An Roinn Iompair
Department of Transport

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

MAKING COMPLEX EASY

N16 MUNAKILL REALIGNMENT

Option Selection Report

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Structure of the Option Selection Report

Volume Ref. No & Title	Contents
Volume A – Main Report	**Option Selection Report**
Volume B – Constraints Study Report	Main Report
Volume C – Stage 1 Assessment Report	Main Report
Volume D – Stage 2 Non-Environmental Appendices	D.1 Economy
	D.2 Safety
	D2.1 RSA Stage F Part 1 Report
	D.3 Accessibility and Social Inclusion
	D.4 Integration
	D.5 Physical Activity
Volume E – Stage 2 Environmental Appendices	E.1 Population and Human Health
	E.2 Biodiversity
	E2.1 Terrestrial Biodiversity
	E2.2 Aquatic Biodiversity
	E.3 Soils, Geology and Hydrogeology
	E.4 Hydrology
	E.5 Air and Climate
	E.6 Noise
	E.7 Material Assets – Agricultural
	E.8 Material Assets – Non-Agricultural
	E.9 Cultural Heritage
	E.10 Landscape and Visual
Volume F – Non-Statutory Public Consultation Feedback Reports	Part A Public Consultation 1 – Study Area & Constraints
	Part B Public Consultation 2 – Route Corridor Options
	Part C Public Consultation 3 – Emerging Preferred Route Corridor
Volume G – Project Appraisal Balance Sheet	PABS (Minor Projects costing €5m to €20m)
Volume H – Road Safety Audit Stage F (Part 2)	Main Report

Contents

Tables

Figures

1 INTRODUCTION AND DESCRIPTION

1.1 General

In December 2019, RPS were commissioned by Leitrim County Council (LCC) to provide the engineering and consultancy services required to deliver the N16 Munakill Realignment Scheme through Phases 1 to 4 of the TII Project Management Guidelines (TII PMG 2019), including Concept and Feasibility, Options Selection, Design and Environmental Evaluation and the Statutory Processes.

This document forms the Option Selection Report which is the core deliverable for Phase 2 of the TII Project Management Guidelines (PMGs). The Option Selection Report has been divided into the following volumes:

- Volume A – Main Report
- Volume B – Constraints Study Report
- Volume C – Stage 1 Assessment Report
- Volume D – Stage 2 Non-Environmental Appendices
- Volume E – Stage 2 Environmental Appendices
- Volume F – Non-Statutory Public Consultation Feedback Reports
- Volume G – Project Appraisal Balance Sheet (PABS)
- Volume H – Road Safety Audit Stage F (Part 2)

The purpose of the Option Selection Report is to document the Phase 2 Option Selection process carried out for the Scheme which has been undertaken in accordance with the TII *Project Management Guidelines* (PE-PMG-02041, December 2020), TII's *Project Managers Manual for Minor National Road Projects* (PE-PMG-02043, December 2020) and TII's *Project Appraisal Guidelines* (PAG) suite of documents.

1.2 Overview of the Proposed Project

The N16 National Primary Route links Northern Ireland with the Republic of Ireland, and more specifically links Sligo and its hinterland in the north-west, with Belfast and Dundalk on the east coast of Ireland as shown in Figure 1-1.

Figure 1-1: The N16/A4/M1 Sligo to Northern Ireland (Belfast) Route

Starting in Sligo the N16 East-West corridor heads east towards Manorhamilton and crosses the Northern Ireland border at Blacklion/Belcoo. In Northern Ireland the route becomes the A4 (trunk road). The A4 runs east from Belcoo to Enniskillen and on to Dungannon where it connects to the M1. The M1 then travels past Craigavon, Lurgan and Lisburn before terminating at Belfast.

The proposed N16 Munakill Realignment Scheme, which is located approximately 4km east of Manorhamilton will seek to remove the current deficiencies of this section of existing road and improve the overall route consistency of the network. The location of the Scheme in the context of Co. Leitrim is shown below in Figure 1-2.

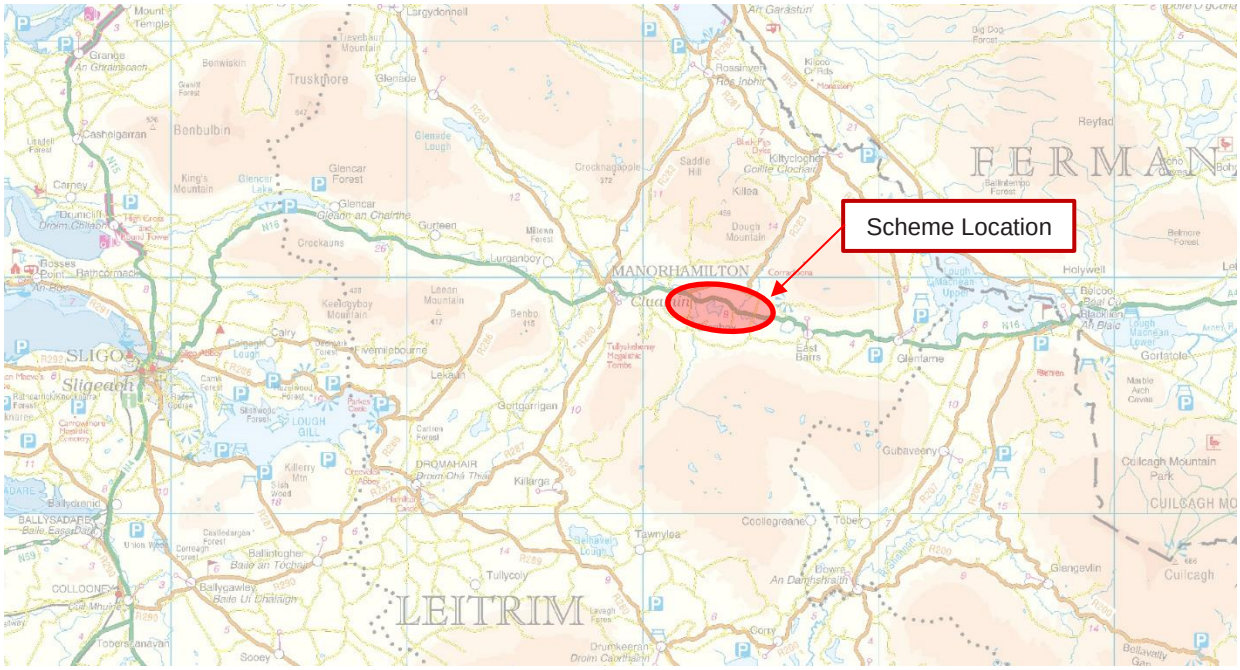

Figure 1-2: Scheme Location Map

(Mapping: Ordnance Survey of Ireland Licence No. 2021/OSI_NMA_139)

Parts of the N16 route have been improved in sections over the past number of years. The section of road under consideration at Munakill which is approximately 2.7km in length and connects two previous road improvement Schemes, namely the Kilmakerrill/Cornacloy section at the eastern end, and the Blackpark Section at the western end as shown in Figure 1-3.

The previous road improvement schemes highlight the inefficiencies of this section of road. A change in road standard across the network can lead to motorists driving the unimproved section at speeds inappropriate for the road type. The delivery of this proposed Scheme will result in a consistent length of improved road over 8.4km of the N16 between Blackpark and Sradrine.

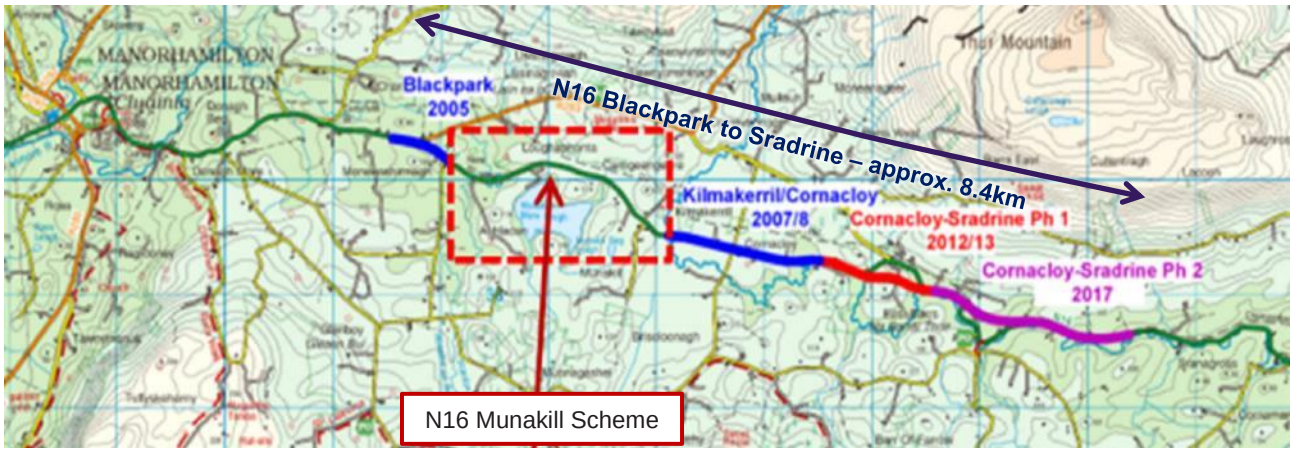

Figure 1-3: Historic N16 Improvement Schemes *(Mapping by Leitrim County Council)*

The overall objective of the N16 Munakill Realignment Scheme is to provide an improved transport corridor that is designed to current standards, that is 'fit for purpose' for all road users, that provides enhanced accessibility, improved consistency and safety, and provides an improved level of service in an environmentally sensitive manner.

There is also a disused rail corridor, the Sligo Leitrim & North Counties Railway (SLNCR), running just north of the existing N16 within the proposed Scheme's study area. There are no future plans to introduce a rail-line between Belfast and the north-west of the country contained in the National Planning Framework (Project Ireland 2040) or the National Development Plan (NDP 2018-2027). Therefore, there will be sole reliance on road transport for public, private, commercial and freight vehicles on the N16 corridor. However, there are plans to develop a Greenway route along the line of the old railway.

The N16 is a national primary strategic route between Sligo and Belfast providing key north–west connectivity. This significance is supported by the fact that the N16 forms part of the Trans-European Network (TEN-T). TEN-T is a network of multi-modal strategic transport corridors identified to improve the mobility of goods and people throughout the European Union (EU). The route will also improve connectivity from north-east Leitrim to Ireland West Airport at Knock.

1.3 Scheme Development to Date

In 2018, a Phase 0 Project Appraisal Plan (PAP) for the Scheme was prepared by the Westmeath National Roads Office. This PAP which was developed and presented to the TII Strategic Planning Unit and the Department of Transport, Tourism and Sport (DTTaS) for approval at Phase 0 Scope & Pre-Appraisal Stage.

Upon appointment in December 2019, RPS prepared a technical review of this PAP for the Scheme followed by the progression of the Scheme through Phase 1 – Concept and Feasibility of the TII PMG 2019. During Phase 1, it was concluded that a need for the Scheme exists and is necessary to remove the current inefficiencies with the N16 at Munakill.

1.4 Project Objectives

The objectives for the N16 Munakill Realignment Scheme are listed below in Table 1-1.

Table 1-1: N16 Munakill Realignment Project Objectives

Project Objectives	
Economy:	• To provide a road that is 'fit for purpose' and consistent with contemporary standards, so as to promote the growth and economic development of the region. This includes improved connectivity between Sligo and its hinterland in the north-west, to Belfast and Dundalk on the east coast of Ireland along this TEN-T strategic transport corridor. • To reduce travel times and provide an improved level of service on the N16.
Safety:	• To provide an improved road that is designed to current standards, that is 'fit for purpose', that brings consistency with adjacent sections of the route, and that can safely provide for current and future needs. • To improve road safety and reduce the risk of collisions through the provision of a consistent alignment with improved forward visibility. • To improve the layout and visibility of accesses on the N16 to provide safer access/egress conditions. • To provide safer conditions for non-motorised and vulnerable road users. • To provide appropriate protection at any roadside hazards. • To support the RSA Road Safety Strategy 2013-2020.

Project Objectives	
Integration:	• To contribute to the achievement of the strategic policy objectives and priorities contained in national, regional, and local policy documents. • To improve the connectivity and route consistency of the national road network and this TEN-T strategic transport corridor. • To improve transport links with the North of Ireland. • To continue and build on the recent investment on the N16 route with a view to improving this route to a consistent and modern standard.
Environment:	• To construct a sustainable project in an environmentally sensitive manner, giving particular consideration to designated environmental sites including the adjacent Lough Gill SAC.
Accessibility and Social Inclusion:	• To provide enhanced accessibility to social and recreational services in the area by providing improved connectivity between Manorhamilton and Glenfarne. • To improve road based public transport by improving journey times and journey time reliability. • To provide improved access for the area to the National Primary Road Network and other modes of transport including rail, air and sea.
Physical Activity:	• To provide opportunities for physical activity for pedestrians and cyclists as part of this Scheme.

To summarise, the primary objective of the N16 Munakill Realignment Scheme is to provide an improved transport corridor that is designed to current standards, that is 'fit for purpose' for all road users, that provides enhanced accessibility, improved consistency and safety, and provides an improved level of service in an environmentally sensitive manner.

1.5 Purpose of Option Selection Report

This Option Selection Report represents the main deliverable for Phase 2 of the TII Project Management Guidelines (PMGs) and documents the Phase 2 process undertaken for the Scheme. The Phase 2 process comprises of the identification of a Study Area, the identification of constraints within the Study Area, consideration and assessment of various alternatives/options, such that an Emerging Preferred Option can be identified, and ultimately a Preferred Option selected before the project progresses to its subsequent design and planning phases. Information is presented in this report (and its accompanying volumes) to provide clarity on the decision-making process which has resulted in the selection of a Preferred Option for the Scheme. In so far as possible this Report presents a non-technical summary of the detailed technical and scientific information collated as part of Phase 2.

The TII Guidelines sets out the implementation of the first three stages of the option selection process leading to the selection of the Preferred Option. A summary of these stages is presented below and the process if also illustrated in Figure 1-4.

Stage 1 – Preliminary Options Assessment

Stage 1 involves a preliminary assessment of the identified preliminary options for the Scheme against the criteria of Engineering, Environment and Economy. This assessment results in a

reduced number of options to be taken forward to the next stage of the appraisal process (Stage 2).

Stage 2 – Project Appraisal Matrix

Stage 2 involves a more detailed Multi-Criteria Analysis (MCA) of the shortlisted options under the six Common Appraisal Framework (CAF) criteria as defined within *PAG Unit 7.0 Multi Criteria Analysis* of Economy, Safety, Environment, Accessibility & Social Inclusion, Integration and Physical Activity.

This assessment results in the identification of an Emerging Preferred Option to be taken forward to the next stage of the appraisal process (Stage 3).

Stage 3 – Preferred Option

Once the Emerging Preferred Option is identified, an assessment is then undertaken using the Project Appraisal Balance Sheet (PABS) in accordance with *PAG Unit 12.0 – Minor Projects (€5m to €20m) (March 2021)* in order to summarise the benefits and impacts associated with the option.

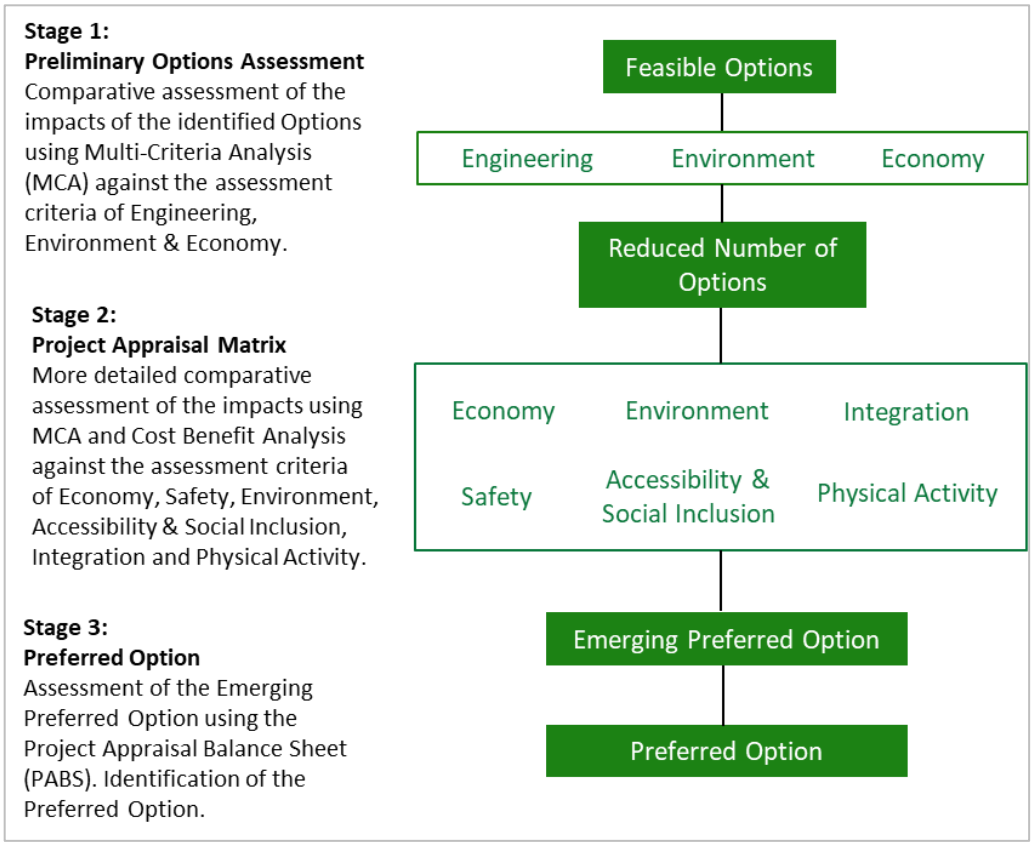

Figure 1-4: Stages of the Option Selection Process (TII PMG)

2 IDENTIFICATION OF NEED

2.1 Policy Context

2.1.1 Strategic Fit and Priority

The N16 National Primary Route links Northern Ireland with the Republic of Ireland, and more specifically links Sligo and its hinterland in the north-west, with Belfast and Dundalk on the east coast of Ireland. The N16 forms part of this East-West corridor.

The improved connectivity provided by the upgrade of the N16 will increase the likelihood of improved economic performance through enhancing accessibility to employment, health and education services across the north-west region and further cross border cooperation with Northern Ireland. It will also allow for an improved road link to Ireland West Airport at Knock.

The proposed Scheme is consistent and compatible with local and national policy documents, details of which are outlined within this chapter. Improving this strategic route aligns with the objectives set out in National, Regional and Local policies, and is supported by TII research documents.

2.1.2 Road Development Policy

2.1.2.1 National Planning Framework – Project Ireland 2040

The National Planning Framework (NPF), published in April 2018, sets out the long-term context for Ireland's physical development and associated progress in economic, social and environmental terms.

The National Planning Framework seeks to incrementally improve access to the north-west from Dublin in the east and from the other cities in the south. The upgrade of the N16 will enhance the accessibility to the north-west of the country.

Policy Objectives outlined are as follows:

National Strategic Outcome 2

- In order to enhance Regional Accessibility, it is an objective to improve average journey times targeting an average inter-urban speed of 90km/h on Inter-Urban Roads.

National Policy Objective 2c

- Accessibility from the north-west of Ireland and between centres of scale separate from Dublin will be significantly improved, focused on cities and larger regionally distributed centres and on key east-west and north-south routes.

National Policy objective 43

- Work with the relevant Departments in Northern Ireland for mutual advantage in areas such as spatial planning, economic development and promotion, co-ordination of social and physical infrastructure provision and environmental protection and management.

National Policy Objective 46

- In co-operation with relevant Departments in Northern Ireland, enhanced transport connectivity between Ireland and Northern Ireland, to include cross-border road and rail, cycling and walking routes, as well as blueways, greenways and peatways.

Project Ireland 2040 outlines the importance of providing better access between Ireland's four other cities (Cork, Limerick, Galway and Waterford) separate from Dublin and to the northern and western region. It sets out National Strategic Outcomes for consideration in developing the National Investment Plan. In terms of Enhancing Regional Accessibility one of the strategic outcomes is to improve accessibility to the north-west by upgrading access to the north-west border area by utilising the existing routes (N2/N14/A5). By upgrading the N16, the proposed Scheme will help support the objectives of Project Ireland 2040.

Project Ireland 2040 also identifies the impact Brexit may have on the north-west region and states:

"Better accessibility between the four cities and to the Northern and Western region will enable unrealised potential to be activated as well as better preparing for potential impacts from Brexit"

Both Project Ireland 2040 and the Regional Development Strategy for Northern Ireland provide a basis for long-term co-ordination on infrastructure development including transport, energy and communications and social and community infrastructure.

The improved route will also support links to Ireland West Airport at Knock, which will allow for the development of north Sligo, north Mayo, south Donegal and north Leitrim.

2.1.2.2 Regional Spatial and Economic Strategy

The Regional Spatial and Economic Strategy (RSES) for the Northern and Western Regional Assembly (2020) provides regional strategic planning, economic policy and coordinating initiatives to support the delivery of the National Planning Framework for the northern and western region of Ireland, including County Leitrim.

The RSES includes a strategic plan for Sligo as a regional growth centre which is part of the north-west City Region. This strategic plan references the importance of the N16 route to "develop a cross border core east-west route" which is best served though a "Sligo-Enniskillen-Dundalk corridor". The RSES also identify the need to invest in transport infrastructure to strengthen the connections between Sligo and the east coast via the N16 route. The proposed improvements to the N16 therefore support the strategies of the RSES for the Northern and Western Regional Assembly.

2.1.2.3 Strategic Investment Framework for Land Transport

In 2015, the Department of Transport, Tourism and Sport (DTTAS) published the Strategic Investment Framework for Land Transport which identifies investment in transport infrastructure as essential to the proper functioning of the economy and society. Within this framework, Priority 3 seeks to maximise the contribution of land transport networks to national development through investment in roads to inter alia:

- Provide access to poorly served regions, for large-scale employment proposals, to complete missing links and to address critical safety issues, and
- Support identified national and regional spatial planning priorities.

2.1.2.4 TEN-T Network

The TEN-T network is a selection of strategic transport corridors throughout the European Union (EU) that have been identified to play a key role in the mobility of goods and passengers through the EU. EU Regulation Number 1315/2013 sets the requirements for the TEN-T network. The overarching aim of the TEN-T network is that all EU citizens should be no further than 30 minutes away from the comprehensive network, thereby being connected nationally and internationally.

The TEN-T network is being developed through a dual-layer structure consisting of a comprehensive network and a core network, these two layers being the highest level of infrastructure planning within the EU. Roads forming part of the TEN-T network are to be high quality roads, designed and built for motor traffic.

The existing N16 forms part of the TEN-T network and has been assigned a status of 'To be upgraded' by the European Commission. Improving the route will support objectives set out in the National Planning Framework, encourage an all-island approach to economic and cultural development and facilitate objectives set out in EU Regulation No 1315/2013 on European Union guidelines for the development of the Trans-European Transport Network (TEN-T).

2.1.2.5 Regional Planning Guidelines (2010-2022)

The Border Regional Authority Regional Planning Guidelines (2010-2022), hereafter referred to as the RPG's, includes County Leitrim. Chapter 5 of the RPG's sets out the infrastructure strategy for the region required to ensure the successful delivery and implementation of the settlement and economic strategies.

The N16 is identified as part of the West/North Central Corridor linking the gateway of Sligo to the gateway of Enniskillen in Northern Ireland and forms part of the Northern Cross as illustrated in Figure 2-1 below.

