regular maintenance and improvement works when required, its life could be extended to 2050.	With regular maintenance and improvement works when required, its life could be extended to 2050.
MU Interconnector (sub-sea cable)	Completed in 2000 with the average design life of 40 years (up to 2040).	With regular maintenance and improvement works when required, its life could be extended to 2050.	MU would expect the cable to last up to an additional 20 years beyond its design life of 40 years (until approximately 2060). Regular maintenance and improvement works when required will assist with this.
E-llan communications fibre optic interconnector	Completed in 2000 with a design life of 45 years	With regular maintenance and improvement works when required, it could last its design life, and possibly beyond.	Possible with careful, continued maintenance and improvement works.

Now 2017	Asset Life	2050	Beyond 2050
Regional Sewage Treatment Strategy Phase 1	Process elements - Anticipated design life of 25 years (minimum 20 years); Civil engineering elements – anticipated design life of 60-100 years.	With regular maintenance and improvement works when required, it could last its design life.	Possible with careful, continued maintenance and improvement works for the civil engineering elements. Process elements will need to be replaced.
Regional Sewage Treatment Strategy Phase 2	When completed this scheme will include process elements with an anticipated design life of 25 years (minimum 20 years); Civil engineering elements – anticipated design life of 60-100 years.	With regular maintenance and improvement works when required, it could last its design life.	Possible with careful, continued maintenance and improvement works for the civil engineering elements. Process elements will need to be replaced.
Meary Veg Treatment Plant	Completed in 2014, the assets have an expected service life of 25 years.	With regular maintenance and improvement works when required, it could last its design life.	
Sulby Water Treatment Works	Completed in 2005, the main items of the process plant have an anticipated service life of 25 years – building and civil engineering elements have an asset life of 60-100 years.	With regular maintenance and improvement works when required, it could last its design life.	
Douglas Water Treatment Works	Completed in 2008, the main items of the process plant have an anticipated service life of 25 years – building and civil engineering elements have an asset life of 60-100 years	With regular maintenance and improvement works when required, it could last its design life.	
Offshore Gas pipeline	Completed in 2000 with the average design life of 50 years (up to 2050).	With regular maintenance and improvement works when required, it could last its design life, and possibly beyond.	With regular maintenance and improvement works when required, it could last its design life, and possibly beyond.
Fuel jetty	Estimates suggest that there is limited remaining useable life left in this asset (5-10 years), and this asset will need replacing before 2050. It is identified	Likely to have been replaced before 2050.	Likely to have been replaced before 2050.

Now 2017	Asset Life	2050	Beyond 2050
	as a probable future replacement project by DOI.		
Energy from Waste Plant (SUEZ / DOI)	Completed in 2004, the current contract August 2029	With regular maintenance and improvement works when required, its life could be extended to 2050.	Possible with careful, continued maintenance and improvement works.
Highways (DOI) Roads	Average design life of 40 years	With regular monitoring, maintenance, and improvement works when required, its life could be extended beyond the design life.	Design life of 40 years from date of construction. Regular review required, and schedule of monitoring will prolong life.
Highways (DOI) Bridges and retaining walls	Nominal design life between 50 and 120 years. Typical age: 40-180 years	With regular maintenance, and improvement works when required, life of structures can be extended beyond the design life. Bridges are assessed against a number of performance and safety criteria for improvement and occasionally reconstruction.	Design life of 120 years from date of construction. Regular review required, and ongoing maintenance will prolong life.
Pulrose Bridge	Current bridge completed in 1930s. A project is currently underway for imminent replacement (scheduled for 2019). Future design life of replacement bridge will be 120 years.	Life of new bridge will extend beyond 2050.	Design life of 120 years from date of construction. Regular maintenance will ensure life well beyond 2050
Douglas Stone Bridge	Built in 1930's, remaining life expected to be in region of 30 years.	With increasing maintenance demand the structure should remain adequate until 2050.	Likely to require reconstruction in longer term.
The Quarterbridge	Old bridge widened in 1930s. Remaining life in region of 30-40 years. Capacity of existing bridge is not likely to meet traffic demands within 15-20 year period.	Structure condition reaches limit prior to 2050. Performance criteria exceeded within period.	Likely to require replacement /extension or additional bridge prior to 2050. A replacement will take life well beyond 2050.