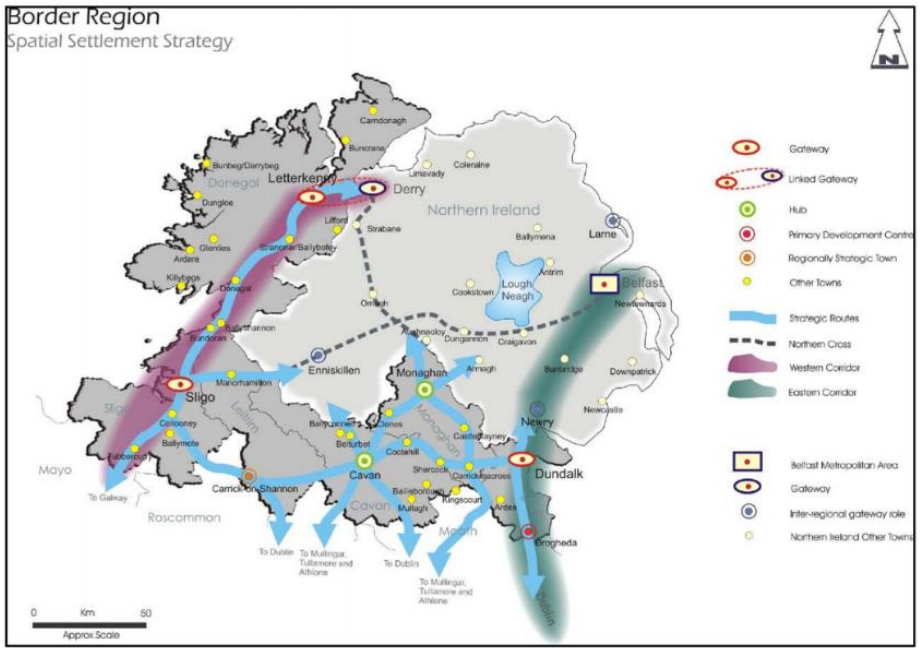

Figure 2-1: Spatial Settlement Strategy (Source: Regional Planning Guidelines (2010-2022))

The RPG's states that:

> *"The Sligo to Enniskillen route also provides access to the international access point of Belfast / Larne and links to the Key Transport Corridor of Enniskillen / Dungannon / Craigavon / Belfast, as identified in the RDS. Improvements to this route in recent years have been limited to short isolated sections. The route requires substantial investment as a matter of priority"*

The proposed improvements to the N16 therefore support the strategies for this corridor within the RPG.

2.1.2.6 Leitrim County Development Plan 2015-2021

The Leitrim County Development Plan 2015-2021 contains core strategy objectives that support the development of transport infrastructure in the County. The plan states that "a modern, efficient and safe road network is vital for the future development of Leitrim".

The improvement of the N16 route is a specific objective in the Leitrim County Council Development Plan 2015-2021. References are as follows:

Policy 54

> *"It is the policy of the Council to upgrade the National Primary Routes serving the County. This can be achieved by carrying out certain road improvements along these routes and in particular completing the following road schemes within the lifetime of the Plan:"*
>
> - *N4 Carrick-on-Shannon to Dromod (including the Carrick-on-Shannon Bypass);*
> - *N16 Glenfarne to Glencar (including the Manorhamilton Bypass).*

Objective 27

> *"It is an objective of the Council to develop the National Cycle Network Corridors within the county – Corridor 1 (Sligo to Dundalk) and Corridor 11 (Limerick to Carrick-on-Shannon)".*
>
> *"The Department of Transport published 'A Study of Border Region East West Transport Corridor' (March 2010), which recommends the N16 as part of this corridor. ICBAN produced a document entitled 'Setting Strategic Direction Improving Transport Infrastructure in the Irish Central Border Area' which discussed the importance of the N16 The Council considers the realignment of the entire N16 route in County Leitrim as vital to the long-term development of the county and thus the Council supports the upgrading of the N16 extending from the proposed Manorhamilton bypass to the Cavan Boundary and from Glencar to the Sligo boundary. These route selections, including the Manorhamilton bypass, will be included within the County Development Plan."*

Objective 31

"It is an objective of the Council to complete the design and progress the realignment /construction of the most critical sections of the N16 route, particularly the Manorhamilton bypass and the interim realignment works already approved by the TII, at Cornacloy."

2.1.2.7 Road Safety Strategy 2013-2020

The government's strategy for road safety sets out the plan to reduce the number of collisions occurring on Irish roads. The main target of this plan is to provide a reduction of road collision fatalities on Irish roads to 25 per million population or less by 2020. This plan seeks to close the gap between Ireland and the safest countries in the EU. This means reducing deaths from 162 in 2012 to 124 or fewer by 2020. A provisional target for the reduction of serious injuries by 30% from 472 (2011) or fewer to 330 by 2020 or 61 per million population has also been set.

As stated in the strategy document the cost benefit of preventing a fatality from a road collision amounts to €2.5 million at 2010 prices and represents a benefit to society of €0.75 billion per annum. There have been six (6) fatal collisions on the N16 through County Leitrim in the period 2005-2016.

The road safety strategy has four key elements to it; Education, Enforcement Evaluation and Engineering. The development of this Scheme would align with the objectives of the road safety strategy.

2.1.3 Other Relevant Plans and Policies

Other relevant plans and policies related to the proposed N16 Munakill Realignment project are set out in Table 2-1.

Table 2-1: Other Relevant Policies

Plan/Policy	Relevance to N16 Munakill Realignment Project
	National Level
Department of Transport: Statement of Strategy, 2016 - 2019	**Land Transport – High Level Goal** To best serve the needs of society and the economy through safe, sustainable and competitive transport networks and services
A Sustainable Transport Future: A New Transport Policy for Ireland 2009-2020	The Policy contains 49 actions, they can be grouped into essentially four overarching ones: • Actions to reduce distance travelled by private car and encourage smarter travel, including focusing population growth in areas of employment and to encourage people to live in close proximity to places of employment and the use of pricing mechanisms or fiscal measures to encourage behavioural change, • The actions aimed at ensuring that alternatives to the car are more widely available, mainly through a radically improved public transport service and through investment in cycling and walking, • Actions aimed at improving the fuel efficiency of motorised transport through improved fleet structure, energy efficient driving and alternative technologies, and • Actions aimed at strengthening institutional arrangements to deliver the targets.

2.2 Existing Conditions on the National Route

2.2.1 Existing Alignment

The Munakill section of the N16 has a sub-standard alignment for a national primary route. The existing vertical and horizontal alignments have not been designed to any standard. The poor alignment restricts forward visibility for motorists and the existing route offers a relatively poor level of service to all users. This substandard character is reflected in the assessment of the route under the recent National Speed Limit

Review (2018) which recommended and subsequently introduced a special speed limit of 80kph for this section of road.

In addition, the sections of the N16 on the either side of the Munakill section have been improved in recent years. Transitioning between these designed alignments and the existing sub-standard undesigned alignments presents inconsistency and potential road safety risks to for road users.

2.2.2 Existing Cross Section

The existing carriageway is generally 6.0m wide (2 x 3m lanes) with grass verges less than 1.0m wide, and much of the roadsides are unforgiving with large trees, walls, fences, utility poles etc. within the Clear Zone.

Figure 2-2: Photographs of the existing substandard N16 cross section

This is in contrast to the previously improved sections of the N16 on the either side of the Munakill Scheme, which have wider lanes, hard strips, or hard shoulders and verges. Transitioning between a designed cross section and the existing sub-standard cross section presents inconsistency and potential road safety risks to drivers and vulnerable road users. In addition, the absence of hard strips/hard shoulders/adequate verges means that there is no space for a broken-down vehicle to pull-in if the need arises, potentially resulting in a road safety hazard to mainline traffic.

2.2.3 Overtaking Opportunities

The lack of overtaking opportunities on a route generally results in unsafe overtaking manoeuvres being completed by frustrated drivers. Due to the rural location of the N16 route there are slow moving agricultural vehicles using this section of the national primary road. These vehicles result in reduced travel times for motorists. It is likely that motorists become frustrated and make unsafe overtaking manoeuvres.

2.2.4 Vulnerable Road Users

The current alignment and cross-section of the Munakill section of the N16 national primary road as indicated in Figure 2-2 provides no hard-shoulders, hard-strips or verge space for pedestrians or cyclists and consequently it poses dangers for vulnerable road users.

2.2.5 Junctions and Direct Access

There are high numbers of junctions and domestic accesses on this section of road. There is also a significant number of agricultural access points which contribute to the safety problems. The frequency of junctions and accesses is presented below in Table 2-2.

Note: It should be noted that the frequency of junctions and accesses has been examined over a section length of 3.7km below. Stage 1 of the Option Selection Process, which is set out in Section 7, involved the development of feasible preliminary options using desirable minimum geometric parameters which were further refined and shortlisted for appraisal in Stage 2 which is set out in Section 8. The refined options examined at Stage 2 each shared common tie-in points with the existing N16 both at the west and east extents of the Study Area. As a result, the length of the existing N16 between these tie-in points and therefore the length of existing N16 which would be replaced with an improved alignment increased from 2.7km (as outlined in Section 1.2) to 3.7km. Therefore, for the purpose of assessment, the frequency of access and junctions has been examined over this 3.7km section.

Table 2-2: Frequency of Direct Accesses & Junctions

N16 Munakill	
Section Length	3.7km
No. of Direct Accesses *(including farm and domestic accesses)*	15
No. of Agricultural Field Access	42
Total	***57***
No. of Side Road Junctions	4

Each access point and junction represents a potential hazard for all road users. A junction or direct access presents a potential conflict point between motorists which may give rise to rear end shunt, side swipe, side on, or turning movement type collisions. The collision hazard is increased because of the reduced levels of visibility from and to many of these access points.

As traffic volumes increase nationally, this will result in further frustration for motorists who may take undue risks when trying to access or exit the N16 from the 61 access points along this section of road.

2.2.6 Analysis of Collision Data

The Transport Infrastructure Ireland (TII) Collison Rate Thresholds for the period 2014 to 2016 were examined. This assessment found that the section of the current N16 within the study area is twice below the expected collision rate nationally. A short section of the N16 at the western end of the study area is twice above the expected collision rate nationally as shown in Figure 2-3.

The colours identify areas as follows:

- Red – Collision rate is twice above the expected rate for that type of road.
- Blue – Collision rate is twice below the expected rate for that type of road.

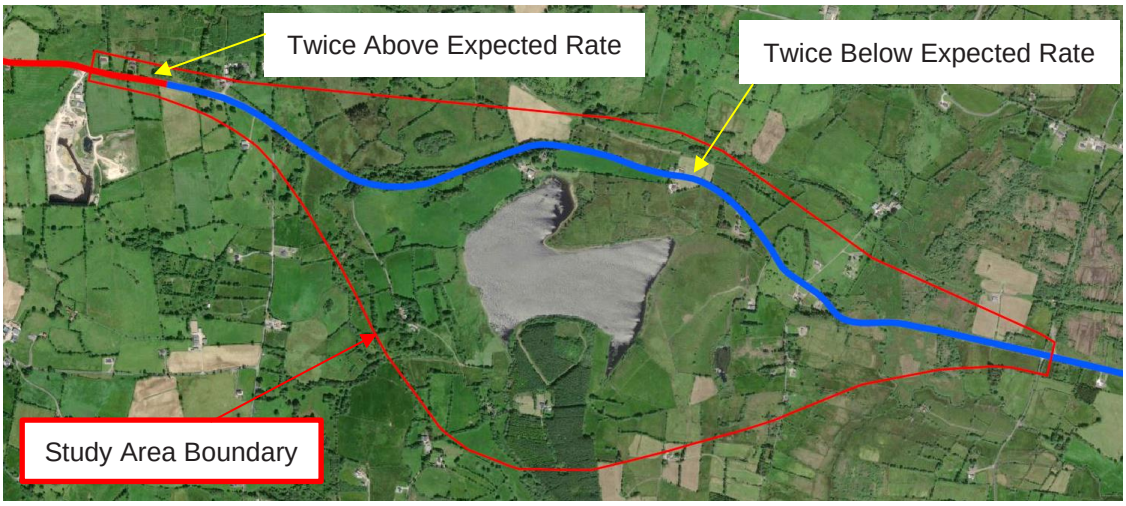

Figure 2-3: TII Collision Rate Thresholds (2014-2016) (Mapping Source: Bing Maps)

Historic road collision data for the route was also obtained from the Road Safety Authority (RSA) and TII for the period of 2005-2016. A total of four collisions have been recorded by An Garda Siochána since 2005 within the study area. The collision data was recorded and analysed. A summary of the analysis is given below.

Table 2-3: Collision Data (2005 – 2016)

Year	Vehicle Type	Collision Type	Circumstances	No of Injuries
2016	Car	Minor Injury Collision	Rear end, right turn	2
2008	Car	Minor Injury Collision	Other	1
2007	Car	Minor Injury Collision	Angle, both straight	1
2006	Car	Minor Injury Collision	Single Vehicle Collision	2

Of these, one involved a rear end right turn impact at the N16/R283 priority junction to the west of the study area in 2016, two collisions involved a single vehicle in 2006 and a car in 2008, both of which occurred west of the N16/L22073 priority junction with the remaining one involving a single vehicle in 2007 at the Cornacloy crossroads to the east of the study area.

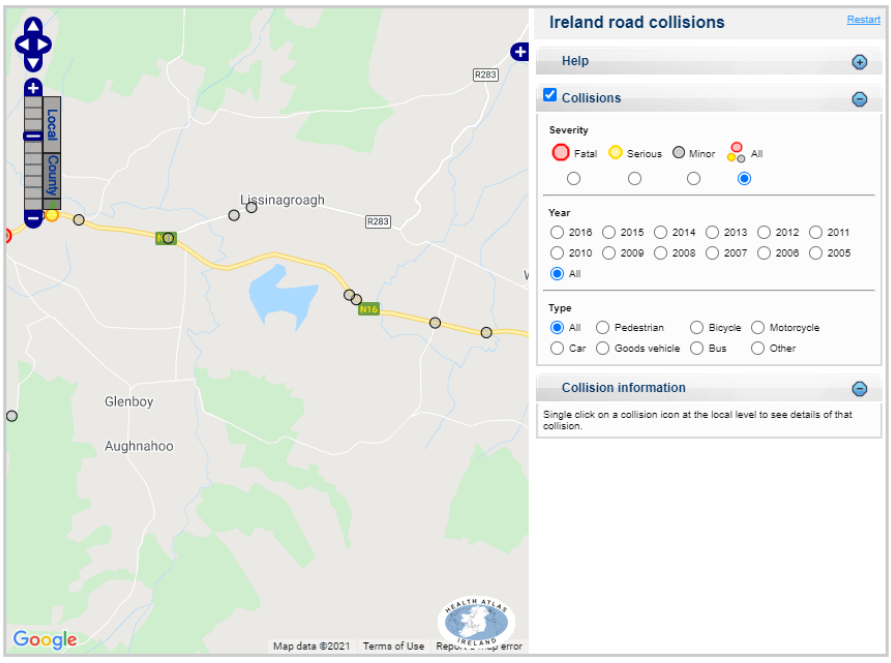

Figure 2-4: Collision Locations from RSA (2005-2016) (Source: RSA.ie)

In addition, collision history was also provided by Leitrim County Council for 2017. This data showed that three minor collisions occurred within the study area during the year period. Two of these occurred in the vicinity of the N16/R283 priority junction to the west of the study and one occurred north of Munakill More Lough on the N16 mainline adjacent to a direct access for a private dwelling.

2.2.7 Vulnerable Road Users

There are no facilities for vulnerable road users within the study area. The lack of proper carriageway width combined with the absence of hard shoulders/hard strips and inadequate verge widths compromises the safety of vulnerable road users.

2.3 Scheme Specific Need

The Need for the Scheme is defined by the existing operational and safety issues of the existing N16 road infrastructure in Munakill and is further supported by the aspirations of European, National and Local strategic and development policy.

The N16 forms a strategic national primary route that vitally links Northern Ireland with the Republic of Ireland, and more specifically links Sligo and its hinterland in the north-west, with Belfast and Dundalk on the east coast of Ireland. An upgraded N16 will improve connectivity and will increased the likelihood of improved economic performance through enhancing accessibility to employment, health and education services.

Project Ireland 2040 outlines the importance of providing better access between Ireland's four other cities (Cork, Limerick, Galway and Waterford) separate from Dublin and to the northern and western region. An improved N16 will therefore support the objectives of Project Ireland 2040 by improving the connectivity of the region. Upgrades to the existing N16 will also represent investment on a strategic link between urban centres and further afield supports access to international ports and airports. The proposed Scheme will also support the strategies of the Regional Spatial and Economic Strategy (RSES) for the Northern and Western Regional Assembly by investing in transport infrastructure and strengthening the connection between Sligo and the East Coast.

Improvements to the N16 will also support the strategies of the Regional Planning Guidelines (2010-2022) which identify the N16 as part of the West/North Central Corridor linking the gateway of Sligo to the gateway of Enniskillen in Northern Ireland and forms part of the Northern Cross. The RPG's outline that the N16 Sligo to Enniskillen route 'requires substantial investment as a matter of priority'.

In the context of European Policy, the N16 also forms part of the TEN-T Network and the existing section at Munakill has been assigned a status of 'To be upgraded' by the European Commission. Improving the route will therefore support objectives set out in the National Planning Framework, encourage an all-island approach to economic and cultural development and facilitate objectives set out in EU Regulation No 1315/2013 on European Union guidelines for the development of the Trans-European Transport Network (TEN-T).

At a local policy level, the current Leitrim County Development Plan 2015-2021 identified the specific needs for road improvements along the N16 between Glenfarne and Glencar. The plan also contains core strategy objectives that support the development of transport infrastructure in the County and states that "a modern, efficient and safe road network is vital for the future development of Leitrim".

The existing section of the N16 are presents significant infrastructural deficiencies when compared to current design standards. The existing section also poses a number of safety issues. The existing section has a sub-standard alignment for a national primary route. The existing vertical and horizontal alignments have not been designed to any standard and the poor alignment restricts forward visibility for motorists. As a result, the existing route offers a relatively poor level of service to all users.

The current cross-section of the Munakill section of the N16 also offers no hard-shoulders, hard-strips or verge space for pedestrians or cyclists and consequently it poses dangers for vulnerable road users.

The existing carriageway is generally 6.0m wide (2 x 3m lanes) with grass verges less than 1.0m wide, and much of the roadsides are unforgiving with large trees, walls, fences, utility poles etc. within the Clear Zone. The existing carriageway is in contrast to the previously improved sections of the N16 on the either side of the Munakill Scheme, which have wider lanes, hard strips, or hard shoulders and verges.

In relation to accesses and junctions onto the existing N16, there are currently four side road junctions and 57 no. direct accesses varying from agricultural and residential accesses, many of which have sub-standard visibility. Each access point and junction represents a potential hazard for all road users.

The existing carriageway also does not offer any dedicated facility for vulnerable road users such as pedestrians and cyclists. The absence of hard-shoulders, hard-strips or verge space results in pedestrians and cyclists travelling in the carriageway where they are at risk of being struck by vehicles.

The Need for the Scheme has therefore been identified in order to alleviate the current safety and infrastructural deficiencies of the current section and in turn provide a route that is 'fit for purpose' for all road users, that provides enhanced accessibility, improved consistency and safety, and provides an improved level of service.

3 CONSIDERATION OF ALTERNATIVES

3.1 Introduction

The Business Case for investing in any project is based on an assessment of the likely impacts of that project. Those impacts are the difference between a future in which the Scheme is built (the Do-Something or Do-Scheme case) and a baseline or reference future in which the Scheme is not built (the Do-Minimum case).

The consideration of alternatives and options was undertaken in accordance with *TII 's PAG Unit 4.0 Consideration of Alternatives and Options.* The following alternatives and options were identified and assessed:

- Do-Nothing Option
- Do-Minimum Option (The Base Case)
- Do-Something Option – Traffic Management
- Do-Something Option – Public Transport
- Do-Something Option – Feasible Route Corridor Option

The alternatives considered for the Scheme were assessed against how they satisfy the Project Objectives set out in Table 1-1.

3.2 Do-Nothing Option

The Do-Nothing option represents the retention of the existing road network without improvement. This option would mean continuing with the existing N16 road infrastructure (i.e. the existing undesigned single carriageway) and its ability to meet future demands for traffic and road safety without any upgrade or junction/access improvement works, other than routine maintenance. *PAG Unit 4.0* states in regard to the Do-Nothing Option that:

> *'The Do-Nothing assumes that there will be no other investment in the transport network (other than regular maintenance) during the appraisal period beyond that being considered as part of the Scheme under appraisal.'*

The assessment of the Do-Nothing Option consisted of a review of the proposed regular maintenance works on this section of the N16 and secondly an investigation of the existing road infrastructure and its issues within the Study Area.

With respect to the existing section of the N16 in Munakill, a number of operational safety issues were identified. These are summarised below:

3.2.1.1 Existing Road Layout

The Munakill section of the N16 has a sub-standard alignment for a national primary route. The existing vertical and horizontal alignments have not been designed to any standard. The poor alignment restricts forward visibility for motorists and the existing route offers a relatively poor level of service to all users.

Table 3-1 below shows a comparison between the existing geometry along the section of the N16 within the Study Area and the desirable minimum curve requirements set out for a design speed of 100km/h within DN-GEO-03031 (Rural Road Link Design, June 2017) of TII Publications.

Table 3-1: Comparison of existing horizontal radii and desirable minimum radii specified within DN-GEO-03031 of TII Publications

Ref No.	General Location	Specific Location	Desirable Min. Radius *(DN-GEO-03031)*	Approx. Radius *(existing)*	Comment
1	Moneenshinnagh	At N16/R283 Priority Junction	720	590	1 Step Below Relaxation
2	Aghlacon	At Scardan River Bridge Crossing	720	405	2 Step Below Relaxation
3	Loughaphonta	North of Lakeview House	720	270	Departure from Standard
4	Carrigeengeare	North of Carrigeengeare School House	720	225	Departure from Standard
5	Munakill	West of access to Kilmakerrill Graveyard	720	140	Departure from Standard
6	Kilmakerrill	East of access to Kilmakerrill Graveyard	720	210	Departure from Standard
7	Kilmakerrill	West of Cornavannoge River Bridge Crossing	720	110	Departure from Standard
8	Kilmakerrill	East of Cornavannoge River Bridge Crossing	720	360	2 Step Below Relaxation

Table 3-1 above highlights significant deficiencies with eight existing curves, five of which would represent departures from standard for a design speed of 100km/h. These characteristics result in a lesser degree of driving comfort for road users and give rise to safety issues which is compounded further by restricted forward visibility and therefore stopping sight distance.

The current cross-section of the Munakill section of the N16 also offers no hard-shoulders, hard-strips or verge space for pedestrians or cyclists and consequently it poses dangers for vulnerable road users.

The existing carriageway is generally 6.0m wide (2 x 3m lanes) with grass verges less than 1.0m wide, and much of the roadsides are unforgiving with large trees, walls, fences, utility poles etc. within the Clear Zone. The existing carriageway is in contrast to the previously improved sections of the N16 on the either side of the Munakill Scheme, which have wider lanes, hard strips or hard shoulders and verges. Transitioning between a designed cross section and the existing sub-standard cross section presents inconsistency and potential road safety risks to drivers and vulnerable road users. In addition, the absence of hard strips/hard shoulders/adequate verges means that there is no space for a broken-down vehicle to pull-in if the need arises, potentially resulting in a road safety hazard to mainline traffic.

3.2.1.2 Junctions and Direct Accesses

In relation to accesses and junctions onto the existing N16, there are currently four side road junctions and 57 no. direct accesses varying from agricultural and residential accesses. Each access point and junction represents a potential hazard for all road users. A junction or direct access presents a potential conflict point between motorists which may give rise to rear end shunt, side swipe, side on, or turning movement type collisions. The collision hazard is increased because of the reduced levels of visibility from and to many of these access points.

3.2.1.3 Journey Time and Speed Assessment

During the period September 16th to September 22nd, 2020, a series of traffic surveys were undertaken within the study area which will be further discussed in Section 4. These surveys which were conducted over a seven-day period found that the existing mean traffic speed was 69km/h. This shows that mean speeds are significantly lower that what would be expected on a current day national primary strategic road. It is considered that these low speeds are attributed to the high demand horizontal alignment of the N16 in Munakill. This substandard character is also reflected in the assessment of the route under the recent National Speed Limit Review (2018) which recommended and subsequently introduced a special speed limit of 80kph for this section of road.

3.2.1.4 Vulnerable Road Users

The existing carriageway also does not offer any dedicated facility for vulnerable road users such as pedestrians and cyclists. The absence of hard-shoulders, hard-strips or verge space results in pedestrians and cyclists travelling in the carriageway where they are at risk of being struck by vehicles.

3.2.1.5 Conclusion

In light of the issues outlined above, it is considered that the Do-Nothing Option does not satisfy the Scheme Objectives, with the exception of Environment, as described below:

- **Economy:** The high demand alignment of the existing N16 is not 'fit for purpose' and is shown to be inconsistent with current design standards and recently improved adjacent sections of the route such as at Cornacloy. The existing mean speed within the study area is also significantly lower than that expected of a national primary strategic transport corridor. The Do-Nothing Option would not reduce journey times and therefore reduce travels cost on the N16.
- **Safety:** The existing alignment is inconsistent with recently improved sections of the N16 and consists of a narrow cross section with numerous hazards within the Clear Zone whilst also offers no facilities for vulnerable road users. The current section also has a high number of direct accesses, many of which have sub-standard visibility. The Do-Nothing Option therefore will not alleviate these existing safety issues.
- **Integration:** The Do-Nothing Option would result in the existing N16 being retained as is with its current infrastructure deficiencies. This option would therefore not provide improvements to the N16 and as a result would not provide improved connectivity and route consistency to this strategic national road which forms part of the TENT-T network. Retaining the existing route as is would also not improve transport links with Northern Ireland or provide increase connectivity to the surrounding urban centres such as Manorhamilton and Glenfarne.
- **Accessibility and Social Inclusion:** The Do-Nothing Option will not enhance accessibility to social and recreational services in the area and retaining the existing N16 as is will not enhance connectivity between Manorhamilton and Glenfarne given the existing deficiencies with the current alignment. In addition, the Do-Nothing Option will not improve journey times and journey time reliability on the existing section of the N16 and as such will not support other modes such as public transport.
- **Physical Activity:** The existing carriageway does not provide any dedicated facility for vulnerable road users such as pedestrians and cyclists. Therefore, the Do-Nothing Option will not provide new opportunities for vulnerable road users.

With respect to the Environment scheme objective, it is assumed for the purposes of assessment that the Do-Nothing Option will meet this objective as no significant impacts on the environment would arise from regular maintenance works (i.e. as no significant improvement works would be undertaken).

In summary, it has been determined that the Do-Nothing Option does not meet the Scheme Objectives and as a result is not considered a viable option for the Scheme.

3.3 Do-Minimum Option

The Do-Minimum alternative provides the baseline for establishing the economic, integration, safety, environmental and accessibility impacts of alternatives and is considered the 'Base Case' in *PAG Unit 4.0* and the *Common Appraisal Framework (CAF). PAG Unit 4.0* states in regard to the Do-Minimum Option that:

> *'The Do-Minimum Option should include those transportation facilities and services that are committed within the appraisal period'*
>
> and
>
> *'The Do Minimum option should consider "committed" schemes alone as the inclusion of "planned" improvements may lead to a set of Scheme options that incorporate projects that may not happen'*

PAG Unit 4.0 outlines that 'committed' schemes are improvements that have been progressed through planning and are either under construction or are programmed into the capital expenditure budget. In the

case of the N16 Munakill Realignment Scheme, no committed schemes were identified within the study area. As a result, the Do-Minimum Option does not exist in the case of the proposed Scheme and therefore is not considered a viable option for the Scheme.

3.4 Do-Something Option – Traffic Management Option

As per *PAG Unit 4.0,* the Traffic Management Option is to be considered and assessed as part of the option selection process. *PAG Unit 4.0* defines the Traffic Management Option as a package of improvements which:

> *'seeks to utilise the existing asset where feasible through on-line improvements, bottleneck removals, road safety works, traffic management measures or Intelligent Systems'*

The Traffic Management Option is outlined within *PAG Unit 4.0* to 'represent the "best" that can be done using the existing infrastructure' and in summary seeks to obtain value for money by responding to transportation problems in low-cost ways that maximise the value of existing infrastructure rather than by major investment in new infrastructure.

In the case of the N16 Munakill Realignment Scheme, one Traffic Management Option was identified which consisted of localised safety infrastructural improvements along the existing section at Munakill. This option would involve localised on-line widening and improvement of the problematic geometry outlined previously in Table 3-1, and the upgrading or improvement of visibility at the numerous junctions and direct accesses throughout the Study Area.

The scope for on-line widening of the existing N16 in the future is however very limited due to the tight and curvilinear existing alignment, the existing constraints (e.g. Lough Gill SAC, Munakill More Lough) and the presence of numerous residential buildings and boundary walls / fence lines running immediately alongside the road. Extensive widening / realignment would be required throughout the Munakill section to address the infrastructural deficit, including in the vicinity of the junctions with the L2217 and L22073 to achieve the desirable values for stopping sight distance and junction visibility. There is also limited space to accommodate dedicated turning lanes to improve turning movements at junctions or to enable platform widening to improve junction visibility.

All of the existing junctions along the route are priority junctions, with the main N16 road having priority, reflecting the relative demand for each movement. There is also a high number of private and agricultural accesses onto the current section of road.

The observed collisions along the route are spaced, rather than being concentrated at any particular location. The existing alignment is sub-standard along the whole route rather than at particular locations. The safety hazard which arises from inconsistency in the standard of route along the whole length of N16 cannot be addressed by piecemeal improvements and such improvements may give rise to further inconsistency when considered in the context of recently improved adjacent sections of the N16. These recent improvement schemes either side of this Scheme also exacerbate the need for a full-scale improvement in order to achieve an acceptable level of route consistency.

In light of the issues outlined above, it is considered that the Do-Something – Traffic Management Option does not satisfy the Scheme Objectives as described below:

- **Economy:** Undertaking on-line widening of the existing N16 would aim to address a series of safety issues along the route however these improvements would not significantly reduce journey times and therefore travel costs on the N16.
- **Safety:** The Traffic Management Option can provide safety improvements to both the existing alignment and its junctions. However due to numerous constraints, issues of landtake and the presence of numerous residential buildings and boundary walls / fence lines running immediately alongside the road, these measures would be localised and cannot be delivered throughout the entire section of the N16. As a result, a consistent safety improvement cannot be delivered along the entire length of this section of the N16.
- **Integration:** The measures which make up a Traffic Management Option relate to safety improvements only and therefore do not address integration issues. Such safety improvement measures would be targeted to address localised safety issues however it is considered that these works would not improve the overall strategic connectivity and route consistency to this strategic national road which forms part of the TEN-T network.

- **Accessibility and Social Inclusion:** Localised safety improvements would not significantly improve journey times and journey time reliability on the existing section of the N16 and as such will not support other modes such as public transport when compared to a full-scale improvement option. It is also considered that a Traffic Management Option would not significantly enhance accessibility to social and recreational services in the area and further beyond in Manorhamilton and Glenfarne.
- **Physical Activity:** The Traffic Management Option would consist of measures to address road safety issues for vehicles only. Therefore, a continuous pedestrian and cyclist facility would not be provided along the entire length of the N16.

Similar to the Do-Nothing Option, it is assumed for the purposes of assessment that the Traffic Management Option would meet the Environment Scheme Objective. This assumes that any potential works forming part of the Traffic Management Option would be appropriately identified, managed, and mitigated during planning, design and construction.

In summary, it has been determined that the Traffic Management Option does not meet the Scheme Objectives and as a result is not considered a viable option for the Scheme.

3.5 Do-Something Option – Public Transport

In addition to the Traffic Management Option, various public transport modes were considered and assessed for the Scheme. In the context of the N16 Munakill Realignment Scheme, the Study Area is rural in character. There are however a number of bus services operating throughout the surrounding area.

Bus Éireann currently operate a year-round local bus route, the 458, between Manorhamilton and Enniskillen. The Transport for Ireland Local Link Service also operates a service within Co. Leitrim. There are currently four stops on both networks within the vicinity of the Scheme, two of these are located within the study area west of R283 priority junction (Blackpark Cross stop) with the remaining stops situated to the east in Cornacloy (Glenboy Big Bog stop). The information provided by Bus Éireann shows that eight weekday stops at both locations on the Sligo to Enniskillen (458) route.

The location of these stops in relation to the Munakill area is presented below in Figure 3-1,

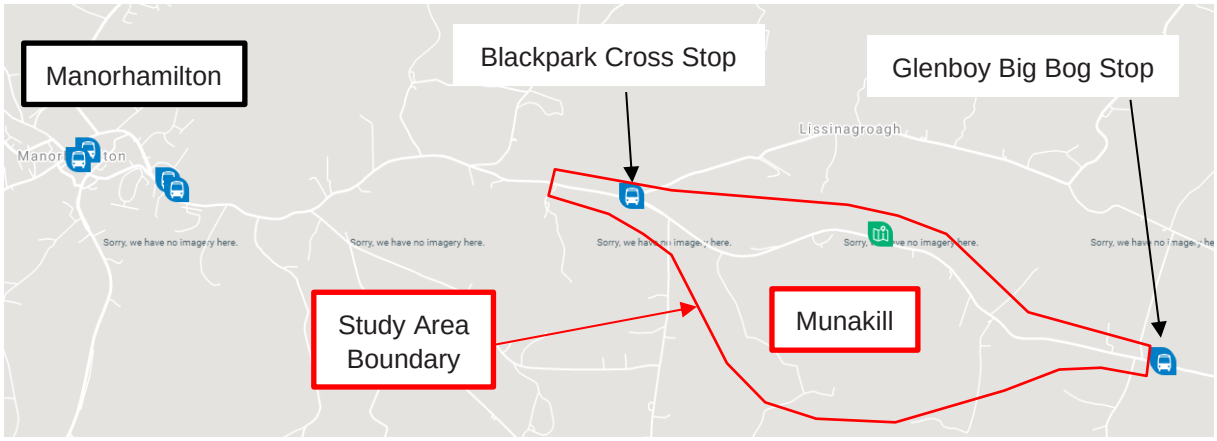

Figure 3-1: Existing Bus Stops (Source: TFI)

In regard to potential future modal shift from private car to bus, it is considered that the potential for improvements to the existing bus service in Munakill is limited given the rural nature of the area and the low-density population. In respect to the Scheme Objectives, it is considered that bus transportation can contribute towards the Accessibility & Social Inclusion objective by serving to provide connectivity for the residents in Munakill and surrounding area to urban centres such as Manorhamilton and Glenfarne and further afield Sligo and Enniskillen. It is however considered that this cannot meet all the Scheme Objectives and that improvements to the road infrastructure are necessary to support journey time and journey time reliability on the N16.

As a result, it is considered that a Public Transport Option does not meet the Scheme Objectives and as a result is not considered a viable option for the Scheme.

3.6 Do-Something Option – Feasible Route Corridor Option

PAG Unit 4.0 states that a corridor improvement 'can be delivered through a major investment to widen an existing road or to develop a new alignment'. The Do-Something Feasible Route Corridor Option therefore includes the development of Route Corridor Options which have been assessed through Stages 1 to 3 of the Option Selection Process. This assessment is outlined in Sections 7, 8 and 9.

3.7 Summary

Table 3-2 below presents a comparison of each of the considered alternatives against the Project Objectives set out in Section 1.4.

Table 3-2: Consideration of Alternatives Summary

Project Objective	Do-Nothing	Do-Minimum	Do-Something Traffic Management	Do-Something Public Transport	Do-Something Feasible Route Corridor Options
Economy	✗	✗	✗	✗	*Refer to Sections 7, 8 and 9*
Safety	✗	✗	✗	✗	
Integration	✗	✗	✗	✗	
Environment	✓	✗	✓	✗	
Accessibility and Social Inclusion	✗	✗	✗	✗	
Physical Activity	✗	✗	✗	✗	

KEY:

✓ Satisfies Scheme Objective

✗ Does Not Satisfy Scheme Objective

4 TRAFFIC ASSESSMENT AND ROAD CROSS SECTION

4.1 Introduction

The following section outlines the traffic assessment undertaken for the proposed N16 Munakill Realignment Scheme. This traffic assessment was to inform the comparative assessment of the identified Route Corridor Options, the identification of the Emerging Preferred Route Corridor and finally the Preferred Route Option. In addition, this assessment was also used to identify the cross-section type for the proposed Scheme.

This traffic assessment was also used to inform the Economy Appraisal of the Stage 2 Project Appraisal Matrix which included a Benefit to Cost Ratio (BCR) appraisal of the Stage 2 Route Corridor Options followed by the preparation of a Project Appraisal Balance Sheet (PABS) for the Stage 3 Preferred Option.

4.2 Traffic Survey Data

During the period September 16th to September 22nd, 2020, traffic surveys were undertaken at a number of locations within the study area. These surveys included:

- Junction Turning Counts (JTC): A count was carried out at both the N16/R283 and N16/L2217 junctions which captured vehicle, pedestrian, and cyclist movements in addition to vehicle queue lengths.
- Automatic Traffic Count (ATC): Traffic volume and speed data was gathered at one ATC site on the N16 mainline west of the access lane to Kilmakerrill Graveyard.
- Automatic Number Plate Recognition (ANPR): Two ANPR surveys were carried out, one west of the N16/R283 priority junction and the second at the eastern extents of the study area approximately 400m east of the access lane to Kilmakerrill Graveyard. These surveys served to capture journey times of different vehicle types when travelling through the study area.

Data from the Transport Infrastructure Ireland (TII) Traffic Monitoring Unit (TMU) database was also collated for use. One permanent TMU is located east of the study area at McNean Court, Co. Leitrim (TMU Ref. N16 040.0E). The data from this TMU provided information on the longer-term trends of traffic on the N16 and was used to supplement the data captured within the study area.

In addition, supplementary speed surveys were undertaken on the recently improved sections of the N16 to the east of the Scheme in the townland of Cornacloy and East Barrs. These surveys were carried out over a 6-day period between February 6th to February 11th, 2021 to ascertain the mean speed of vehicles travelling on an improved alignment (similar to the proposed Munakill Realignment) under the same N16 traffic conditions. These surveys were used to inform the selection of the forecasted future speed as a result of the Scheme and were furthermore used to inform the Economic appraisal of the Stage 2 Route Corridor Options.

4.3 Traffic Data Analysis

4.3.1 Annual Average Daily Traffic (AADT)

The prediction of future AADT flows was carried out through a review of the long-term traffic data available at the permanent TII TMU in addition to the localised traffic surveys carried out within the study area in September 2020.

Table 4-1 below outlines the Annual Average Daily Traffic (AADT) flows recorded for the period 2016 – 2020 at this permanent TMU site.

Table 4-1: Traffic Count Data at TII Automatic Traffic Counter (TMU N16 040.0E)

ATC ID: TMU N16 040.0 E	2020	2019	2018	2017	2016
AADT	1,749	2,686	2,746	2,690	2,625
%HGV	7.8%	5.8%	5.7%	5.6%	6.7%
Coverage	57.9%	99.5%	99.7%	99.7%	99.7%

Table 4-1 above shows that the AADT for 2020 is significantly less than the general trend in AADT volumes recorded in the preceding years from 2016 to 2019. It is considered that this reduction in AADT is directly attributed to the impacts on traffic patterns due to national travel restrictions imposed due to COVID-19. For this reason, the data recorded for 2020 was not included in the traffic forecasting process set out below.

This AADT for 2019 was compared to the 24-hour Weekday Average recorded at the Automatic Traffic Counter (ATC) which was 2,540. This reduction in flow was again attributed to the impacts of travel restrictions due to COVID-19 on traffic patterns.

Therefore, for the purposes of traffic forecasting a base year **AADT of 2,686 for 2019** was used. In addition, the percentage of HGV traffic report for 2019 at the TII TMU site of 5.8% was also used.

4.3.2 Forecasting

Traffic forecasting was undertaken on the 2019 Base Year AADT using the link-based growth procedure prescribed within PAG Unit 5.3 Travel Demand Projections for the following years:

- Opening Year (assumed): 2024
- Design Year: 2039
- Horizon Year: 2050.

Using PAG Unit 5.3 Travel Demand Projections, central growth link-based factors were extracted for Co. Leitrim and have been presented in Table 4-2.

Table 4-2: TII Link Based Growth Rates

Co. Leitrim	Light Vehicles (LV)	Heavy Vehicles (HV)
2016-2030	1.0060	1.0313
2030-2040	0.9990	1.0124
2040-2050	0.9971	1.0157

Using a base year ADDT of 2,686 in 2019, Opening Year, Design Year and Horizon Year forecasts were generated using the growth factors set out above. The forecasting results were generated and are summarised in Table 4-3.

Table 4-3: Forecasted ADDT Growth

Stage	Year	Predicted AADT (Central Growth)
Opening Year	2024	2,789
Design Year	2039	2,922
Horizon Year	2050	2,888

As shown above, the highest predicted AADT of 2,922 will occur during the 2039 Design Year. The predicted AADT was found to further reduce in the 2050 Horizon Year to 2888. This is due to the link-based growth rates for light vehicles reducing for Co. Leitrim during the period 2040-2050 as shown in Table 4-2.

4.3.3 Existing Mean Speed

The existing mean speed of vehicles within the study area was established through the initial phase of traffic surveys (using automatic traffic counters as set out in section 4.2 above) carried out within the study area (i.e. on the unimproved N16 alignment) over a seven-day period between September 16th to September 22nd, 2020. The existing mean traffic speed from these surveys was found to be 69 km/h.

4.4 Selection of Road Type

The forecasted traffic flows as presented in Table 4-3 were compared against the capacity specified for each type of cross section listed within Table 6.1 of DN-GEO-03031 (June 2017) for a Level of Service (LOS) of 'D'. Based on the highest predicted AADT of 2888 and taking in account the National Primary classification of the existing N16, a Type 2 single carriageway is selected as the appropriate road type.

In accordance with Table 6.1 of DN-GEO-03031, a Type 2 single carriageway consists of 3.5m traffic lanes, 0.5m hard strips, a cycle track facility on one side and has a capacity of 8,600 AADT for a LOS D. The Type 2 single carriageway cross section is shown in Figure 4-1 below.

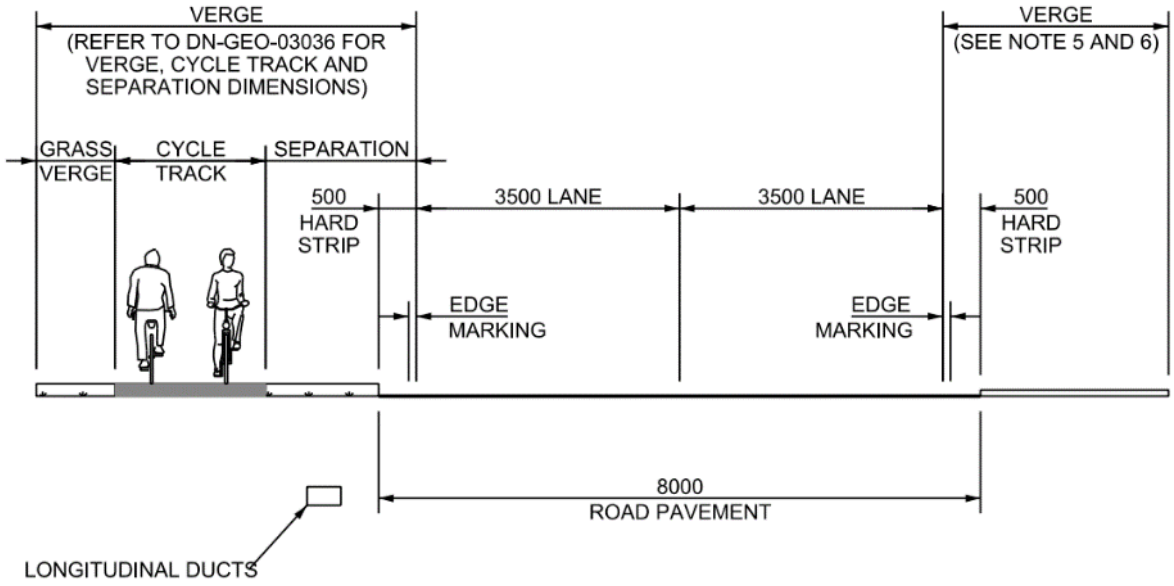

Figure 4-1: Type 2 Single Carriageway Cross Section (DN-GEO-03031)

4.5 Junction and Access Treatment

As part of the Option Selection process it was necessary to determine the requirements for junctions providing access on and off the proposed Scheme. A preliminary junction strategy has been developed at this stage with further detailed analysis to be undertaken at the Phase 3 design stage for the Preferred Option. This may lead to alternative locations or layouts for junctions being proposed.

The preliminary junction analysis undertaken at this stage aimed to determine the general line of each alignment for the purpose of selecting a Preferred Option. The refinement of the Preferred Option in terms of horizontal and vertical alignment as well as development of the detailed layouts of each junction arrangement will be necessary at during preliminary and detailed design.

The junction strategy also considered Scheme tie-in locations (and associated constraints) to the existing road network, as well as traffic data and route consistency.

4.5.1 Junction Types

Table 6.1 of DN-GEO-03031 specifies the following junction types on schemes which adopt a Type 2 single carriageway cross section:

Junction Treatment at Minor Roads: Priority Junctions, with ghost islands where necessary.

Junction Treatment at Major Roads: Priority Junctions, with ghost islands, roundabouts and compact grade separation where necessary.

Table 6.1 of DN-GEO-03031 also specifies that the number of accesses should be minimised to avoid standing vehicles (e.g. when turning right) and concentrated turning movements.

While the final choice of junction type will be determined during Phase 3 Design, for the purpose of the Phase 2 Option Assessment a preliminary junction type has been selected as outlined below for all options shortlisted at Stage 2 (Project Appraisal).

- Three junction locations have been identified as common to Options A, B and C. These are the N16/R283, the N16/L2217 and the farm access lane located just east of the Scardan River. Priority junctions are proposed at all three locations.
- As part of both Option A and Option B, a priority junction is also proposed to maintain access to Kilmakerrill Graveyard. In the case of Option C, access will be maintained using the existing N16 mainline and a priority junction will be provided with the L22073.
- Two additional priority junctions will be provided as part of Option A, one of which will serve a private access to the north-west of Munakill More Lough with the second connecting to the existing N16 in Kilmakerrill.
- Similarly, two additional priority junctions will be provided as part of Option B each of which will connect with the existing N16 north and south of the option's crossing point with the existing N16 adjacent to Kilmakerrill.
- Option C will consist of one additional priority junction with the existing N16 to provide connection to the area north-east of Munakill More Lough.

The type and location of junctions will be further assessed during Phase 3 Design and may be changed from what is proposed at Phase 2 Option Selection.

5 NON-STATUTORY PUBLIC CONSULTATIONS

5.1 Introduction

Consultation and engagement with the public forms a key step in the Phase 2 Option Selection process. These non-statutory Public Consultations are undertaken to generate awareness and initiate participation of the public and key stakeholders and also to obtain feedback for consideration by the Project Team.

In the case of the N16 Munakill Realignment Scheme, three non-statutory Public Consultation events were held during the Phase 2 Option Selection process. These where:

- Public Consultation 1 – Study Area & Constraints – June 2020
- Public Consultation 2 – Route Corridor Options – November to December 2020
- Public Consultation 3 – Emerging Preferred Corridor Option – March to April 2021

The following sections summarise each of these three consultations. Three separate Feedback Reports which outline a detailed description of the process and the feedback received during each Public Consultation are provided in **Volume F**.

Figure 5-1 below presents a roadmap adopted at the start of the Scheme which sets out each stage of Public Consultation with respect to the three defined stages (Stage 1 to Stage 3) of the Option Selection Process.