Now 2017	Asset Life	2050	Beyond 2050
Douglas Lift Bridge	Completed in 1998 with a design life of 50 years. Mechatronic elements are a major component.	With regular monitoring, maintenance, and improvement works when required, its life should last beyond 2050.	Likely to require major upgrade of partial replacement in longer term.
Douglas Harbour Breakwater & main piers	Life likely to extend beyond 2050. (Sections may need to be strengthened or upgraded).	With regular maintenance, and improvement works when required, its life should be last beyond 2050. However, obsolescence will develop with changes in shipping requirements.	Possible with careful, continued maintenance and improvement works. However, adequate functionality may become more difficult.
Douglas Harbour Linkspan	Completed in 1995 with an end of life in 2040's. Recently completed its mid-life refurbishment. Being considered as part of the Douglas Outer Harbour Master Plan.	Likely to be replaced before 2050.	A replacement will take life well beyond 2050.
Douglas and Peel Tidal Flapgates	Design life of mechanical and electric/electronic systems 50 years	With regular maintenance, and improvement works when required, its life should last beyond 2050.	Likely to need major upgrade in due course.
Peel Breakwater and associated structures	The breakwater was constructed in the 19th century. Its remaining life is expected to be at least 40-50 years with good maintenance.	With regular monitoring, maintenance, and improvement works when required, its life should last beyond 2050.	Possible with careful, continued maintenance and improvement works.
Existing Sea Defences (Promenades and Baie-ny-Carrickey defences)	Typically built or with major improvements in 1930's but with older sections. Remaining life 30-40 years or possibly longer.	Some sea defence elements are likely to reach the end of their useable life within this period. Replacements may be required, but maintenance and monitoring will extend life as far as possible.	Modifications to structures and some replacements will be needed after 2050.
Harbour flooding and wave overtopping protection works to be	Existing programme of works over 20 years - average design life of 120 years.	Programme designed to provide adequate defence well beyond 2050.	Design life is to cope with 2115 sea level rises.

Now 2017	Asset Life	2050	Beyond 2050
undertaken (DOI) – Climate Change adaptation			
Fluvial Flooding - Climate Change adaptation (Manx Utilities)	The formal river flood protection schemes have an asset life of approximately 60-100 years.	With regular monitoring, maintenance, and improvement works when required, its life should last beyond 2050.	
High pressure gas pipeline (Manx Utilities)	Commissioned in 2003 with a design life of 40 years. However, with regular maintenance and repair works when required that it will last beyond its 40 years then.		Design life of 40 years from date of construction. Regular review required, and schedule of monitoring will prolong life.
Runway	Average design life of 50 years.	With regular monitoring, maintenance, and improvement works when required, its life could be extended beyond the design life.	Possible with careful, continued maintenance and improvement works.

APPENDIX 5

Island's main infrastructure providers

Provider	Responsibility	Contact details
Department of Infrastructure	Highways	Department of Infrastructure Customer Services Ellerslie Depot Old Church Road Crosby Isle of Man IM4 2HA Telephone:+44 1624 850000; Emergency number: +44 1624 672000
	Ports	Marine Operations Centre 2nd Floor Sea Terminal Building Douglas and Inner Harbour Office Douglas Telephone: +44 1624 686628 (24 hour) Port Security Ports Division Sea Terminal Building Douglas IM1 2RF Telephone:+44 1624 686631 or +44 1624 686632
	Airport	Isle of Man Airport Ballasalla Isle of Man IM9 2AS Telephone:+44 1624 821600
	Waste	Waste Management Unit Murray House Mount Havelock Douglas Isle of Man IM1 2SF Telephone:+44 1624 686535
Department of Environment, Food and Agriculture	Coastal Erosion	Thie Slieau Whallian Foxdale Road St John's Isle of Man IM4 3AS