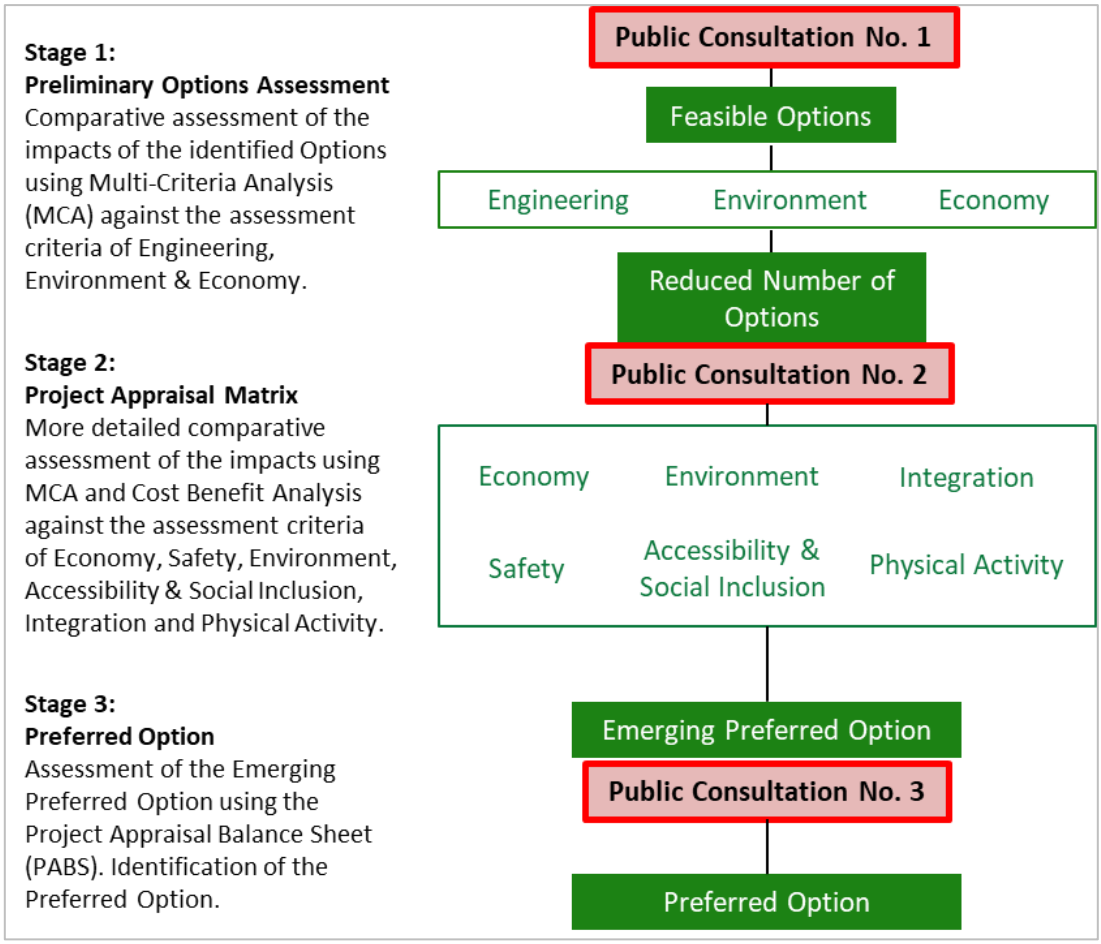

Figure 5-1: Public Consultation Roadmap with respect to Option Selection Process

5.2 Public Consultation No.1 – Study Area & Constraints (June 2020)

The first non-statutory public consultation event for the N16 Munakill Realignment Scheme took place virtually as a result of restrictions on public events due to COVID-19. The purpose of this consultation was to generate awareness of the Scheme and was undertaken in advance of the development and assessment of options.

This round of public consultation also served to provide an opportunity for public participation in the project development process by requesting feedback on any issues or information relating to the study area and constraints, which should be considered by the Project Team when developing the preliminary route options.

A public information leaflet and a questionnaire were posted to all landowners within the study area on 3rd June 2020 and a digital copy was made available on the Leitrim County Council project webpage. In addition, an advertisement for the public consultation was placed in the Leitrim Observer, also on 3rd June, which directed members of the public to the project webpage where scheme information and questionnaires were made available. The public consultation was also promoted on Leitrim County Council social media.

The consultation ran for a three-week period from 3rd June to 24th June 2020.

The Project Team was available during the consultation period for telephone calls whilst submissions and queries could also be submitted through a dedicated email address set up for the Scheme.

In total 7 submissions were received by the Project Team during the consultation period. All feedback received was reviewed and considered by the Project Team, included in the Constraints Study, and used in the development of the Stage 1 Preliminary Route Options.

The Public Consultation 1 Feedback Report is provided in **Volume F Part A.**

5.3 Public Consultation No.2 – Route Corridor Options (November to December 2020)

The second non-statutory public consultation presented the Stage 1 Preliminary Route Options which were shortlisted to be taken forward for Stage 2 assessment and ran for a four-week period from 18th November to 18th December 2020.

Again, due to COVID-19, it was not possible to hold a formal event or an in-person gathering of stakeholders during this time. Therefore, the call for consultation was advertised in the Leitrim Observer newspaper, and on the Leitrim County Council website and social media accounts. An information brochure was distributed to all residents and landowners throughout the Study Area. Scheme maps and brochures were also made available at the Leitrim County Council offices in Carrick-on-Shannon and Manorhamilton, along with notice board displays in a number of local shops and premises in Glenfarne and Manorhamilton that were open to the public at the time.

The information brochure, the Preliminary Route Options map and other relevant information were also made available for viewing and download on the Leitrim County Council project webpage at www.leitrimcoco.ie.

In addition to the above, a briefing was provided by the Project Team to the Elected Representatives of the Manorhamilton Municipal District of Leitrim County Council. This was held online on November 16th, 2020.

Accompanying the brochures, a questionnaire was also distributed within the Study Area to allow members of the public to have their say on the project. Members of the public could also make direct submissions to the Project Team through the dedicated project email address n16munakill@rpsgroup.com or by returning a hard copy of the questionnaire to RPS or Leitrim County Council. This questionnaire was available on the project webpage in digital format.

The Public Consultation 2 process offered the following means for stakeholders to provide feedback on the Stage 1 Preliminary Route Options:

- Consultation questionnaires.
- Online virtual consultation meetings (via Microsoft Teams).
- Telephone consultations; and
- In-person socially distanced site meetings on request.

In total 31 submissions were received by the Project Team during the consultation period. All feedback received was reviewed and considered by the Project Team in further developing and appraising the Stage 2 Route Corridor Options.

The Public Consultation 2 Feedback Report is provided in **Volume F Part B.**

5.4 Public Consultation No.3 – Emerging Preferred Route Corridor (March to April 2021)

The third non-statutory public consultation presented the Emerging Preferred Route Corridor identified for the Scheme and again ran for a four-week period from 24th March to 22nd April 2021.

This Public Consultation again took place under COVID-19 restrictions and therefore it was not possible to hold a formal event or an in-person gathering of stakeholders. As per Public Consultation 2, the same information and promotional channels were used to provide information of the Emerging Preferred Route Corridor to the public including a newspaper advert, LCC's website and promotion on social media channels.

A brochure, questionnaire, and a summary handout with a map of the Emerging Preferred Route Corridor was distributed to all residents and landowners throughout the Study Area. This information was also made available at the Leitrim County Council offices in Carrick-on-Shannon and Manorhamilton, again along with notice board displays in a number of local shops and premises in Glenfarne and Manorhamilton that were open to the public at the time.

All relevant information was also made available for viewing and download on the Leitrim County Council project webpage. As with Public Consultation 2, a briefing was also provided by the Project Team to the Elected Representatives of the Manorhamilton Municipal District of Leitrim County Council. This was held online on March 24th, 2021.

Members of the public were again able to make direct submissions to the Project Team through the dedicated project email address or by returning a hard copy of the questionnaire to RPS or Leitrim County Council. This questionnaire was also made available on the project webpage in digital format

Similar to Public Consultation 2, the Public Consultation 3 process offered the following means for stakeholders to provide feedback on the Emerging Preferred Route Corridor:

- Consultation questionnaires.
- Online virtual consultation meetings (via Microsoft Teams).
- Telephone consultations; and
- In-person socially distanced site meetings on request.

In total 18 submissions were received by the Project Team during the consultation period. All feedback received was reviewed and considered by the Project Team in advance of finalising the Emerging Preferred Route Corridor as the Preferred Route Corridor or Preferred Option.

The Public Consultation 3 Feedback Report is provided in **Volume F Part C.**

5.5 Consultations with Statutory Bodies

Throughout the Phase 2 Option Selection process, the Project Team also contacted and provided notification of the Scheme to various Prescribed Bodies as outlined in Table 5-1. In advance of each of the three stages of Public Consultation, pre-consultation briefings were also undertaken with the Elected Representatives of the Manorhamilton Municipal District of Leitrim County Council. Individual consultation meetings also took place with respective bodies where requested such as the local Glenboy/Glenfarne Group Water Scheme in the area.

Table 5-1: List of Statutory Consultees Contacted

Consultee	Consultee	Consultee
An Taisce	Leitrim County Council Environment Department	Leitrim County Council Public Lighting
Birdwatch Ireland	ESB	Leitrim County Council Road Department
BT Ireland	Fáilte Ireland	Local Authority Waters and Communities Office
Bus Éireann	Gas Networks Ireland	National Inventory of Architectural Heritage
Coillte	Geological Survey of Ireland (GSI)	National Monuments Service
Cycling Ireland	Health Service Executive	National Museum of Ireland
Department of Agriculture, Food and the Marine	Inland Fisheries Ireland	National Trails Office / Irish Sports Council
Department of Communications, Climate Action & Environment	Integrated Development Companies	National Transport Authority (NTA)
Department of Culture, Heritage and the Gaeltacht	Irish Farmers Association (IFA) Leitrim, Longford, Roscommon & Sligo Office	Office of Public Works Head Office
Department of Rural and Community Development	Irish Water	Ordnance Survey Ireland
Department of Transport, Tourism and Sport (DTTAS)	Leitrim County Enterprise Board	Property Registration Authority
Eir	Leitrim County Council Heritage Department	Road Safety Authority
Enet (Broadband)	Leitrim County Council Planning Department	Royal Irish Academy: Committee For Historical Studies
Shannon Development Tourism Division	The Arts Council	Three
Siro	The Heritage Council	Virgin Media
Teagasc	The Irish Cycling Advocacy Network	Vodafone
Water Services	Waterways Ireland	Glenboy/ Glenfarne Group Water Scheme

6 CONSTRAINTS STUDY

6.1 Introduction

The first step of the Option Selection Process is the definition of the Study Area and the subsequent identification of all existing constraints within that Study Area. These constraints were then mapped and documented as part of Constraints Study Report which is provided in **Volume B**.

6.2 Study Area

The study area identified for the Scheme is shown below in Figure 6-1.

This study area covers an area of approximately 2.222km2 (spherical) and commences in the townland of Moneenshinnagh west of the existing R283 Kiltyclogher junction. The area then captures the townlands of Munakill, Aghlacon, Loughaphonta, Carrigeengeare and Kilmakerrill before terminating to the east in the townland of Cornacloy. The study area starts in Moneenshinnagh approximately 4km east of Manorhamilton.

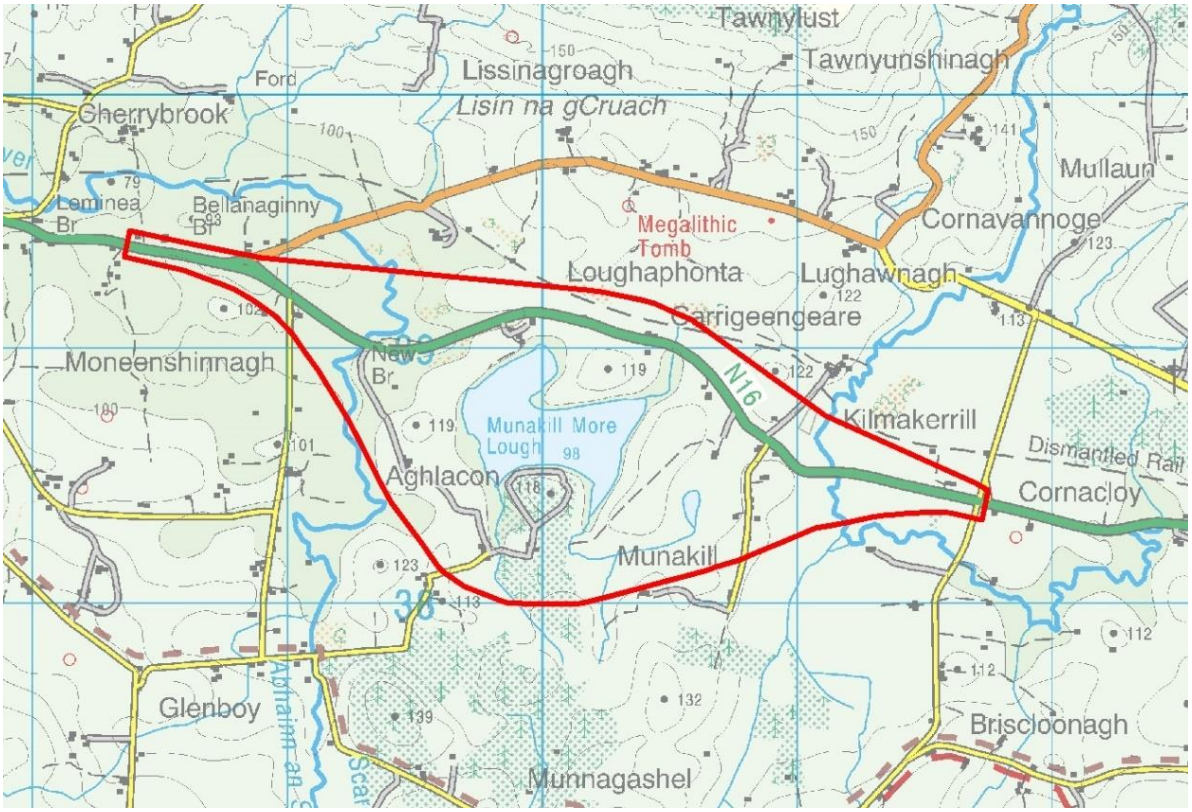

Figure 6-1: Study Area

(Mapping: Ordnance Survey of Ireland Licence No. 2021/OSI_NMA_139)

6.3 Constraint Study

A Constraints Study was undertaken in order to identify key constraints within the study area and to examine alternative options for the proposed improvement of the N16 at Munakill. These constraints and their assessment informed the decision-making process in terms of the Stage 1 Preliminary Options Assessment, the Stage 2 Project Appraisal Matrix and the selection of the Stage 3 Preferred Option.

The Constraints Study considered the natural constraints (landscapes and features), physical constraints (the built environment) as well as the external constraints (design standards, policy, legal issues), in accordance with the TII Project Management Guidelines.

The natural and physical constraints were assessed in terms of the environmental factors as per Section 171A(b)(i) of the Planning and Development Act (2000) as amended by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

External constraints were considered in terms of alignment with design standards, achieving the objectives of EU, national and local policies, and meeting legal requirements, e.g. protecting the integrity of SAC and SPA designated sites.

The Constraints Study examined all of the relevant environmental aspects likely to be potentially impacted by any new road developed within the defined study area. The key constraints which have been identified in relation to the environment are:

- Population, Human Health and Material Assets – Economic and employment activity, Recreational and Amenity Assets, Tourism, Residential dwellings and agricultural outbuildings.
- Agronomy – Agricultural activities.
- Special Area of Conservation (SAC) – Lough Gill SAC.
- Biodiversity - Regionally important breeding area for the hen harrier (Circus cyaneus).
- Hydrology – Munakill More Lough, Munakill Beg Lough, Scardan and Cornavannoge River, Loughaphonta, Glenboy and Munakill Stream.
- Hydrogeology – Regionally Important Aquifer (Rkc) - Karstified (conduit), zones of High and Extreme groundwater vulnerability.
- Soils and Geology - Deep poorly drained mineral soil, Limestone Till (Carboniferous) (TLs) subsoil. Bedrock geology comprising of three limestone and one sandstone formation type underlain with Darty Limestone Formation.
- Utilities – Medium and low voltage overhead ESB, Eir network and Glenboy/ Glenfarne Group Water Scheme Network.
- Cultural Heritage – Record of Monuments and Places (RMP) protected sites; and
- Landscape Character Areas (LCAs) - Type No. 9: Drumlin Farmland.

7 STAGE 1 PRELIMINARY OPTIONS ASSESSMENT

7.1 Introduction

A full description of the Stage 1 Preliminary Options Assessment carried out is provided in the Phase 2 Stage 1 Assessment Report provided in **Volume C**.

The following section provides a summary of the development of the Stage 1 Route Corridor Options and outlines the Stage 1 assessment methodology, the criteria examined and the results and recommendations arising from the Stage 1 process.

7.2 Preliminary Options

An objective of option selection is to identify an alignment which would avoid, where possible, impacts on the environment at early stages of project planning and design. This is achieved in the first instance through the avoidance of the major constraints identified during the Constraints Study. Where avoidance is not possible, every effort is made to ensure that any interaction is minimised.

Consideration was given to the constraints within the study area, as identified in the Constraints Study and six preliminary options were developed using the desirable minimum geometric parameters outlined for a design speed of 100km/h within DN-GEO-03031 (Rural Road Link Design, June 2017) of TII Publications.

The six preliminary options developed are illustrated below in Figure 7-1.

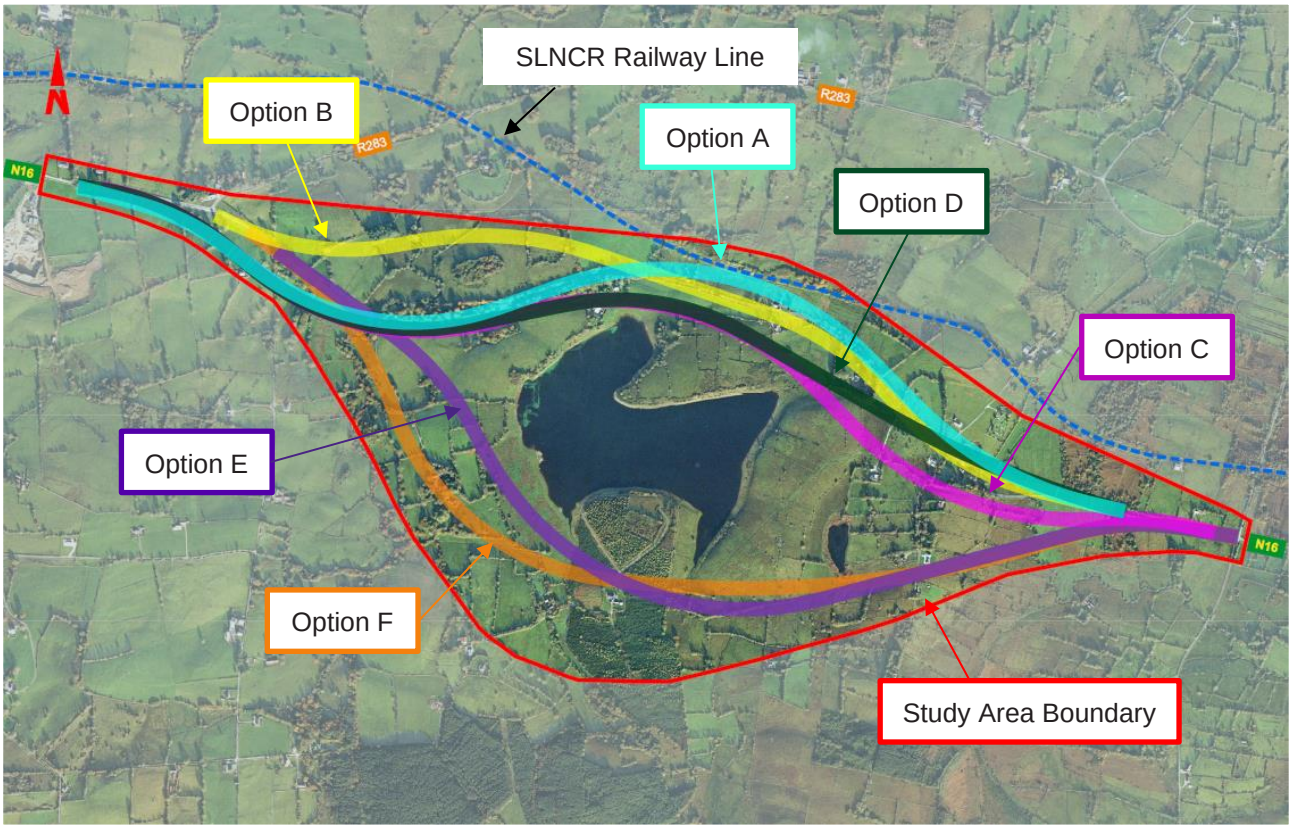

Figure 7-1: Stage 1 Preliminary Options

(Mapping: Ordnance Survey of Ireland Licence No. 2021/OSI_NMA_139)

A brief description of each option has been provided in Table 7-1 below.

Table 7-1: Stage 1 Preliminary Option Descriptions

Option	Length	Description
A	**3,317m**	Option A runs partially online with an online section of approximately 350m to the north-west of Munakill More Lough. The option runs off-line to the west and intersects the L2217 before crossing the Scardan River and returning online again. From here, this option travels off-line between the existing Sligo, Leitrim & Northern Counties Railway line (SLNCR) and a number of private dwellings which face onto the existing N16. To the east, the option then continues to travel off-line north of the existing N16, crossing the access road for Kilmakerrill graveyard before its tie-in with the existing N16.
B	**2,737m**	Option B runs predominantly online and follows closely to the existing N16 to the north and east of Munakill More Lough. This option however is positioned off-line in the west and passes through the Lough Gill Special Area of Conservation (SAC). The shortest of all five options, Option B would pose a direct impact to the SAC and would require the construction of a bridge crossing over the River Scardan within the SAC footprint.
C	**3,419m**	Option C runs predominantly offline and to the south of the existing N16. It commences to the west of the N16/R283 priority junction and intersects the L2217 before crossing the Scardan River to the south of the Lough Gill SAC. The alignment intersects with a farmyard while following closely to the northern extents of the Munakill More Lough and stays to the south of the N16, intersecting the L22073 before its tie-in with the existing N16.
D	**3,483m**	Similar to Option C, Option D runs predominantly offline to the south of the existing N16. It commences to the west of the N16/R283 priority junction and intersects the L2217 before crossing the Scardan River to the south of the Lough Gill SAC. The alignment intersects with a farmyard while following closely to the northern extents of the Munakill More Lough. To the east the option then crosses the existing N16 at the Kilmakerrill graveyard, intersecting its access road before its tie-in with the existing N16.
E	**3,126m**	Option E is an offline option extending to the south of Munakill More Lough. It commences to the east of the N16/R283 junction and intersects with the L2217 before crossing the Scardan River to the south of the Lough Gill SAC. It then follows closely to the southern extents of the Munakill More Lough, traveling between a number of residential properties on the L22073, intersecting with the local road before its tie-in with the existing N16.
F	**3,251m**	Similar to Option E, Option F is an offline option extending to the south of Munakill More Lough. It commences to the east of the N16/R283 junction and intersects with the L2217 before crossing the Scardan River to the south of the Lough Gill SAC. It then travels to the south intersecting a farmyard to the east of Munakill More Lough before passing to the south of the Lough. To the east it then travels between a number of residential properties on the L22073, intersecting with the local road before its tie-in with the existing N16.

7.3 Methodology

The Stage 1 Preliminary Options Assessment involved a comparative Multi-Criteria Analysis (MCA) of the potential impacts of the preliminary options and examines their relative success in achieving the Project Objectives under the headings of Engineering, Environment and Economy in accordance with *PAG Unit 7.0 Multi Criteria Analysis.*

For Economy, Level 1 cost estimates were prepared for each preliminary option in accordance with the *TII Cost Management Manual (CMM), December 2020* and informed by *PAG Unit 6.2 Preparation of Scheme Costs* using rates calculated to reflect current market conditions and rates documented within the TII document *Schedule of Rates 2019*.

A summary of the criteria and respective sub-criteria examined during Stage 1 is presented below in Table 7-2.

Table 7-2: Stage 1 Assessment Criteria and Sub-Criteria

Stage 1 Main Criteria	Stage 1 Sub-Criteria
Engineering	• Traffic Assessment & Cross-Section • Compliance with Technical Standards • Constructability • Junction & Access Strategy • Structures • Earthworks • Road Safety Assessment • Drainage and Utilities
Environment	• Population, Human Health and Material Assets (Non-Agricultural Land) • Agronomy • Air Quality and Climate • Noise and Vibration • Terrestrial and Aquatic Ecology • Soils and Geology • Hydrology and Hydrogeology • Cultural Heritage • Landscape and Visual
Economy	• Options Comparison Estimate

This Stage 1 assessment was undertaken on each option to include both quantitative and qualitative assessment. Following the assessment of each preliminary option under each criteria and respective sub-criteria, an overall preference was determined. Preferences were rated as one of the following:

- Preferred (denoted by green)
- Intermediate (denoted by orange)
- Least Preferred (denoted by red)

The appropriate preferences were assigned to each sub-criteria as outlined in Table 7-2 above and were then examined collectively to derive an overall preference for each main criterion (i.e. Engineering, Environment and Economy). These preferences were then summarised in the form of a Stage 1 Performance Matrix to determine which options should proceed to Stage 2 – Project Appraisal.

7.4 Engineering Assessment

Table 7-3 below presents the preference ratings for each preliminary option with respect to each Engineering sub-criteria. This table also presents an overall preference rating which was derived by assessing the number of preferences across the nine sub-criteria.

Table 7-3: Stage 1 Engineering Assessment Preferences

Engineering Criteria	Option A	Option B	Option C	Option D	Option E	Option F
Traffic Assessment and Cross Section						
Compliance with Technical Standards						
Constructability						
Junction and Access Strategy						
Structures						
Earthworks						
Road Safety Assessment						
Drainage						
Utilities						
Overall	Preferred	Intermediate	Intermediate	Intermediate	Least Preferred	Least Preferred

Table 7-3 above shows that all options vary in respect to their overall preference with respect to Engineering with a number of options considered as Least Preferred with regards to Structures, Earthworks and Utilities.

In terms of Structures, all options will require a crossing of both the Scardan River and the Cornavannoge River. Options A, B, C and D which pass to the northern side of Munakill More Lough will require one additional crossing over the Loughaphonta stream. However, Option E and Option F will require three additional watercourse crossings, one of which is for the Glenboy stream to the south-west of Munakill More Lough. Both options will also cross the Munakill stream at two locations thus equating to a total of three crossings for both options.

The theoretical imbalance between cut and fill quantities with respect to Earthworks also varies for each option. Options D, E and F have the highest theoretical imbalance between cut and fill quantities. Option D cuts through a defined hill feature to the north-east of Munakill More Lough, while Options E and F have a high balance between cut and fill quantities as they travel through a rolling type terrain with defined hills present on the west, south and east banks of the Lough.

Options B and E have the most significant impact on existing utilities when compared to all options. Option B has the greatest impact on both existing EIR services and on the existing water network. It was also found that Option B extends along the path of approximately 1,120m of 100mm diameter water pipeline where this option travels online through the Kilmakerrill area. Option C presents the highest number of conflicts with ESB Medium Voltage (MV) Network (7 no). It also has two conflicts with ESB Low Voltage (LV) and EIR. It was also found that some ESB MV cables extend longitudinally along the alignment of Option C creating significant conflicts which may require larger diversions of ESB MV services of approximately 750m.

Taking into consideration the preference rating for each option across the nine Engineering sub-criteria, Option A is considered to be Preferred with Options B, C and D considered to be Intermediate. Option E and Option F are considered to be Least Preferred.

7.5 Environment Assessment

Table 7-4 below presents the preference ratings for each preliminary option with respect to each Environmental sub-criterion. This table also presents an overall preference rating which was derived by assessing the number of preferences across the nine sub-criteria.

Table 7-4: Stage 1 Environment Assessment Preferences

Environmental Criteria	Option A	Option B	Option C	Option D	Option E	Option F
Human Beings and Material Assets						
Agronomy						
Air Quality and Climate						
Noise and Vibration						
Terrestrial and Aquatic Ecology						
Soils and Geology						
Hydrology and Hydrogeology						
Cultural Heritage						
Landscape and Visual						
Overall	Preferred	Least Preferred	Intermediate	Intermediate	Intermediate	Least Preferred

Similar to Engineering, Table 7-4 shows that all options vary in respect to their preferences under the Environmental sub-criteria with a number of options considered as Least Preferred.

Option B passes though the existing Lough Gill SAC to the west of Study Area. TII policy and guidance states that all reasonably practicable efforts should be made to ensure that all options avoid any significant effects on European sites of conservation importance. In addition, Article 6(2) of the Habitats Directive states that Member States shall take appropriate steps to avoid, in the special areas of conservation, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of this Directive. As alternative options are available which do not impact on the Lough Gill SAC, Option B is considered the Least Preferred option with respect to Environment.

Option F was also considered as Least Preferred overall. Option F will pass through farm property located to the west of Munakill More Lough and will directly impact on both the dwelling and all existing outbuildings. Option F also intersects the lane leading to this farm from the current N16 and the access tracks distributed throughout the surrounding farmland. Option F also results in a direct impact to the property access to the residential property south of Munakill More Lough by intersecting the track leading towards the existing Lough. Option F also has negative impacts with respect to Agronomy as this option passes to the south of Munakill More Lough which in turn results in significant impacts on agriculture due to severance.

Both Option E and Option F will have 3 additional stream crossings consisting of: 1 no. crossing of the Glenboy stream to the south-west of Munakill More Lough and two crossings of the Munakill stream to the south-east of Munakill More Lough. Option F also tips the southern end of Munakill Beg Lough within a reedy, wetland area of local ecological significance which results in a Least Preferred preference for both options in regard to Terrestrial and Aquatic Ecology.

In terms of Soils and Geology, Option E and Option F pass through areas of Karst Limestone (given their path south of Munakill More Lough) and they both also pass through significant areas of Soft Ground. Although Options E and F have the shortest lengths cutting through areas of potential rock at or near the surface, both are significantly impacted by areas of soft ground.

In respect to Cultural Heritage, Options E and F have the least overall measurable indirect impact on recorded RMP sites within the Study Area, largely due to the alignments traversing south of Munakill More Lough where there is overall less RMP site distribution density. However, this area south of the existing N16 also retains four archaeological anomalies identified from UAV data, all of which are relevant to Options E and F and considered potential slight or moderate impacts. Only one archaeological anomaly, AN01 is relevant to options A – D inclusive. Options E and F each have direct impact on three built heritage structures, including Lakeview farmstead (Option F – moderate impact) as well as lime kilns, a vernacular structure and New Bridge (slight impacts). An indirect moderate impact is also noted for Option F on an extensive vernacular thatched settlement complex at Aghlacon, as well as closer proximity to RMP sites LE012-005001- and LE012-005002- (22m distance from ZoN) when compared with Option E.

Finally, with regards to Landscape and Visual, both Option E and Option F travel primarily offline and pass to the south of Munakill More Lough before returning online with the existing N16 corridor at each end of the Study Area. The tie-in point with the existing N16 is at approximately 90m AOD in the west and approximately 100m AOD in the east. The land along the path of each option is a rolling type terrain with defined hills (approximately 110m AOD) present on the west, south and east banks of Munakill More Lough. By following this path, it is considered that both Options E and F pose a negative impact in regard to Landscape. Not only will each option bring the road to an area which is primarily occupied for agricultural, but the option will have a carving impact through the undulating landscape and hills. This in turn is considered to negatively impact on the visual amenity of this area.

Taking into consideration the preference rating for each option across the nine Environmental sub-criteria, Option A is considered to be Preferred with Options C, D and E considered to be Intermediate. Option B and Option F are considered to be Least Preferred.

7.6 Economy Assessment

For Economy, Level 1 cost estimates were prepared for each preliminary option in accordance with the *TII Cost Management Manual (CMM), December 2020* and informed by *PAG Unit 6.2 Preparation of Scheme Costs* using rates calculated to reflect current market conditions and rates documented within the TII document *Schedule of Rates 2019*.

Table 7-5 below sets of the OCE's for each option in units of €1 million in accordance with the procedure outlined within *TII PAG Unit: 6.2 Preparation of Scheme Costs.*

Table 7-5: Option Comparison Estimates to TII PAG Unit 6.2

Base Costs (€m) *(Incl. VAT and Project-specific contingency)*	Option A	Option B	Option C	Option D	Option E	Option F
Main Contract Construction	€9.41	€7.16	€10.43	€15.65	€13.13	€15.02
Main Contract Supervision	€0.71	€0.54	€0.79	€1.19	€1.00	€1.14
Archaeology	€0.63	€0.52	€0.65	€0.66	€0.59	€0.62
Advance Works and other contracts	€0.85	€0.70	€0.88	€0.89	€0.80	€0.84
Walking, Cycling and Asset Renewal	€0.08	€0.06	€0.09	€0.14	€0.11	€0.13
Land & Property	€1.85	€1.79	€2.43	€2.72	€2.53	€2.60
Planning and Design	€1.41	€1.16	€1.45	€1.48	€1.33	€1.38
Subtotal	€14.95	€11.94	€16.71	€22.72	€19.49	€21.72
Total Inflation Allowance	€1.32	€1.05	€1.47	€2.00	€1.72	€1.91
TII Programme Risk	€0.75	€0.60	€0.84	€1.14	€0.97	€1.09
Option Comparison Cost Estimate	**€17.02**	**€13.59**	**€19.02**	**€25.86**	**€22.18**	**€24.72**

The assessment set out in Table 7-5 found that Options D, E and F (costing €25.86m, €22.18m, and €24.72m respectively) are the most expensive options to deliver due primarily to the poor theoretical balance

between cut and fill quantities for each, and the impact that each option has on property within the study area. As a result, it is considered that Options D, E and F are ranked as the 'Least Preferred' options under economy.

Option B was found to be the least expensive option at €13.59m and is therefore ranked as the 'Preferred' option. This was then followed by Option A and Option C which were found to cost €17.02m and €19.02m respectively. Both of these options are therefore ranked as 'Intermediate' preference.

A summary of the preference rating for each option with respect to economy is shown in Table 7-6.

Table 7-6: Stage 1 Economy Assessment Preferences

Option	Preference Ranking
Option A	Intermediate
Option B	Preferred
Option C	Intermediate
Option D	Least Preferred
Option E	Least Preferred
Option F	Least Preferred

7.7 Overall Stage 1 Performance Matrix

An overall preference ranking was derived from a collective qualitative assessment of the Engineering, Environmental and Economic parameters to each of the preliminary options.

The results of the assessment are presented below in Table 7-7.

Table 7-7: Stage 1 Performance Matrix

Option	Engineering	Environment	Economy	Progress to Stage 2
Option A				**Yes**
Option B				No *(See Below)*
Option C				**Yes**
Option D				**Yes**
Option E				No
Option F				No

Table 7-7 above shows that all options vary in preference with respect to Engineering, Environment and Economy. It was found that Option A was the most preferred option collectively under Engineering, Environmental and Economic parameters.

As outlined within Section 7.4, Option B passes though the existing Lough Gill SAC. As alternative options are available which do not impact on the Lough Gill SAC, Option B shall not proceed to Stage 2.

Option A was found to be the most preferred option collectively under the Engineering, Environmental and Economic parameters. This is then followed by Option C which was found to be of 'Intermediate' preference under all three headings. Option D was found to of 'Intermediate' preference under both Engineering and Environment however to be 'Least Preferred' under Economy. Options E and F were found to be the least preferred options collectively under Stage 1. Both options were found to be of 'Least Preferred' preference under both Engineering and Economy with Option F also being of 'Least Preferred' preference under Environment. It was therefore considered that both Option E and Option F should not proceed to Stage 2.

7.8 Stage 1 Recommendation

Six preliminary options were defined for the N16 Munakill Realignment Scheme, four of which passed north of Munakill More Lough with the remaining two passing to the south. Each option was examined using a Stage 1 Multi-Criteria Analysis (MCA) which assessed the potential impacts of each option and its relative success in achieving the project objectives under the headings of Engineering, Environment and Economy in accordance with *PAG Unit 7.0 Multi Criteria Analysis.*

Three options have been identified as having the best combination of benefits vs impacts with respect to the Stage 1 criteria examined and therefore for this reason should progress to Stage 2. The options are summarised below and presented in Figure 7-2.

- Option A: This option passes north of Munakill More Lough and is the northernmost option of those considered at Stage 1. This option passes close to the existing Sligo, Leitrim & Northern Counties Railway line (SLNCR) before running south of Kilmakerrill Graveyard before its tie-in with the existing N16. The alignment is 3,317m in length and runs predominantly offline with 436m (13%) of the option coinciding with the existing N16 alignment. **In the Stage 2 assessment, this option will continue to be referred to as Option A and will be Cyan in colour.**
- Option D: This option is 3,483m in length runs predominantly offline (86%) and passes close the northern backs of Munakill More Lough. This option provides a section of straight horizontal geometry to the east and passes south of the site of Kilmakerrill Graveyard before its tie-in with the existing N16. **In the Stage 2 assessment, this option will be referred to as Option B and will be Yellow in colour.**
- Option C: This option is 3,419m in length again runs predominantly offline (92%) and follows the same path as Option B from its tie-in with the existing N16 in the west to the northern back of Munakill More Lough. From this point, this option continues south of the existing N16 intersecting the L22073 before its tie-in with the existing N16 in the east. **In the Stage 2 assessment, this option will be continued to be referred to as Option C and will be Pink in colour.**

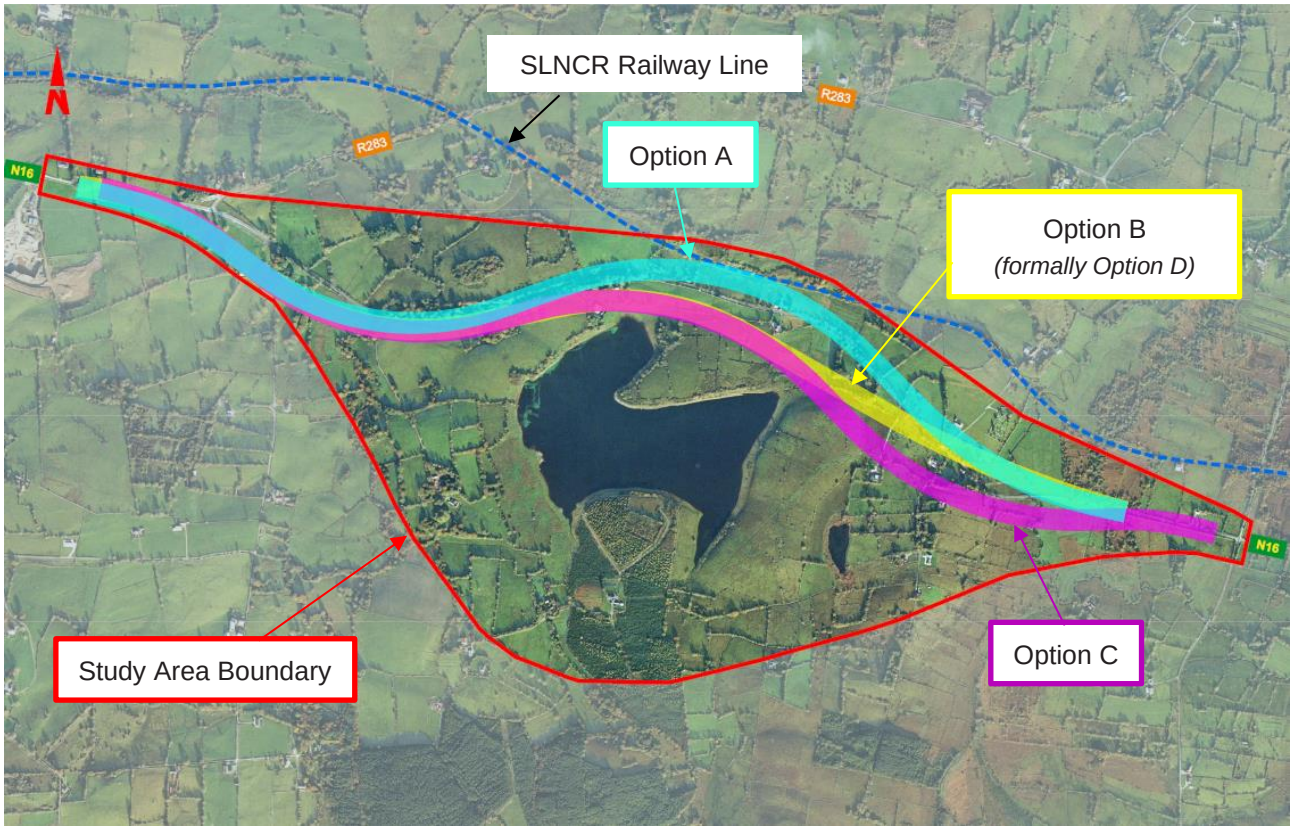

Figure 7-2: Stage 1 Options Progressing to Stage 2

(Mapping: Ordnance Survey of Ireland Licence No. 2021/OSI_NMA_139)

8 STAGE 2 PROJECT APPRAISAL

8.1 Introduction

The following section outlines the findings of the Stage 2 Project Appraisal of the shortlisted options for the N16 Munakill Realignment Scheme. This appraisal involved a detailed Multi-Criteria Analysis (MCA) of the shortlisted options using the six Common Appraisal Framework (CAF) criteria as defined within *PAG Unit 7.0 Multi Criteria Analysis.* Under each criterion defined within *PAG Unit 7.0,* a number of sub-criteria were defined to allow for a more detailed assessment of the Scheme options to be undertaken. The criteria and sub-criteria examined are:

- **Economy:**
  - Transport efficiency and effectiveness
  - Wider economic impacts
  - Funding impacts
- **Safety:**
  - Collision Reduction
  - Security
  - Road Safety Audit (Stage F) Part 1
- **Environment:**
  - Population and Human Health
  - Waste
  - Terrestrial Biodiversity
  - Aquatic Biodiversity
  - Soils, Geology and Hydrogeology
  - Hydrology
  - Air and Climate
  - Noise
- **Environment** (continued):
  - Material Assets (Agricultural)
  - Material Assets (Non-Agricultural)
  - Cultural Heritage
  - Landscape and Visual
- **Accessibility & Social Inclusion:**
  - Deprived geographical areas.
  - Vulnerable groups.
- **Integration:**
  - Transport integration.
  - Land use integration.
  - Geographical integration.
  - Other government policy integration.
- **Physical Activity:**
  - Health Benefits.
  - Journey Ambience Benefits.

The appraisal criteria listed above were individually assessed by competent experts. The assessments carried out were a combination of quantitative and qualitative processes, with a high emphasis placed on detailed expert opinion used in the assessments of each option. Following this assessment, each option was given an overall impact score based on the likely impact that the option had under each sub-criterion.

Section 2 of *PAG Unit 7.0 Multi Criteria Analysis* provides a recommended scoring system which was adopted during the assessment as shown in Table 8-1. Each impact was scored on a scale of 1 (major or highly negative impact) to 7 (major or highly positive impact). A score of 4 represents a neutral or not significant impact.

Table 8-1: Impact scoring system per PAG Unit 7.0 Multi Criteria Analysis

7	Major or highly positive;
6	Moderately positive;
5	Minor or slightly positive;
4	Not significant or neutral;
3	Minor or slightly negative;
2	Moderately negative; or
1	Major or highly negative.

Subsequently, each option was then ranked, and a preference determined. Preferences were grouped into one of three types:

- Preferred – the option(s) which have the most positive impact, considering the project objectives.
- Intermediate – the option(s) where negative and positive impacts are considered reasonable in terms of the anticipated impacts and overall project objectives. Impacts are worse than those of the preferred option(s) but considerably better than those of the least preferred option(s); or
- Least Preferred - the option(s) which have the potential for the greatest negative impact.

8.2 Shortlisted Options

Three options were shortlisted following the MCA assessment undertaken at Stage 1. These options were Option A, Option B and Option C. On completion of Stage 1 and following feedback received during the second public consultation a number of option refinements were made. The horizontal alignment of Option A was adjusted to reduce the impact on two existing properties. This change was achieved by increasing the length of a horizontal curve so as to provide a separation between the proposed road and the grounds of both properties. This minor change increased the length of Option A from 3,317m at Stage 1 to 3,440m for Stage 2 and resulted in a material impact on the existing disused Sligo, Leitrim & Northern Counties Railway line (SLNCR).

> **Note on the SLNCR**: Preliminary planning is underway by others to develop the SLNCR railway line into a Greenway Scheme between Sligo and Enniskillen. Any required modifications to the existing railway line should Option A be progressed will be further examined at Stage 3 – Preferred Option.

The alignments of both Option B and Option C are equivalent to that considered at Stage 1.

Option A, Option B and Option C are presented below in Figure 8-1.

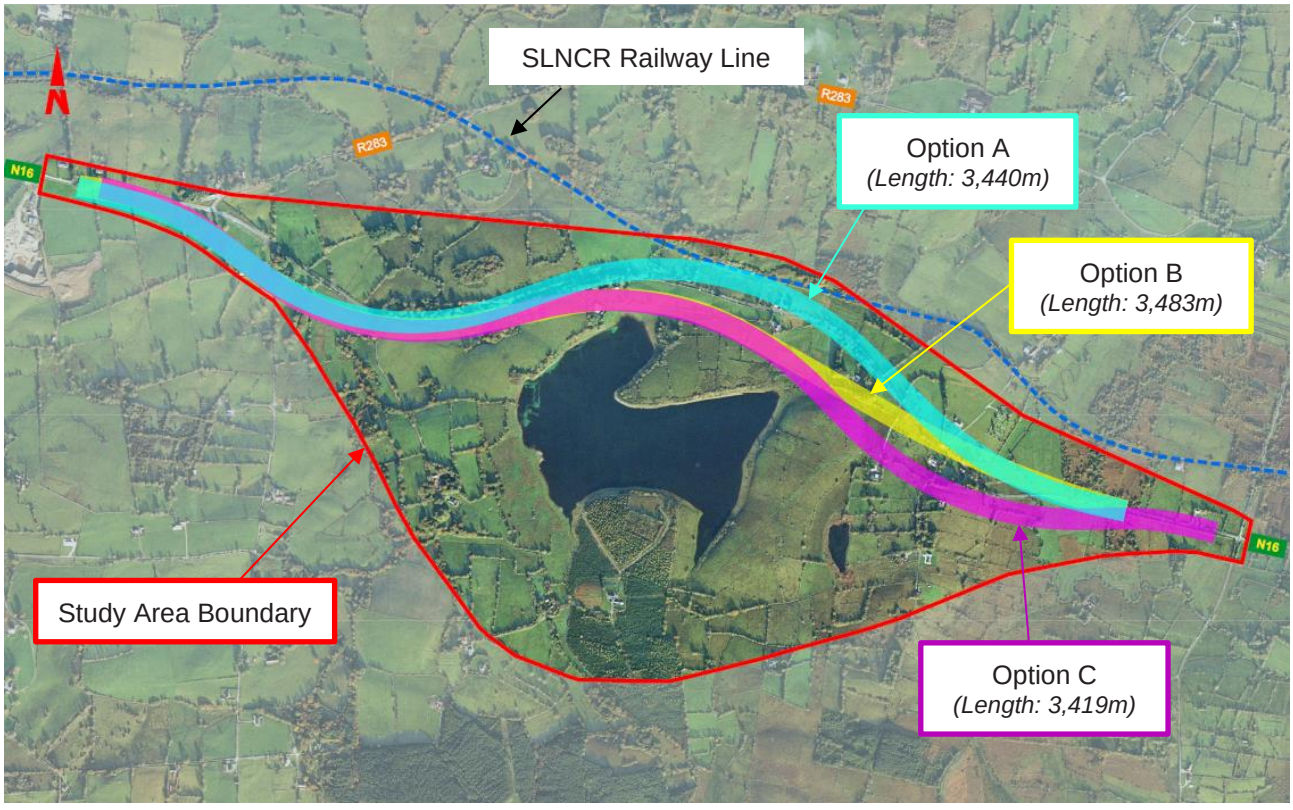

Figure 8-1: Stage 2 Options

(Mapping: Ordnance Survey of Ireland Licence No. 2021/OSI_NMA_139)

8.3 Economy

Three principal areas were examined with respect to Economy in accordance with *PAG Unit 7.0 Multi Criteria Analysis.* These were Transport Efficiency and Effectiveness, Wider Economic Impacts and Funding Impacts. A summary of the findings of each assessment with respect to each sub-criterion is set out below.

The full Stage 2 Economy Appraisal is included in **Volume D.1.**

8.3.1 Transport Efficiency and Effectiveness

Level 2 cost estimates were prepared for the shortlisted options in accordance with the *TII Cost Management Manual (CMM), December 2020* using rates calculated to reflect current market conditions and rates documented within the TII document *Schedule of Rates 2019*. It was estimated that Option A would cost approximately €14.43m, Option B €15.73m and Option C €16.71m.

Using these cost estimates, an analysis of each option was undertaken using the TII Simple Appraisal Tool (Version 4) as outlined within *PAG Unit 12.0 Project Appraisal Guidelines for National Roads*. This tool calculated the change in journey time and vehicle operating cost as a result of each option and furthermore calculated the expected monetary benefits. It was estimated that the Benefit to Cost Ratio (BCR) for Option A is 0.76, for Option B is 0.80 and for Option C is 0.69.

Option A was found to have the second lowest BCR of 0.76 but also be the least expensive option at €14.43m. Option B has the highest BCR of 0.80 but it is the second most expensive option at €15.73m. In comparison to Option A, Option B is €1.3m more expensive (9%). Finally, Option C was found to be the most expensive option at €16.71m (16% more the Option A) and has the lowest BCR at 0.69.

Table 8-2 below provides a summary of each option with respect to Transport Efficiency and Effectiveness.