		Telephone:+44 1624 685835
Manx Utilities Authority	Energy generation Natural Gas transmission Sewerage and water Fluvial flooding e-llan Communications	PO Box 177 Douglas Isle of Man IM99 1PS Telephone:+44 1624 87687
Manx Gas	Natural gas and LPG distribution	Manx Gas Ltd Murdoch House South Quay Douglas Isle of Man IM1 5PA Telephone:+44 1624 644444
Manx Telecom	Telecommunications provider	Manx Telecom, Isle of Man Business Park, Cooil Road, Braddan, Isle of Man IM99 1HX Telephone:+44 1624 624624
Sure	Telecommunications provider	33-37 Athol Street, Douglas, Isle of Man, IM1 1LB Telephone: +44 7624 247 247
Wi-Manx	Provider of provider of network, data centre, cloud, voice and hosting solutions	Wi-Manx Limited 1st Floor Heywood House Ridgeway Street Douglas Isle of Man IM1 1EW Telephone:+44 1624 641188

There are a number of other Island infrastructure providers in addition to those listed above, including (but not limited to) Manx Petroleum, Ellan Vannin Fuels, CPL Petroleum, BlueWave Communications, Contingent 8 Technologies, and Domicillium.

APPENDIX 6

Key supporting documents consulted as part of the preparation of the NIS

As part of the preparation of the National Infrastructure Strategy, a number of Key documents were used. These are listed below.

Should any further information be sought in relation to the preparation of the National Infrastructure Strategy, please contact Emma Rowan, Senior Infrastructure Policy Officer, Department of Infrastructure (email emma.rowan@gov.im; tel: 685163) and a response will be issued as soon as possible.

"Our Island - a special place to live and work" (2017) – Programme for Government 2016 – 2021 - https://www.gov.im/about-the-government/government/the-council-of-ministers/programme-for-government-2016/

Isle of Man Census Report March 2017 - https://www.gov.im/media/1355784/2016-isle-of-man-census-report.pdf

The Isle of Man in Numbers 2016 - https://www.gov.im/news/2016/mar/21/isle-of-man-in-numbers-2016/

The Isle of Man Social Attitudes Survey 2016 - https://www.gov.im/media/1352363/2016-06-15-social-attitudes-survey-final.pdf

Joint Strategic Needs Assessment 2014 - https://www.gov.im/media/1345872/iom-government-joint-strategic-needs-assessment-2014.pdf

The Isle of Man Strategic Plan 2016 - https://www.gov.im/media/1350906/the-isle-of-man-strategic-plan-2016-approved-plan-15_03_16.pdf

JMP Study (transport) – as submitted as evidence as part of the Isle of Man Strategic Plan 2016 Review (Evidence Paper 3) https://www.gov.im/media/1348723/the-draft-isle-of-man-strategic-plan-2015-paper-3-future-housing-requirements-recommended-policy-change.pdf

Highway maintenance programme https://www.gov.im/about-the-government/departments/infrastructure/highway-services/highway-maintenance/

Manx Marine Environmental Assessment (2013) - https://www.gov.im/categories/planning-and-building-control/marine-planning/manx-marine-environmental-assessment/

Harbours traffic information - https://www.gov.im/about-the-government/departments/infrastructure/harbours-information/harbour-traffic-information/

Airport passenger figures information - https://www.gov.im/categories/travel-traffic-and-motoring/isle-of-man-airport/passenger-figures/

Harbours Maritime Strategy (Currently being prepared by the Department)

Strategic Sea Services Policy - https://www.gov.im/about-the-government/departments/infrastructure/strategic-sea-services/

Manx Utilities Annual Statement - https://www.manxutilities.im/about-us/annual-reports-financial-statements/annual-reports-financial-statements/

Waste strategy 2012 to 2022 - https://www.gov.im/about-the-government/departments/infrastructure/waste-management/waste-strategy-2012-to-2022/

Greater efficiency, cleaner energy, resilient economy; A climate challenge mitigation strategy for the Isle of Man 2016 – 2020 (2016) - https://www.gov.im/media/1354417/a-climate-challenge-mitigation-strategy-2016-2020.pdf

National Strategy on Sea Defences Flooding and Coastal Erosion (2016) - https://www.gov.im/about-the-government/departments/environment-food-and-agriculture/environment-safety-and-health-directorate/national-strategy-on-sea-defences-flooding-and-coastal-erosion/

Coastal and Wave Overtopping (2014) - https://www.gov.im/categories/home-and-neighbourhood/floodwatch/coastal-and-wave-overtopping/

Digital Strategy (2015) - https://www.gov.im/media/1347695/digital-strategy-01.pdf

Communications Commission - https://www.iomcc.im/