Table 8-2: Impact scores for Transport Efficiency and Effectiveness

	Option A	Option B	Option C
Impact Description	Minor or slightly negative	Minor or slightly negative	Minor or slightly negative
Impact Score	3	3	3
Preference	Preferred	Intermediate	Least Preferred

8.3.2 Wider Economic Impacts

All route options were examined with respect to Competition in the Market, Agglomeration, Inward Investment, Labour Supply and Urban Regeneration. It was shown the all route options will contribute to improving access to surrounding areas, will reduce travel times and result in an improved level of service on the N16. This will have a positive outcome in terms of reducing travel time between production centres and markets thus deriving additional productivity.

All route options will specifically support connectivity between the economic centres of Manorhamilton, Sligo and Enniskillen and beyond. As a result, this will improve the attractiveness of the local area and support inward investment to its economic areas

However, although all options will support and provide an improved link between markets, the scheme will not link two geographic markets that were previously separated due to its scale. It is also not anticipated that a significant change in labour supply will occur as a result of the route options, however it is anticipated that a residual positive effect in terms of labour markets and attractiveness will remain. Given the rural location of the link, none of the proposed options will support urban regeneration.

Table 8-3 below provides a summary of each option with respect to Wider Economic Impacts.

Table 8-3: Impact scores for Wider Economic Impacts

	Option A	Option B	Option C
Impact Description	Neutral	Neutral	Neutral
Impact Score	4	4	4
Preference	Preferred	Preferred	Preferred

8.3.3 Funding Impacts

As the N16 corridor forms part of the TEN-T network and has been assigned a status of 'To be upgraded' by the European Commission, there is an opportunity to secure non-exchequer funding through the European Union. However, at the time of this assessment, it is unknown if such funding is available. Therefore, all options are considered to be deemed to be 'Neutral' in impact.

Table 8-4 below provides a summary of each option with respect to Funding Impacts.

Table 8-4: Impact scores for Funding Impacts

	Option A	Option B	Option C
Impact Description	Neutral	Neutral	Neutral
Impact Score	4	4	4
Preference	Preferred	Preferred	Preferred

8.4 Safety

Two principal sub-criteria were considered with respect to road safety in accordance with *PAG Unit 7.0 Multi Criteria Analysis*. These were Collision Reduction and Security of Road Users. The appraisal also considered the findings from a Stage F Part 1 Road Safety Audit (RSA) which consisted of a comparative assessment of the options from a road safety perspective in accordance with the requirements of GE-STY-01024, dated December 2017 of TII Publications.

A summary of the findings of each assessment with respect to each sub-criterion is set out below

The full Stage 2 Safety Appraisal is included in **Volume D.2.** Additionally, the Stage F Part 1 Road Safety Audit Report is also included in **Volume D.2.1.**

8.4.1 Collision Reduction

All route options have been developed to address the legacy safety issues on the existing N16 such as sub-standard alignment, restricted forward visibility, restricted visibility at accesses, poor level of service, narrow verges, absence of facilities for vulnerable road users, high frequency of direct accesses, unforgiving roadsides including boundary walls at the edge of carriageway.

Each option will therefore provide a significant improvement in infrastructure provision in comparison to the existing N16 alignment. All proposed options and their associated junctions will be designed to current design standards and therefore will result in a consistent cross-section width for road users (given that it is tying into previously improved sections of route at either end) in addition to ensuring sufficient capacity for future traffic volumes.

All options will also rationalise the number direct accesses (currently 57 No.) onto the current alignment which in turn will reduce conflict points between road users which may give rise to rear end shunt, side swipe, side on, or turning movement type collisions.

Table 8-5 below provides a summary of each option with respect to Collision Reduction.

Table 8-5: Impact scores for Collision Reduction

	Option A	Option B	Option C
Impact Description	Moderately positive	Moderately positive	Moderately positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.4.2 Security of Road Users

The security objective is concerned with improving the personal security of travellers and their property. Security also considers the security of vulnerable road users, such as pedestrians and cyclists.

The existing N16 at Munakill is currently a sub-standard single carriageway alignment that has numerous roadside hazards. There are also no facilities for vulnerable road users within the study area. The lack of adequate carriageway width combined with the absence of hard strips and highly constrained verge widths compromises the safety of vulnerable road users.

The proposed cross section for the Scheme is a Type 2 Single Carriageway in accordance with CC-SCD-00002 of TII Publications. A requirement of this type of cross section is the provision of a walking/cycling facility on one side of the new road construction which is separated by a grass verge.

Preliminary planning is underway by others to develop the existing disused Sligo, Leitrim & Northern Counties Railway line (SLNCR), which passes through the North of the Study Area, into a Greenway scheme between Sligo and Enniskillen. Considering the requirements of the selected cross section together with the preliminary works underway on the planning of the SLNCR Greenway, the cycling strategy considered for the purpose of the Stage 2 Appraisal consists of two scenarios as follows.

- **Scenario A:** The first scenario will involve using the planned SLNCR Greenway as the dedicated pedestrian/cyclist facility for the Scheme. This approach will involve providing links to the SLNCR line to allow pedestrians and cyclists within the Study Area to access the facility from the N16 and the Local Road network. This scenario will have safety benefits by diverting pedestrians and cyclists away from the N16 carriageway and onto the Greenway thereby reducing the potential for conflicts.
- **Scenario B:** The second scenario will involve the re-use of the existing N16 cross section where possible combined with the development of short sections of dedicated pedestrian/cyclist facility running parallel to the new carriageway as per the cross section requirements defined in CC-SCD-00002 of TII Publications. This scenario may include for the provisions of links to the SLNCR Greenway at a later stage however has the benefit of ensuring that facilities for pedestrians and cyclists will be provided irrespective of the SLNCR Greenway.

Both scenarios will represent a significant improvement with respect to pedestrian and cyclist provisions when compared to the current situation. The provision of formal facilities will reduce the potential for conflicts with vehicles on the N16 and in turn cater for pedestrian and cyclist movements in a safer environment thereby enhancing security. Both scenarios will be further examined at Stage 3 – Preferred Option.

Table 8-6 below provides a summary of each option with respect to Security of Road Users.

Table 8-6: Impact scores for Security of Road Users

	Option A	Option B	Option C
Impact Description	Moderately positive	Moderately positive	Moderately positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.4.3 Road Safety Audit (Stage F) Part 1

A Stage F Part 1 Road Safety Audit was undertaken which examined the proposed options in respect to road safety from the perspective of all road users. This audit was carried out in accordance with the requirements of TII Publication GE-STY-01024 Road Safety Audits (December 2017) of TII Publications.

The Road Safety Audit found that all route options represent a significant improvement to the existing arrangement in terms of safety. The Audit Team concluded that each option would 'constitute a significant improvement on the existing layout and the differences between each from a road safety perspective are not significant'.

Table 8-7 below provides a summary of each option based on the findings of the Road Safety Audit Stage F Part 1.

Table 8-7: Impact scores for Road Safety Audit Stage F Part 1

	Option A	Option B	Option C
Impact Description	Moderately positive	Moderately positive	Moderately positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.5 Environment

The Stage 2 environmental appraisal was carried out considering the following sub-criteria:

- Population and Human Health;
- Waste;
- Terrestrial Biodiversity;
- Aquatic Biodiversity;
- Soils, Geology and Hydrogeology;
- Hydrology;
- Air and Climate;
- Noise;
- Material Assets (Agricultural);
- Material Assets (Non-Agricultural);
- Cultural Heritage; and
- Landscape and Visual.

Each option was appraised by competent experts and preferences determined. The full assessment for each discipline is contained in **Volume E – Environmental Appendices** and a summary of the findings of the competent expert in terms of each sub-criterion is presented in Section 8.5.1 through Section 8.5.12.

8.5.1 Population and Human Health

The assessment was informed by the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis (PE-PAG-02031). The EPA Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EIAR) (EPA, 2017) were consulted for the specific topics to assess under the environmental factor of population and human health.

The principal objectives of the population and human health assessment is to:

- Complete a desk study and to obtain relevant data relating to population and human health sub-criteria for each option;

- Assess the significance of the likely direct physical impacts of the proposed road Scheme on population and human health along each option within a 300m wide corridor;
- Evaluate and compare the indirect and wider impacts on population and human health for each option taking into account interactions with other environmental, engineering and economic criteria;
- Assess each option in line with the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis; and
- Based on the above assessments, compare and rank the options in order of preference.

The methodology adopted for the option selection comprised primarily of a desktop study and additional information gathered during site surveys. These elements, including properties, settlements and community severance, were used to identify and describe areas of potential value or sensitivity.

A detailed assessment of the population and human health impacts of the options is included in **Volume E.1.**

Options A is the preferred option as it has the least number of negative impacts when compared with the other options. Options B and C have the same overall impact score as Option A but are less preferred, as their impact on properties is considered greater.

A summary of each option and the impact in terms of the population and human health appraisal is provided in Table 8-8.

Table 8-8: Summary of Population and Human Health Appraisal

Option	A	B	C
Impact Description	Slightly negative	Slightly negative	Slightly negative
Impact Score	3	3	3
Preference	Preferred	Intermediate	Intermediate

8.5.2 Waste

Waste is defined as any substance or object which the holder discards or intends or is required to discard. In terms of a road construction project, most naturally occurring materials excavated as part of the works will not be considered a waste as they can be re-used within the works. There are three broad types of excavated material as set out in TII's *Specification for Road Works Series 600 – Earthworks*:

- Acceptable material: material excavated from within the site or imported on to the site which meets the requirements of the specification for acceptability for use in the works.
- Unacceptable material Class U1: material excavated from within the site which, unless processed so that it meets the requirements of the specification for acceptable material will not be used in the works; and
- Unacceptable material Class U2: material having hazardous chemical or physical properties requiring special measures for its excavation, handling, storing, transportation, deposition and disposal. Class U2 material excavated from within the site will not be used in the works unless processed so that it meets the requirements of the specification for acceptable material.

Acceptable excavated material that is not surplus to requirements will be re-used in the works for engineering purposes including fill to embankments, landscaping, etc. Acceptable material that is surplus to requirements will be used in spoil heaps on-site or at off-site locations, subject to proper approvals.

Both Class U1 and Class U2 material may be processed by mechanical, chemical or other means to render the material acceptable for use in the works. It is possible that some unacceptable material may become a waste if disposal of the material is required.

All excavated material from the site of the proposed road will be managed in accordance with best practice to ensure in so far as possible that there is minimal waste generated.

Any excavated contaminated material will fall under Class U2 and must be removed off-site for disposal at an authorised waste management facility. Currently, there is no indication of contaminated material being present within the footprint of the options.

Where there is a deficit of fill material for the construction of the project then clean soil and stone must be imported from other sources to make up the shortfall. This has the effect of requiring the use of fill material from quarries or borrow pits outside of the site boundary or the importation of inert waste fill material that has been re-classified as a by-product and which meets the specification for acceptable material. Production, processing and transporting of material to make up the deficit could have a significant environmental impact in terms of traffic movements, greenhouse gas emissions, use of valuable raw materials, etc.

The cut/fill balance estimates associated with each option are summarised in Table 8-9. There is a significant variance in the cut/fill volumes of material associated with the options. The negative number indicates a deficit of fill material following the cut/fill balance exercise. All options show importation of material will be required for the road construction resulting in a neutral impact scoring for waste impacts.

The total figures presented below **do not** represent the volume of waste that will be generated from each option. They are an indication of an excess in either cut or fill from initial road alignments designed during Phase 2. It is only in Phase 3, following detailed site investigation, that an estimation of the likely quantities of unsuitable material can be determined. Following that, an estimation can be made on any unsuitable material that may not be capable of being processed into an acceptable construction material and therefore will require disposal as a waste.

Table 8-9: Summary of Waste Appraisal

Option	A	B	C
Cut/Fill Difference (m3)	-46,966	-258,242	-71,684
Impact Description	Neutral	Neutral	Neutral
Impact Score	4	4	4
Preference	Preferred	Least Preferred	Intermediate

8.5.3 Terrestrial Biodiversity

The biodiversity study compared the potential impacts of the options on the terrestrial environment. Each of the options was assessed as a 300m wide corridor to determine potential impacts on the principal Ecological Receptors (ERs) within or adjacent to each option, and also in relation to potential impacts arising from fragmentation or interference with species' movement across the options. The assessment was undertaken in accordance with the NRA Guidelines for the Assessment of Ecological Impacts of National Road Schemes (Revision 2, June 2009).

The appraisal of biodiversity involved desk and field studies in order to characterise habitats and identify flora and fauna of ecological value of all potentially affected habitats intercepted by, or within the Zone of Influence (ZoI) of each of the options.

A detailed assessment of the biodiversity (terrestrial) elements of the options is included in **Volume E.2.1** while the biodiversity (aquatic) elements is included in **Volume E.2.2**.

There are 15 European sites, namely Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), three Natural Heritage Areas (NHAs) and 14 proposed NHAs (pNHAs) located within the ZoI of the study area. Lough Gill SAC is located within a 300m corridor of each of the three options.

The habitats found within the study area highlight the rural nature of the landscape. The dominant habitat types within the study area are wet grassland (GS4) and improved agricultural grassland (GA1). These habitats support hedgerow (WL1) and treeline (WL2) boundaries. The Scardan River flows in a northerly direction in the western half of the study area and the Cornavannoge River, located in the east of the study area, flows in a southerly direction.

A total of twenty-one ERs were recorded within the study area. These include sites designated for nature conservation (i.e. SACs), rare and protected species, and sites supporting habitats or habitat assemblages of county and local ecological value that are not afforded legal protection.

In relation to proposed options located in or adjacent to potential Annex I priority habitats or sites of International Importance i.e. Lough Gill SAC, the primary mitigation measure is avoidance in that no option should be located through these areas.

Option A is given an impact rating of *2 – Moderately Negative* as this option intersects the greatest area of Lough Gill SAC territory and intersects a greater number of ERs classified as *National Importance* (B) in this case Wildlife Act species: badger activity, potential bat roosts, deer and squirrel activity. Option A is ranked 3rd, least preferred option.

Option B is given an impact rating of *3 – Minor or Slightly Negative* due to the option impacting less of the area designated under Lough Gill SAC, fewer *Moderately Negative effects* and primarily encompassing habitats of *Local Importance (lower value).* Option B is ranked 1st, the preferred option.

Option C is given an impact rating of *3 – Minor or Slightly Negative* due to the lower number of ERs intersected of which the majority are rated moderately negative or minor or slightly negative. Option C is the 2nd, the intermediate option.

Note: As per the methodology adopted for each Environmental appraisal, this assessment is based on a 300m corridor within which the Option is located. Although the 300m corridor encompassing Option A marginally intersects the Lough Gill SAC, there is scope to locate the new alignment outside the boundary of the European site this avoiding any negative impacts. This will be further examined during Phase 3 Design and Environmental Evaluation.

A summary of each option and the impacts in terms of biodiversity (terrestrial) appraisal is provided in Table 8-10.

Table 8-10: Summary of Biodiversity (Terrestrial) Appraisal

Option	A	B	C
Impact Description	Moderately negative	Slightly negative	Slightly negative
Impact Score	2	3	3
Preference	Least preferred	Preferred	Intermediate

8.5.4 Aquatic Biodiversity

The aquatic biodiversity assessment involved use of qualitative and quantitative parameters to compare potential impacts of the three options for the N16 road upgrade at Munakill, Co. Leitrim. Each of the options was assessed as a 300m wide corridor, with downstream impacts also considered, to determine potential impacts on aquatic receptors within the corridor and its possible ZoI according to hydrological connectivity. The assessment was undertaken in accordance with the NRA Guidelines for the Assessment of Ecological Impacts of National Road Schemes (Revision 2, June 2009) and *Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis* (TII, 2016).

The appraisal of aquatic biodiversity was based on desk and field studies that characterized habitats and species of ecological value intercepted by the options or within the ZoI. This included consideration of biological water quality (Q-value) as a fundamental component of aquatic habitat quality, in addition to fisheries and protected species value. A detailed assessment of the biodiversity (aquatic) elements is included in **Volume E.2.2**.

All three options cross the same three EPA delineated watercourses, but in slightly different locations. Watercourses intersected by the proposed options lie mainly within the Owenmore sub-catchment of the greater Bonet River and Lough Gill catchment, draining in a westerly direction. One crossing affects the Cornavannoge River, which flows east into Upper Lough Macnean.

Munakill More Lough and Munakill Beg Lough occur directly to the south of all three route options. Lough Munakill is hydrologically connected to the Scheme via Loughaphonta Stream. There are no direct drainage routes to Munakill Beg Lough, but the topography dictates that natural overland drainage flows south from the options towards this small waterbody. Each of the options crosses the Scardan (Owenmore) River immediately upstream of the Lough Gill Special Area of Conservation (River Finn SAC: Site Code 002301), where the aquatic Annex I and Annex II Qualifying Interests (QIs) are: natural eutrophic lakes; white-clawed crayfish; Atlantic salmon; sea, river and brook lampreys. Of these QIs, Atlantic salmon, white-clawed crayfish and lampreys are likely to occur in the ZoI of the Scardan (Owenmore) River crossing area, although the crossing reach (and the downstream ZoI) has poor quality salmonid spawning and nursery habitats.

Overall, there were only minor differences between the three options in terms of the aquatic receptors / values they potentially affect (fish, crayfish, water quality). The main differences were in the distance upstream of the crossing points from the wetland habitats of Munakill More and Munakill Beg Loughs, which are connected (via underground drainage) to the Scardan River and therefore connected to Lough Gill SAC.

Option A emerged as preferred based on potential to impact aquatic ecological receptors. Option A has the greatest separation distance from the two wetlands, Munakill More and Munakill Beg Loughs, which are the natural receptors for run-off during construction and operation phase of the road project.

A summary of each option and the impacts in terms of biodiversity (aquatic) is provided in Table 8-11.

Table 8-11: Summary of Biodiversity (Aquatic) Appraisal

Option	A	B	C
Impact Description	Moderately Negative	Moderately Negative	Moderately Negative
Impact Score	2	2	2
Preference	Preferred	Intermediate	Intermediate

The main issues will be the design and construction methodology for water course crossings at: (1) Scardan River, located immediately upon the Lough Gill SAC boundary with QI salmonid and white-clawed crayfish habitats in the ZoI; and (2) Cornavannoge River, with good quality salmonid spawning/nursery habitats and recent presence of white-clawed crayfish recorded in the catchment. A clear-span crossing (with set-back abutments) of the Scardan River is recommended. A well designed and sensitively constructed open-bottomed or box culvert with low flow channel (at the very least), is necessary at the Cornavannoge River to ensure fish passage.

8.5.5 Soils, Geology and Hydrogeology

The soils, geology and hydrogeology assessment examine each option in terms of their importance and the possible impacts resulting from the construction of a proposed option. These elements have been assessed together due to their interaction because of the karisfied natured of the bedrock in the area. The options are compared, and impacts assessed from a land, soil, and hydrogeological perspective. In order to compare the options, the assessment has considered and appraised the following attributes.

Soils and Geology

- Geological heritage sites;
- Landfills and historic waste sites;
- Quarries;
- Karst features;
- Agricultural soils;
- Extent of peat and soft ground.

Hydrogeology

- Aquifers;
- Groundwater vulnerability;
- Source Protection Areas;
- Important abstractions for water supply.

A detailed assessment of the options is included in **Volume E.3**.

All three options cross soft soil areas of alluvium, poorly drained mineral soils, and cutover peat. These soils were grouped together to determine the proportion of each option that will cross soft soils. The amount of cut which is required along each option has been calculated based on the preliminary option designs. This has been considered in the assessment where cut is greater than 3m depth and traverses' areas of high

groundwater vulnerability; this could increase the vulnerability rating to extreme through removal of soil and subsoil cover.

From the review of the impacts of each proposed option on the soil, geology and hydrogeology in the ZoI of each route option, Option A is the most favourable as 40% of the route remains online (compared with 27% and 13% for Options B and C) giving rise to a lower relative impact on the local geological and hydrogeological regime. All three of the route options will require the removal of peat and other soft soils, and construction over areas of extreme groundwater vulnerability and in areas classified as Regionally Important Karstified aquifers. Option C is the least preferred option as a small amount of deep cutting is required in areas of high groundwater vulnerability.

A summary of each option and the impacts in terms of soils, geology and hydrogeology appraisal is provided in Table 8-12.

Table 8-12: Summary of Soils, Geology and Hydrogeology Appraisal

Option	A	B	C
Impact Description	Neutral	Slightly negative	Slightly negative
Impact Score	4	3	3
Preference	Preferred	Intermediate	Least Preferred

8.5.6 Hydrology

The hydrology assessment was prepared having regard to the TII Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes as recommended by the TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis. A comparative evaluation of the options was undertaken, having regard to the specific hydrological impacts associated with each option in order to identify a preferred option(s).

A detailed assessment of the hydrological impacts of the options is included in **Volume E.4**.

The study area lies within both the Erne and Sligo Bay & Drowse Catchment and forms part of the National Hydrometric Areas 36 and 35 respectively. The main surface water features potentially impacted by the three option extents include the Scardan River, Loughaphonta stream, Cornavannoge River and Munakill More Lough.

The Loughaphonta Stream is crossed by Option A approximately 45m north of the existing N16/ Loughaphonta crossing while Option B and Option C are located approximately 128m and 157m south of the existing N16/Loughaphonta crossing respectively. The Loughaphonta outfalls to Munakill More Lough at its north eastern boundary. Munakill More Lough has no surface water outfall but is believed to be drained by a subterranean karst swallow hole. This swallow hole would be consistent with the karst limestone geological features of the area surrounding the lake. Following flooding in the late 1980's the required outflow from the lake was achieved by a 600mm diameter concrete pipe to the Scardan River. The pipe passes through a hill and outfalls at an existing field drain south of the N16 before passing under the N16.

The hydrological assessment has determined that Option A is the preferred option. Option A has the greatest separation distance from Munakill More Lough and therefore has less potential short-term and long-term impact on the hydrological environment of the study area compared to Options B & C.

A summary of each option and the impacts in terms of hydrology is provided in Table 8-13.

Table 8-13: **Summary of Hydrology Appraisal**

Option	A	B	C
Impact Description	Moderately negative	Moderately negative	Moderately negative
Impact Score	2	2	2
Preference	Preferred	Intermediate	Intermediate

It is recommended that the ultimate preferred option be aligned as necessary to avoid encroaching upon watercourses and their potential flood extents. Any required crossings will require detailed hydrological and hydraulic analysis so as to eliminate any risk of flooding to adjacent lands. Adequate storm water attenuation and treatment will be required before out-falling to any watercourse along the option routes.

8.5.7 Air and Climate

The air quality and climate analysis was undertaken by means of a desktop assessment. The assessment focussed on NOx exposure and the anticipated climate impacts through a calculation on greenhouse gas emissions (GHG). The detailed report on the assessment is included in **Volume E.5**.

From the assessment, Option A and Option B were identified as the intermediate options and Option C the preferred option. Overall, the results indicated that Option C had the potential to impact on the fewest number of properties relative to the other options and resulted in the lowest NO_X score, illustrating the highest preference. Option A and Option B both scored equally in terms of exposure. However, there was only one extra property affected by Options A and B compared to Option C, therefore Option C is only marginally preferred.

Climate impacts were broadly similar for each option. Option A and Option B scored almost equally for construction and operational GHGs. Option C scored slightly lower in GHGs arising from construction, thus it is marginally preferred from a climate perspective.

Table 8-14 provides the summary of the overall combined assessment of both air quality and climate. Options A and B scored equally in terms or air quality exposure to sensitive receptors. Options A and B also scored very similarly in terms of climate impacts (GHGs arising from construction and operational carbon). Therefore, both options are deemed to have moderately negative impacts and, are intermediate in preference. Option C scored slightly better in terms of air quality exposure. With regard to climate, all three options scored similarly for operational GHGs, but Option C had fewer GHGs arising from the construction stage. Therefore, from both an air quality and climate perspective, Option C is the preferred option.

Table 8-14: Summary of Air Quality and Climate Appraisal

Option	A	B	C
Impact Description	Moderately negative	Moderately negative	Minor or slightly negative
Impact Score	2	2	3
Preference	Intermediate	Intermediate	Preferred

8.5.8 Noise

A comparative assessment of each of the three options in the phase two N16 Munakill alignment was carried out in relation to noise with reference to key sensitive receptors in proximity to the proposed options. The noise impacts for each of the options are identified so that those impacted by unacceptably high levels of noise can be avoided where feasible as part of the overall option selection process.

A quantitative assessment was carried out where the property impact rating (PIR) was calculated. The PIR is based on the anticipated traffic flows using each option and the number of properties likely to be impacted, banded into distances from the centreline of each option within a 300m wide corridor. A qualitative assessment was then carried out which considered factors such as noise sensitive receptors and commercial properties. The results of the quantitative and qualitative assessments were then combined to provide an overall impact level for each option. The detailed report on the assessment is included in **Volume E.6**.

The overall rating shows that option A has the lowest noise impact, followed closely by options B and C (Table 8-15). Option A runs north of the existing N16 predominately and affects the least number of properties along the N16 corridor. Options B and C received an intermediate preference based on to the PIR assessment and are very similar to option A although there are a slightly higher number of properties within these options.

Table 8-15: Summary of Noise Appraisal

Option	A	B	C
Impact Description	Not Significant/Neutral	Not Significant/Neutral	Not Significant/Neutral
Impact Score	4	4	4
Preference	Preferred	Intermediate	Intermediate

8.5.9 Material Assets (Agricultural)

The impacts that an option may have on agriculture are a function of the following factors:

- Area of lands acquired;
- Area and orientation of lands severed;
- Removal of farm buildings and/or facilities;
- Farm enterprises; and
- Intensity and viability of farming practices.

A detailed assessment of the Material Assets (Agricultural) impacts of the options is included in **Volume E.7**.

The results of agronomy assessment indicate that as the differences in option lengths are marginal and as no option has an impact on a sensitive farm, preference is based on the significant severance of folios. As a result, order of preference for the Scheme from an agronomy perspective is given to Option A, Option B and Option C respectively. Table 8-16 shows the summary of assessment for the Scheme.

Table 8-16: Summary of Material Assets (Agricultural) Appraisal

Option	A	B	C
Impact Description	Moderately negative	Moderately negative	Moderately negative
Impact Score	2	2	2
Preference	Preferred	Intermediate	Least preferred

8.5.10 Material Assets (Non-Agricultural)

The assessment was informed by the TII *Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis (PE-PAG-02031)*[1] with regards to headings to approaching utilities and infrastructural features. Agricultural areas are assessed within a separate Material Assets (Agricultural) Technical **Appendix E.8** and summarised in Section 8.5.9 above. The *EPA Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EIAR)[2] (EPA, 2017) were consulted for the specific topics to assess under the environmental factor of Material Assets (Non-agricultural).

The principal objectives of the Material Assets (Non-agricultural) assessment is to:

- Complete a desk study and to obtain relevant data relating to material assets including utilities, transport, infrastructure and other amenities for each option;
- Assess the significance of the likely direct physical impacts of the proposed road Scheme on each of these material assets along each option;

[1] http://www.tiipublications.ie/library/PE-PAG-02031-01.pdf

[2] http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf

- Evaluate and compare the impact on material assets for each option taking into account interaction with other environmental, engineering and economic criteria,
- Assess each option in line with the Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis TII[3] in October 2016; and
- Compare the options and determine a preference.

The methodology adopted for the option selection comprised primarily of a desktop study and additional information gathered during a site survey. These elements, including transport infrastructure, utilities and non-agricultural land use, were used to identify and describe areas of potential infrastructural value or sensitivity.

The assessment can broadly be categorised into:

- Utilities.
- Transport Infrastructure.
- Waste Management; and
- Forestry.

All of the options score similarly across the range of criteria due to the local nature of the impacts, and overall have impact scores of 3 – minor or slightly negative. Slight variations are noted in the preferences due to the number of conflicts between the options. Option A appears to be the preferred route on this basis.

A detailed assessment of the Material Assets (Non-agricultural) impacts of the options is included in **Volume E.8**.

A summary of each option and the impacts in terms of material assets (non-agricultural) appraisal is provided in Table 8-17.

Table 8-17: Summary of Material Assets (Non-agricultural) Appraisal

Option	A	B	C
Impact Description	Minor or slightly negative	Minor or slightly negative	Minor or slightly negative
Impact Score	3	3	3
Preference	Preferred	Intermediate	Least Preferred

8.5.11 Cultural Heritage

The Cultural Heritage assessment was undertaken in accordance with TII *Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes* (2005) and *Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes* (2005).

Principles applied in this assessment have been both desk and field based as follows:

- **Desk-Study**: further expansion of cultural heritage dataset information gathered during the Constraints Study (**Volume B**), including the examination of UAV Digital Terrain Models (Hillshade and profile modelling), historical cartographic sources, aerial mapping/photography and relevant published information.
- **Field-Study**: primarily a site survey of the environs, topography and landscape and observations therein with a view to identifying significant cultural heritage impacts and/or areas of archaeological potential. This has been coupled with site specific visits, as required, in order to determine level of impact and/or extent and condition of the heritage asset.

[3] The National Roads Authority (NRA) and the Railway Procurement Agency were merged to become Transport Infrastructure Ireland (TII) in 2015.

The compilation of a cultural heritage constraints inventory has been undertaken to include core locational and descriptive data, as well as identification of the distance to the options and the type of impact (direct/indirect).

The comparative evaluation of each option was assessed by scoring of impacts to the overall presence of sensitive receptors using the Preference Rating Key per the *Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis* (TII, 2016). An impact assessment was undertaken on each option to include both quantitative and qualitative assessment. Each option was scored based on the seven-point scale and an MCA integer was assigned according to the overall impact level.

A detailed assessment of the cultural heritage impacts of the options is included in **Volume E.9.**

The study area is located within a wider riverine and lakeland environment of a portion of the Glenfarne valley at the lower southern slopes of Dough Mountain (462 m OD), *c.* 2.5 km east of Manorhamilton, Co. Leitrim. The Scardan/Owenmore River and the Cornavannoge River are located at the western and eastern extents of the study area respectively, with Munakill More Lough and Munakill Beg Lough centrally located to the south. The highest point relative the option corridors is 119m OD located at a ridge on the northern limits of Munakill More Lough, whilst the remainder of the study area is largely concentrated along a 100m OD contour level. Land use in the area is of improved agricultural pasturelands interspersed with pockets of woodland, rock outcropping and low-lying marshy areas.

There are a total of 23 No. Cultural Heritage receptors within the study area, and a total of three river/stream crossings. All identified heritage receptors are common to each of the three option alignment corridors A, B and C. All recorded 6 no. archaeological sites are of probable early medieval origins (a ringfort, an enclosure and souterrain site, and an ecclesiastical site). All other 17 no. receptors are of an undesignated built heritage nature and comprise elements constructed in the late nineteenth/early twentieth century (vernacular houses and outbuildings, gated entrances and a disused railway line embankment) as well as an area of archaeological potential. The latter was identified at one area north of Munakill More Lough, at the location of a former vernacular structure. The river crossings are also considered to be areas of archaeological potential at the Scardan River, a townland/parish boundary stream north of Munakill More Lough and the Cornavannoge River.

The designated RMP site of Kilmakerrill church, graveyard and enclosure is not directly impacted by the proposed options however there is measurable indirect impact with regard to its setting and current amenity value with respect to Options A and B. Assessment of the remaining identified designated sites within the study area are deemed to have imperceptible levels of impact.

Moderate levels of impact have been identified by some or all of the options at undesignated sites including Moorfield house, grounds and outbuildings (Option B), Lakeview House (Options B and C), a vernacular structure at the entrance to Kilmakerrill graveyard (Option B), the ruins of a vernacular structure and area of archaeological potential (Options B and C), and a vernacular settlement complex (Options A and C).

Assessment of level of impact on the Cultural Heritage resource indicates that Option C is deemed a preferred option from a Cultural Heritage perspective, with Option A (marginally) deemed an intermediate option. Option B is deemed a least preferred option from a Cultural Heritage perspective.

A summary of each option and the impacts in terms of Cultural Heritage appraisal is provided in Table 8-18.

Table 8-18: Summary of Cultural Heritage Appraisal

Option	A	B	C
Impact Description	Minor or slightly negative	Moderately negative	Minor or slightly negative
Impact Score	3	2	3
Preference	Intermediate	Least Preferred	Preferred

8.5.12 Landscape and Visual

The landscape and visual impact assessment was undertaken to identify the receptors associated with each option and the likely effects upon them which are then taken into consideration in developing and refining the options. A desktop study was undertaken to establish an understanding of the landscape and visual context of the proposed options. Landscape and visual impact assessments are assessed as two discrete topics:

- Landscape impact assessment is concerned with the alteration to the physical landscape which can give rise to changes in its character, how it is experienced and the ascribed value of the landscape.
- Visual impact assessment is concerned with changes that arise in the overall effect on the area's visual amenity.

The detailed report on the assessment is included in **Volume E.10**.

When landscape impacts are considered overall for the proposed options, there is a preference for Option A as this option largely avoids impacts on visually significant vegetation that lies between the existing N16 corridor and the northern shoreline of Munakill More Lough, which includes coniferous shelterbelt planting, mixed broadleaved species woodland, hedgerows and hedgerows with mature trees.

The proposed Option B and Option C are least favoured, in landscape terms, as they both have the potential to impact on areas of coniferous shelterbelt planting, mixed broadleaved species woodland, hedgerows and hedgerows with mature trees that lie between the existing N16 corridor and the northern shoreline of Munakill More Lough, with potential direct impacts on existing residential / farm steading buildings.

When visual impacts are considered all options are predicted to have a similar, overall, effect on residential properties, however Option B and Option C are predicted to directly impact a residential property and farm steading buildings located on the northern shoreline on Munakill More Lough.

A summary of each option and the impacts in terms of landscape and visual impact appraisal is provided in Table 8-19.

Table 8-19: Summary of Landscape and Visual Appraisal

Option	A	B	C
Impact Description	Moderately Negative	Major or Highly Negative	Major or Highly Negative
Impact Score	2	1	1
Preference	Preferred	Intermediate	Least Preferred

It should be noted that potential landscape and visual effects for the preferred option shall be mitigated by minimising the footprint of the new road in the landscape and by using carefully sited landscape screening and boundary treatments.

8.6 Accessibility and Social Inclusion

The assessment of Accessibility and Social Inclusion covered two principal areas in accordance with *PAG Unit 7.0 Multi Criteria Analysis.* These were Deprived Geographical Areas and Vulnerable groups. A summary of the findings of each assessment with respect to each sub-criterion is set out below.

The full Stage 2 Accessibility and Social Inclusion Appraisal is included in **Volume D.3**.

8.6.1 Deprived Geographical Areas

The 2016 Pobal HP Deprivation Index shows the level of overall affluence and deprivation across the country using identical measurements and scales using data from the 2016 Census of Population. The N16 Munakill Study Area is 'Marginally Above Average' according to this index. The Study Area comprises mostly of land which is principally occupied by agriculture. As the area is identified as being 'Marginally Above Average' from a Deprivation Index perspective, and on visual assessment has a significant proportion of its land used for farming, it is considered likely that participants in the Rural Social Scheme reside within the Study Area.

All route options present an improved link between Manorhamilton and Blacklion/Enniskillen and will therefore aid accessibility to and from the rural Munakill area. All options will also improve connectivity from Sligo to Northern Ireland whilst contributing to improved access to surrounding areas. The construction of the project will also provide short term employment opportunities.

Table 8-20 below provides a summary of each option with respect to Deprived Geographical Areas.

Table 8-20: Impact scores for Deprived Geographical Areas

	Option A	Option B	Option C
Impact Description	Neutral	Neutral	Neutral
Impact Score	4	4	4
Preference	Preferred	Preferred	Preferred

8.6.2 Vulnerable Groups

All route options will present an opportunity to improve the journey time and journey time reliability between centres such as Sligo, Manorhamilton and Blacklion/Belcoo by servicing single vehicle and public transport methods within the area. All route options, through the provision of improved access and improved junctions to the immediate communities, will also contribute to improving access to surrounding areas such as Manorhamilton, Sligo, Blacklion and Enniskillen and in addition will reduce travel times resulting in an improved level of service on the N16. In turn, such benefits will support and improve access for residents to jobs, key facilities, and social opportunities in Manorhamilton, Enniskillen and further to Sligo and Northern Ireland.

Given the rural nature of the study area, all options are considered to represent a means of improved accessibility to vital services such as health (e.g. Our Lady's Community Hospital in Manorhamilton), education and employment.

Table 8-21 below provides a summary of each option with respect to Vulnerable Groups.

Table 8-21: Impact scores for Vulnerable Groups

	Option A	Option B	Option C
Impact Description	Minor or Slightly Positive	Minor or Slightly Positive	Minor or Slightly Positive
Impact Score	5	5	5
Preference	Preferred	Preferred	Preferred

8.7 Integration

Four principal areas were examined with respect to Integration in accordance with *PAG Unit 7.0 Multi Criteria Analysis.* These were Transport Integration, Land Use Integration, Geographical Integration and finally Other Government Policy Integration: Regional Balance. A summary of the findings of each assessment with respect to each sub-criterion is set out below.

The full Stage 2 Integration Appraisal is included in **Volume D.4**.

8.7.1 Transport Integration

All route options will provide an improved link between Manorhamilton and Blacklion/Enniskillen and further afield will also aid connectivity from Sligo to Northern Ireland. In turn, each option will contribute to improving access to surrounding areas and address the identified gap in the network. In addition, it is considered that all options will provide greater route consistency and provide a safer transition into recently improved sections, namely the Kilmakerrill/Cornacloy (2007/08) and Cornacloy/Sradrine (2012/13 & 2017) schemes to the east.

All options will give rise to benefits with respect to connectivity of different transport modes. Bus Éireann currently operate a year-round local bus route, the 458, between Manorhamilton and Enniskillen. The Transport for Ireland Local Link Service also operates a service within Co. Leitrim. There are currently four stops on both networks within the vicinity of the Scheme, two of these are located within the study are west of R283 priority junction (Blackpark Cross Stop) with the remaining stops situated to the east in Cornacloy (Glenboy Big Bog Stop). The information provided by Bus Éireann shows that eight weekday stops at both

locations on the Sligo to Enniskillen (458) route. All proposed route options will therefore improve the journey time and journey time reliability along both these networks by improving the existing road infrastructure.

The proposed cross section for the Scheme is a Type 2 Single Carriageway in accordance with CC-SCD-00002 of TII Publications.

A requirement of this type of cross section is the provision of a walking/cycling facility on one side of the new road construction which is separated by a grass verge. Preliminary planning is also currently underway by others to develop the existing disused Sligo, Leitrim & Northern Counties Railway line (SLNCR), which passes through the North of the Study Area, into a Greenway scheme between Sligo and Enniskillen. Considering the requirements of the selected cross section together with the preliminary works underway on the planning of the SLNCR Greenway, the cycling strategy considered for the purpose of the Stage 2 Appraisal consists of two scenarios.

Scenario A will involve using the planned SLNCR Greenway as the dedicated pedestrian/cyclist facility for the Scheme. Scenario B will involve the re-use of the existing N16 cross section where possible combined with the development of short sections of dedicated pedestrian/cyclist facility running parallel to the new carriageway as per the cross-section requirements defined in CC-SCD-00002. Both scenarios will represent a significant improvement with respect to pedestrian and cyclist provisions when compared to the current situation. The provision of formal facilities will reduce the potential for conflicts with vehicles on the N16 and in turn cater for pedestrian and cyclist movements in a safer environment. Each scenario will encourage more sustainable modes of transport and make leisure activity more attractive in the area.

With respect to other transport infrastructure, the N16 is the primary strategic route linking Sligo, Leitrim and the North West region to Belfast (including Belfast International Airport, Belfast Port and the Port of Larne). An upgraded N16 will therefore improve these linkages, accommodate increased capacity, and improve the journey times and journey time reliability, albeit over a short section.

Table 8-22 below provides a summary of each option with respect to Transport Integration.

Table 8-22: Impact scores for Transport Integration

	Option A	Option B	Option C
Impact Description	Moderately positive	Moderately positive	Moderately positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.7.2 Land Use Integration

The importance of the N16 as a strategic transport corridor is highlighted within the current Leitrim County Development Plan 2015-2021. Therefore, all options of the N16 Munakill Realignment Scheme are equally positive when considered in respect to support for the Scheme in the local development plan.

The N16 is a national primary strategic route between Sligo and Belfast providing key North East and North–West connectivity and also forms part of the Trans-European Network (TEN-T). All options aim to replace an undesigned section of the existing N16 with an improved alignment with a wider cross-section, which will subsequently improve the capacity, operation, and safety of the N16 route.

Given the rural location of the Scheme, none of the proposed options have an impact on the future risk of urban sprawl.

Table 8-23 below provides a summary of each option with respect to Land Use Integration

Table 8-23: Impact scores for Land Use Integration

	Option A	Option B	Option C
Impact Description	Moderately positive	Moderately positive	Moderately positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.7.3 Geographical Integration

Project Ireland 2040, the National Planning Framework (NPF), outlines the importance of providing better access between Ireland's four other cities (Cork, Limerick, Galway and Waterford) separate from Dublin and to the Northern and Western region. It sets out National Strategic Outcomes for consideration in developing the National Investment Plan. In terms of Enhancing Regional Accessibility one of the strategic outcomes is to improve accessibility to the North West by upgrading access to the North West border area by utilising the existing routes (N2/N14/A5). By upgrading the N16, the proposed Scheme will help support the objectives of Project Ireland 2040.

All options perform equally in satisfying the goals of the NPF. They also equally follow through with themes from the National Spatial Strategy, by improving connectivity between Hubs and Gateways. Additionally, the N16 is also part of the Trans European Transport Network (TEN-T), meaning it has National and European significance and provides cross-border, international connectivity.

Table 8-24 below provides a summary of each option with respect to Geographical Integration.

Table 8-24: Impact scores for Geographical Integration

	Option A	Option B	Option C
Impact Description	Moderately positive	Moderately positive	Moderately positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.7.4 Other Government Policy Integration: Regional Balance

In addition to improved accessibility, another theme of the NPF is promotion of regional parity, with National Policy Objective 1a stating that *"The projected level of population and employment growth in the Eastern and Midland Regional Assembly area will be at least matched by that of the Northern and Western and Southern Regional Assembly areas combined"*.

PAG Unit 7.0 – Multi Criteria Analysis states that transport projects should be scored positively for regional balance if investment is:

- Within or to urban centres from peripheral regions
- On links between urban centres
- On routes which improve access to international ports and airports

All options meet two of these criteria through investment on a strategic link between urban centres and further afield supporting access to international ports and airports.

Table 8-25 below provides a summary of each option with respect to Other Government Policy Integration: Regional Balance.

Table 8-25: Impact scores for Other Government Policy Integration: Regional Balance

	Option A	Option B	Option C
Impact Description	Moderately positive	Moderately positive	Moderately positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.8 Physical Activity

The assessment of Physical Activity covered two principal areas in accordance with *PAG Unit 7.0 Multi Criteria Analysis.* These were Health Benefits and Journey Ambience Benefits. The basis of the appraisal covered the nature of physical activity impacts of the proposed Scheme, including the provision of new

cyclist and pedestrian facilities. A summary of the findings of each assessment with respect to each sub-criterion is set out below.

The full Stage 2 Physical Activity Appraisal is included in **Volume D.5**.

8.8.1 Health Benefits

The proposed cross section for the Scheme is a Type 2 Single Carriageway in accordance with CC-SCD-00002 of TII Publications. A requirement of this type of cross section is the provision of a walking/cycling facility on one side of the new road construction which is separated by a grass verge. Preliminary planning is also currently underway by others to develop the existing disused Sligo, Leitrim & Northern Counties Railway line (SLNCR), which passes through the North of the Study Area, into a Greenway scheme between Sligo and Enniskillen. Considering the requirements of the selected cross section together with the preliminary works underway on the planning of the SLNCR Greenway, the cycling strategy considered for the purpose of the Stage 2 Appraisal consists of two scenarios.

Scenario A will involve using the planned SLNCR Greenway as the dedicated pedestrian/cyclist facility for the Scheme. This scenario will require the provision of dedicated links to allow pedestrians and cyclists to access the facility. This scenario will provide for better connectivity within the local environs and provide a facility and access to a number of secondary loops along the Regional and Local Road network to the north which have significant benefits for existing properties accessing onto the existing section of the N16.

Scenario B will involve the development of short sections of dedicated pedestrian/cyclist facility running parallel to the new carriageway in addition to the re-use of the existing N16 cross section where appropriate. This scenario will again provide for a safer environment for pedestrians and cyclists as they will not be mixing with traffic on the improved alignment. This will in turn attract greater use and provide greater connectivity to existing properties within the local environs.

Table 8-26 below provides a summary of each option with respect to Health Benefits.

Table 8-26: Impact scores for Health Benefits

	Option A	Option B	Option C
Impact Description	Moderately Positive	Moderately Positive	Moderately Positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.8.2 Journey Ambience Benefits

The transfer of cyclist and pedestrian movements onto the proposed Greenway scheme (Scenario A) or onto a dedicated pedestrian/cyclist facility or declassified section of road (Scenario B) will in turn reduce potential conflicts between such road users and vehicular traffic on the N16. This segregation will improve safety and subsequently increase the attractiveness of cycling and walking in the area.

Both scenarios will require the provision of dedicated links and defined crossing points to ensure that pedestrians and cyclists can safely move across the new N16 alignment to access both the surrounding road network and in the case of Scenario A the SLNCR Greenway. The number and location of these links and crossings will be further examined in the developing design.

Table 8-27 below provides a summary of each option with respect to Journey Ambience Benefits.

Table 8-27: Impact scores for Journey Ambience Benefits

	Option A	Option B	Option C
Impact Description	Moderately Positive	Moderately Positive	Moderately Positive
Impact Score	6	6	6
Preference	Preferred	Preferred	Preferred

8.9 Project Appraisal Matrix (Multi-criteria Analysis)

As set out in Section 8.3 to Section 8.8 inclusive, the impacts of each of the Stage 2 Route Corridor Options were assessed and an impact score determined for each of the following criteria defined in *PAG Unit 7.0 Multi Criteria Analysis.* The Stage 2 Project Appraisal Matrix showing the breakdown of the individual impact scores for both the sub-criteria and main criteria for each Route Corridor Option is provided overleaf in Table 8-28.

Table 8-28: Stage 2 Multi-Criteria Project Appraisal Matrix - Impact Score Summary

	Option A	Option B	Option C
Economy			
Transport Efficiency and Effectiveness	3	3	3
Wider Economic Impacts	4	4	4
Funding Impacts	4	4	4
Sub-Total	*11*	*11*	*11*
Safety			
Collision Reduction	6	6	6
Security of Road Users	6	6	6
Road Safety Audit Stage F Part 1	6	6	6
Sub-Total	*18*	*18*	*18*
Environment			
Population and Human Health	3	3	3
Waste	4	4	4
Terrestrial Biodiversity	2	3	3
Aquatic Biodiversity	2	2	2
Soils, Geology and Hydrogeology	4	3	3
Hydrology	2	2	2
Air and Climate	2	2	3
Noise	4	4	4
Material Assets (Agricultural)	2	2	2
Material Assets (Non-Agricultural)	3	3	3
Cultural Heritage	3	2	3
Landscape and Visual	2	1	1
Sub-Total	*33*	*31*	*33*
Accessibility & Social Inclusion			
Deprived Geographical Areas	4	4	4
Vulnerable Groups	5	5	5
Sub-Total	*9*	*9*	*9*
Integration			
Transport Integration	6	6	6
Land Use Integration	6	6	6
Geographical Integration	6	6	6
Other Government Policy Integration: Regional Balance	6	6	6
Sub-Total	*24*	*24*	*24*
Physical Activity			
Health Benefits	6	6	6
Journey Ambience Benefits	6	6	6
Sub-Total	*12*	12	12
Total Impact Score	**107**	**105**	**107**

On the basis of the quantitative impact scores presented in Table 8-28, Option A and Option C have the same impact score of 107 with Option B having an impact score of 105. In order to bring the qualitative aspects of each criteria and the consideration of other factors by expert opinion to bear, a second Project Appraisal Matrix was prepared and this is presented below in Table 8-29.

Table 8-29: Stage 2 Multi-Criteria Project Appraisal Matrix – Preference Summary

	Option A	Option B	Option C
Economy			
Transport Efficiency and Effectiveness	Preferred	Intermediate	Least Preferred
Wider Economic Impacts	Preferred	Preferred	Preferred
Funding Impacts	Preferred	Preferred	Preferred
Safety			
Collision Reduction	Preferred	Preferred	Preferred
Security of Road Users	Preferred	Preferred	Preferred
Road Safety Audit Stage F Part 1	Preferred	Preferred	Preferred
Environment			
Population and Human Health	Preferred	Intermediate	Intermediate
Waste	Preferred	Least Preferred	Intermediate
Terrestrial Biodiversity	Least Preferred	Preferred	Intermediate
Aquatic Biodiversity	Preferred	Intermediate	Intermediate
Soils, Geology and Hydrogeology	Preferred	Intermediate	Least Preferred
Hydrology	Preferred	Intermediate	Intermediate
Air and Climate	Intermediate	Intermediate	Preferred
Noise	Preferred	Intermediate	Intermediate
Material Assets (Agricultural)	Preferred	Intermediate	Least Preferred
Material Assets (Non-Agricultural)	Preferred	Intermediate	Least Preferred
Cultural Heritage	Intermediate	Least Preferred	Preferred
Landscape and Visual	Preferred	Intermediate	Least Preferred
Accessibility & Social Inclusion			
Deprived Geographical Areas	Preferred	Preferred	Preferred
Vulnerable Groups	Preferred	Preferred	Preferred
Integration			
Transport Integration	Preferred	Preferred	Preferred
Land Use Integration	Preferred	Preferred	Preferred
Geographical Integration	Preferred	Preferred	Preferred
Other Government Policy Integration: Regional Balance	Preferred	Preferred	Preferred
Physical Activity			
Health Benefits	Preferred	Preferred	Preferred
Journey Ambience Benefits	Preferred	Preferred	Preferred

Table 8-29 above shows that Option A is collectively the best performing Route Corridor Option and is identified as Preferred under 23, Intermediate under 2 and Least Preferred under 1 of the 26 criteria examined. Option A is however defined as Least Preferred with respect to Terrestrial Biodiversity. As set out

within **Volume E.2.1,** Option A intersects the greatest area of the Lough Gill SAC territory to the north-west of the Study Area.

Note: As per the methodology adopted for each Environmental appraisal, this assessment is based on a 300m corridor within which the Option is located. Although the 300m corridor encompassing Option A marginally intersects the Lough Gill SAC, there is scope to locate the new alignment outside the boundary of the European site this avoiding any negative impacts. This will be further examined during Phase 3 Design and Environmental Evaluation.

Option A is then followed by Option B, which is Preferred under 14, Intermediate under 10 and Least Preferred under 2 of the 26 criteria examined. Option B has the highest theoretical imbalance between cut and fill quantities and therefore is Least Preferred with respect to Waste. In terms of Cultural Heritage, Option B has a moderate level of impact on the setting and amenity value of the designated site of Kilmakerrill church and graveyard; as well as a moderate and slight levels of impact on the adjacent stone vernacular structure and gated entrance and access lane to the site. Furthermore, there is moderate level of impact identified at the undesignated Moorfield house, grounds, and outbuildings and at the setting of Lakeview House. Option B also directly impacts the undesignated ruins of a vernacular house/area of archaeological potential which is considered a moderate level of impact. Option B also extends in close proximity to an undesignated vernacular complex which is deemed a slight level of impact. Overall, from a Cultural Heritage perspective, Option B is the Least Preferred.

Option B is then closely followed by Option C, which is Preferred under 15, Intermediate under 6 and Least Preferred under 5 of the 26 criteria examined. In terms of Economy, Option C was found to be the most expensive option and also give rise to the lowest Benefit to Cost Ratio (BCR) of 0.69. With respect to Soils, Geology and Hydrogeology, Option C proposed a proportion of cutting area of high groundwater vulnerability and will require some areas of soft soil to be removed. The Option will also impact on rock at or near the surface and passes through a Regionally Important Aquifer which is hydro geologically connected with a protected area. Option C is also Least Preferred with regards to Material Assets both Agricultural and Non-Agricultural. In terms of Material Assets (Agricultural), Option C significantly severs 12 agricultural land folios and will also pass through farm property located to the west of Munakill More Lough in turn directly impacting on both the dwelling and all existing farm outbuildings. Option C also has a series of negative impacts with respect to Landscape and Visual. This option impacts on vegetation cover on the northern shoreline of Munakill More Lough and as it runs south of the existing N16 will result in increased embankments and cutting thereby imposing a negative visual impact. This Option also directly impacts on a residential property and farm buildings on the northern edge of Munakill More Lough.

Table 8-30 below presents the overall preference ratings for each Route Corridor Option.

Table 8-30: Stage 2 Multi-Criteria Project Appraisal Matrix – Overall Assessment

	Option A	Option B	Option C
Economy	Preferred	Intermediate	Least Preferred
Safety	Preferred	Preferred	Preferred
Environment	Preferred	Intermediate	Intermediate
Accessibility & Social Inclusion	Preferred	Preferred	Preferred
Integration	Preferred	Preferred	Preferred
Physical Activity	Preferred	Preferred	Preferred
Overall Preference	**Preferred**	**Intermediate**	**Intermediate**

8.10 Recommendation of an Emerging Preferred Route Corridor Option

Based on the findings of the Stage 2 Project Appraisal process and the overall summary Project Appraisal Matrix presented in Table 8-30, Option A has been identified as the best overall performing option with the lowest overall impact and greatest benefit. As a result, Option A has been identified as the Emerging Preferred Route Corridor for the Scheme and it is recommended to progress Option A to Stage 3 of the Phase 2 Option Selection Process.

The Emerging Preferred Route Corridor is presented below in Figure 8-2.

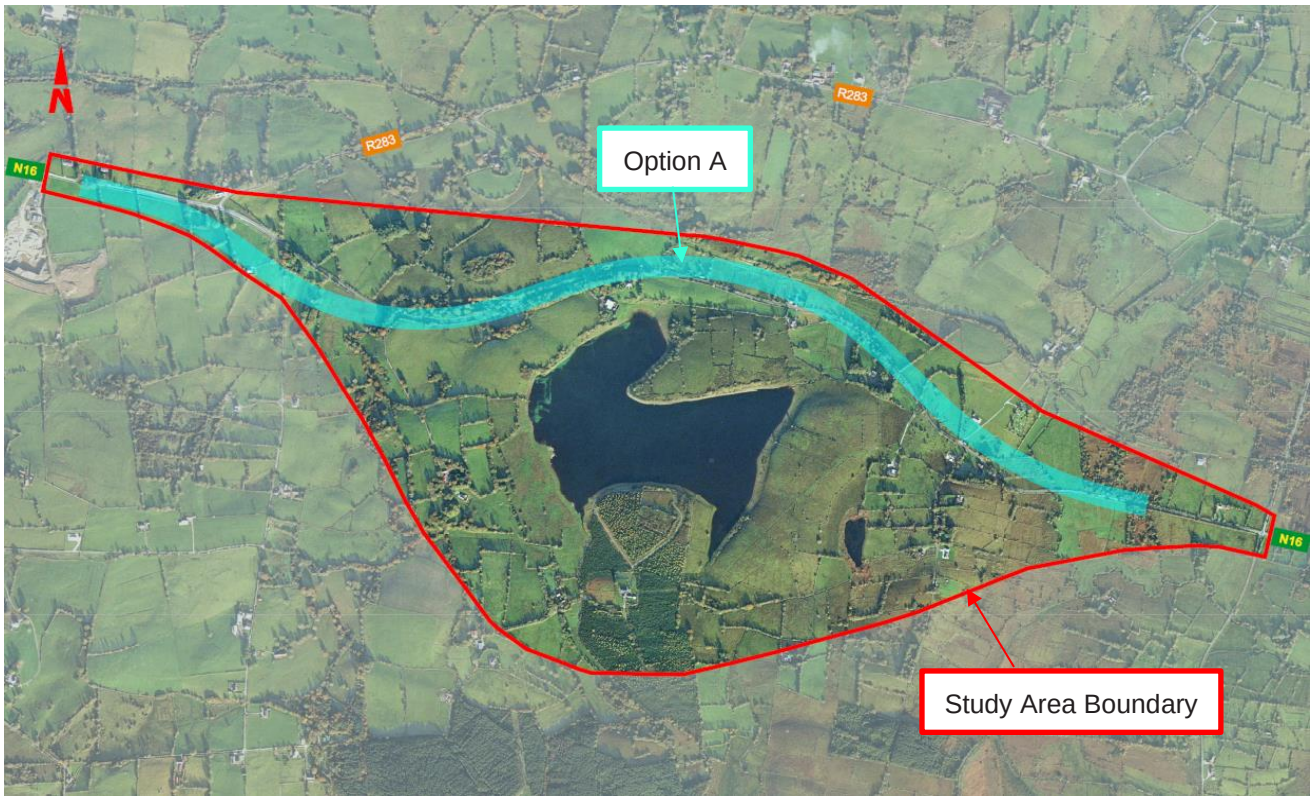

Figure 8-2: Emerging Preferred Route Corridor (Option A)

(Mapping: Ordnance Survey of Ireland Licence No. 2021/OSI_NMA_139)

9 STAGE 3 PREFERRED OPTION

9.1 Introduction

Following the identification of the Emerging Preferred Route Corridor, a Project Appraisal Report (PAR) was prepared for the Scheme in accordance with *PAG Unit 12.0 – Minor Projects (€5m to €20m) (March 2021).* The PAR forms the single integrated Stage 3 deliverable required under the TII Project Appraisal Guidelines (PAG) and encompasses the Project Appraisal Balance Sheet (PABS) for the Scheme which was undertaken to assess and summarise the benefits of the Preferred Option.

Additionally, during the Stage 3 process, a 3rd non-statutory public consultation (Public Consultation 3) event was held to invite feedback from landowners of the area, members of the public and other interested parties on the Emerging Preferred Route Corridor. This event was held over a four-week period between Wednesday 24th March and Thursday 22nd April 2021 inclusive. Feedback received was considered by the Project Team in identifying a Preferred Route Corridor. A copy of the Feedback Report from this stage of Public Consultation is provided within **Volume F Part C**.

The following section outlines the findings of the Stage 3 process and sets out a recommendation for the Preferred Option.

9.2 Emerging Preferred Route Corridor Option

Following the completion of the Stage 2 Project Appraisal of the shortlisted options and the completion of the Project Appraisal Matrix, Option A (Cyan) was identified as the best overall performing option, with the lowest overall impact and greatest benefit (i.e. the best combination of impacts and benefits), and was consequently identified as the Emerging Preferred Route Corridor Option.

As part of Public Consultation 3, a map showing the Emerging Preferred Route Corridor was presented to the public. This map presented a 60m wide corridor. This corridor did not represent the actual width of the road scheme or the lands to be acquired but indicated the lands within which the scheme could be developed. As the design progresses, and addition consultation and assessments are undertaken, it was noted that there may be a requirement to extend beyond this corridor to optimise the design and to avoid or minimise effects on landowners and the environment.

In addition to this 60m corridor, indicative junction locations were also shown along the proposed route. This plan also included an indicative line to represent the new alignment of the N16 at this stage of the design. This line is indicative and was provided to encourage feedback from the public and stakeholders. This map as presented during Public Consultation 3 is provided below in Figure 9-1.

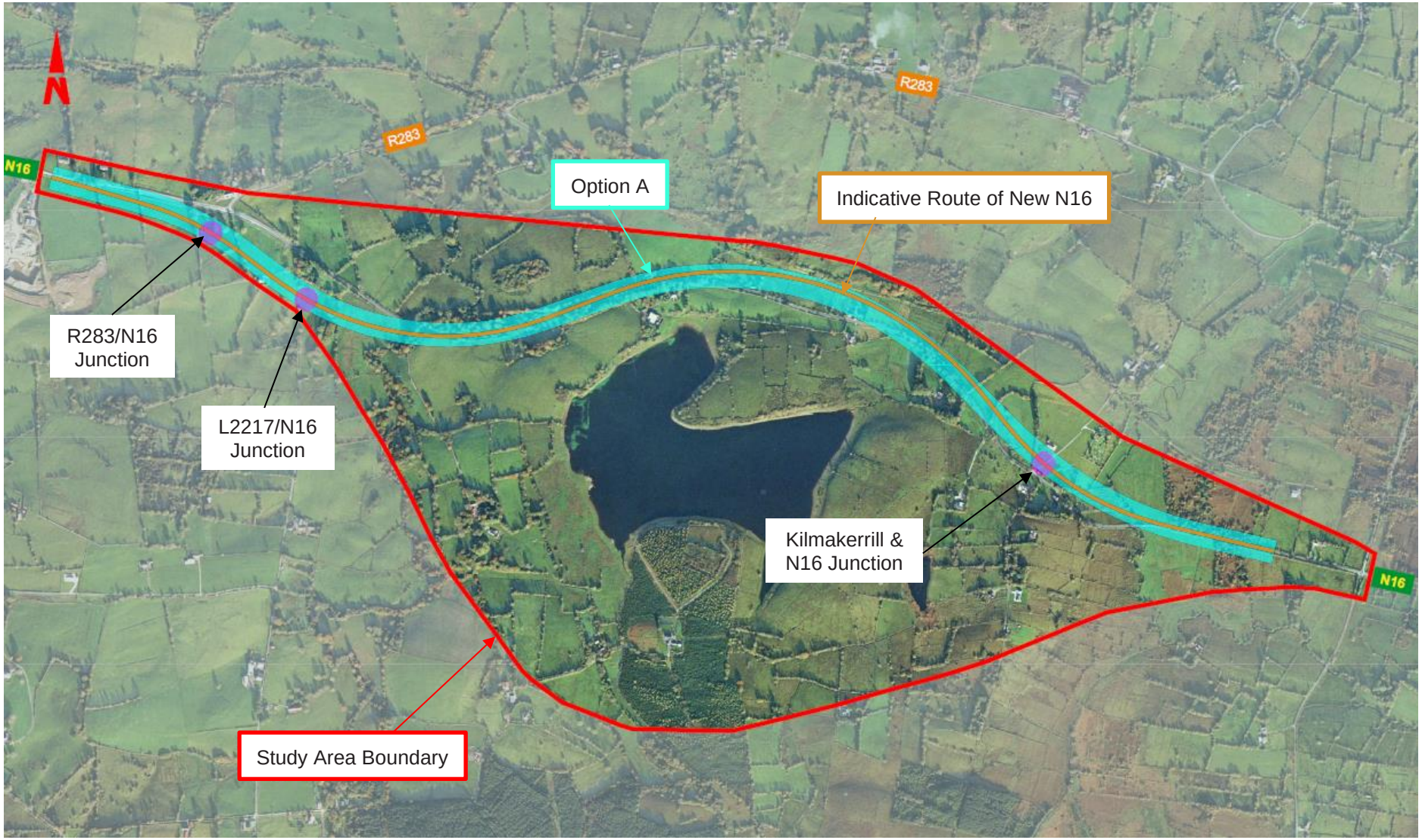

Figure 9-1: Stage 3 Emerging Preferred Route Corridor (Option A) as presented at Public Consultation 3

9.3 Project Appraisal Balance Sheet

Following identification of the Emerging Preferred Route Corridor Option, a PABS was developed as part of the Project Appraisal Report (PAR) prepared for the Scheme.

An extract of the PABS from the PAR is provided in **Volume G**.

As part of the PABS process, an Economic and Multi-Criteria Analysis (MCA) was undertaken on the Preferred Option in accordance with *PAG Unit 12.0 – Minor Projects (€5m to €20m) (March 2021).* This assessment is set out below.

9.3.1 Economic Appraisal

The economic appraisal of the Preferred Option was undertaken using the TII Simple Appraisal Tool (Version 4) as outlined within *PAG Unit 12.0 Project Appraisal Guidelines for National Roads.* The Scheme costs generated as part of Stage 2 Project Appraisal for Option A were inputted into the appraisal tool to generate a Present Value of Benefits (PVB), Present Value of Costs (PVC), Net Present Value (NPV) and a Benefit to Cost Ratio (BCR) for the Preferred Option.

The results from this analysis based on TII Central Traffic Growth is presented below in Table 9-1.

Table 9-1: Economic Appraisal using TII Simple Appraisal Tool (Version 4)

Projected Benefits (TII Central Traffic Growth)	
Appraisal Period (Years)	30
Journey Time Impacts (€ Million)	€ 4.90
Vehicle Operating Costs Impacts (€ Million)	-€ 0.05
Residual Impacts (€ Million)	€ 3.16
Present Value Benefits, PVB (€ Million)	€ 8.01
Present Value Costs, PVC (€ Million)	€ 10.57
Net Present Value (NPV)	-€ 2.57
Benefit to Cost Ration (BCR)	**0.76**
Design Year AADT	2909
HGV%	8.4%

Table 9-1 above shows that the BCR for the Preferred Option is 0.76. Whilst the BCR for the Scheme is less than 1.0, the MCA shows a strong case for the Scheme and demonstrates that the delivery of the improved link would give rise to other benefits such as a significant improvement in road safety and the delivery of a road link which would be consistent with recently improved sections in Cornacloy in turn providing improved accessibility and connectivity to Munakill and the surrounding areas, and an improved Ten-T strategic route. These non-economic benefits are outlined further in section 9.3.2 below.

9.3.2 Multi-Criteria Analysis

The economic appraisal only captures some of the benefits of the Scheme. The Need for the Scheme is defined by the existing operational and safety issues of the existing N16 road infrastructure in Munakill and is further supported by the aspirations of European, National and Local strategic and development policy.

Project Ireland 2040 outlines the importance of providing better access between Ireland's four other cities (Cork, Limerick, Galway and Waterford) separate from Dublin and to the northern and western region. An improved N16 will support the objectives of Project Ireland 2040 by improving the connectivity of the region. Upgrades to the existing N16 will also represent investment on a strategic link between urban centres and further afield supports access to international ports and airports. The proposed Scheme will also support the strategies of the Regional Spatial and Economic Strategy (RSES) for the Northern and Western Regional

Assembly by investing in transport infrastructure and strengthening the connection between Sligo and the East Coast.

Improvements to the N16 will also support the strategies of the Regional Planning Guidelines (2010-2022) which identify the N16 as part of the West/North Central Corridor linking the gateway of Sligo to the gateway of Enniskillen in Northern Ireland and forms part of the Northern Cross. The RPG's outline that the N16 Sligo to Enniskillen route 'requires substantial investment as a matter of priority'.

In the context of European Policy, the N16 also forms part of the TEN-T Network and the existing section at Munakill has been assigned a status of 'To be upgraded' by the European Commission. Improving the route will therefore support objectives set out in the National Planning Framework, encourage an all-island approach to economic and cultural development and facilitate objectives set out in EU Regulation No 1315/2013 on European Union guidelines for the development of the Trans-European Transport Network (TEN-T).

At a local policy level, the current Leitrim County Development Plan 2015-2021 identified the specific needs for road improvements along the N16 between Glenfarne and Glencar. The plan also contains core strategy objectives that support the development of transport infrastructure in the County and states that "a modern, efficient and safe road network is vital for the future development of Leitrim".

9.3.2.1 Preferred Option

The following section outlines a summary of the MCA of the Preferred Option.

9.3.2.1.1 Safety

The Preferred Option will constitute a significant improvement to road safety when compared to the existing section of the N16 and will in turn provide an alignment designed to current standards which will form an improved strategic transport corridor that is 'fit for purpose' for all road users and which is consistent with recently improved sections of the N16. As a result, the Preferred Option has been scored as Moderately Positive (6) with regards to Collision Reduction.

The Preferred Option will adopt one of two potential scenarios with respect to pedestrian and cyclist provision. Each scenario will represent a significant improvement with respect to pedestrian and cyclist provisions when compared to the current situation. The provision of formal facilities will reduce the potential for conflicts with vehicles on the N16 and in turn cater for pedestrian and cyclist movements in a safer environment thereby enhancing security. Both scenarios will be further examined at Stage 3 – Preferred Option. Therefore, the Preferred Option has been scored as Moderately Positive (6) with respect to Security of Road Users.

9.3.2.1.2 Environment

The Preferred Option will provide a road alignment with the least number of negative impacts on the environment when compared to the other two options.

The Preferred Option is preferred in 9 No. sub-criteria under the environmental criteria including; Population and Human Health, Waste, Aquatic Biodiversity, Soils, Geology and Hydrogeology, Hydrology, Noise, Material Assets – Agricultural, Material Assets – Non-agricultural and Landscape & Visual. This is due to the lower number of negative impacts on properties, a lower cut/fill deficit and lower impacts on the hydrological environment in the Preferred Option. The Preferred Option is least preferred in Terrestrial Biodiversity due to a greater portion of the 300m assessment corridor for the option interacting with a European designated site, in comparison to the other two options.

Due to the size and scale of the project, it can be assumed however, that within the 300m corridor there is scope to avoid or minimise impacts to the European site to non-significant levels through engineering design and mitigation. Therefore, the N16 Munakill road project can be located and designed in a manner that will not adversely affect the integrity of the European site. This will be further examined during Phase 3 Design and Environmental Evaluation. The Preferred Option is also intermediate preferred for Air Quality & Climate and Cultural Heritage. This is due to the slightly higher impacts of air quality exposure, Green House Gas generation and Cultural Heritage.

The Preferred Option has therefore been scored with the impact scores shown in **Table 9-2** with regards to Environment.

Table 9-2: Summary of Impact Scores for the Environment Appraisal

Environment Sub-Criteria	Preferred Option Impact Score	Preferred Option Impact Score Key
Population and Human Health	3	Minor or slightly negative
Waste	4	Not significant or neutral
Terrestrial Biodiversity	2	Moderately negative
Aquatic Biodiversity	2	Moderately negative
Soils, Geology and Hydrogeology	4	Not significant or neutral
Hydrology	2	Moderately negative
Air and Climate	2	Moderately negative
Noise	4	Not significant or neutral
Material Assets (Agricultural)	2	Moderately negative
Material Assets (Non-Agricultural)	3	Minor or slightly negative
Cultural Heritage	3	Minor or slightly negative
Landscape and Visual	2	Moderately negative

9.3.2.1.3 Accessibility and Social Inclusion

The Preferred Option will provide an improved link between Manorhamilton and Blacklion/Enniskillen and will also aid accessibility to and from the rural Munakill area. The Scheme will also improve connectivity from Sligo to Northern Ireland whilst contributing to improved access to surrounding areas. In the short term, the project will also provide short term employment opportunities.

With respect to Vulnerable Groups, the Preferred Option will also present an opportunity to improve the journey time and journey time reliability between centres such as Sligo, Manorhamilton and Blacklion/Belcoo by servicing single vehicle and public transport methods within the area. The Preferred Option will provide improved access and improved junctions to the immediate communities whilst also contributing to improved access to surrounding areas such as Manorhamilton, Sligo, Blacklion and Enniskillen. In addition, the Scheme will also reduce travel times resulting in an improved level of service on the N16 which in turn will support and improve access for residents to jobs, key facilities, and social opportunities in Manorhamilton, Enniskillen and further to Sligo and Northern Ireland.

The Scheme will also improve access to vital services such as health (e.g. Our Lady's Community Hospital in Manorhamilton), education and employment.

The Preferred Option has therefore been scored as Minor or Slightly Positive (5) with regards to Vulnerable Groups and Not Significant/Neutral (4) with respect to Deprived Geographical Areas.

9.3.2.1.4 Integration

In respect to Transport Integration, the Preferred Option will provide an improved link between Manorhamilton and Blacklion/Enniskillen and further afield which would also aid connectivity from Sligo to Northern Ireland. In turn, the Preferred Option will contribute to improving access to surrounding areas and address the identified gap in the network. It would also provide a safer transition to recently improved sections of the N16 in particular the Kilmakerrill/Cornacloy (2007/08) and Cornacloy/Sradrine (2012/13 & 2017) schemes to the east.

Additionally, the Preferred Option will give rise to benefits with respect to connectivity of different transport modes by improving journey time and journey time reliability along both the Bus Éireann and Transport for Ireland Local Link Service network by improving the existing road infrastructure.

The Preferred Option will also aid to encourage more sustainable modes of transport such as walking and cycling though one of two potential scenarios with respect to pedestrian and cyclist provision. Scenario A will involve using the planned SLNCR Greenway as the dedicated pedestrian/cyclist facility for the Scheme. Scenario B will involve the re-use of the existing N16 cross section where possible combined with the

development of short sections of dedicated pedestrian/cyclist facility running parallel to the new carriageway as per the cross-section requirements defined in CC-SCD-00002. Both scenarios will represent a significant improvement with respect to pedestrian and cyclist provisions when compared to the current situation. The provision of formal facilities will reduce the potential for conflicts with vehicles on the N16 and in turn cater for pedestrian and cyclist movements in a safer environment. Each scenario will encourage more sustainable modes of transport and make leisure activity more attractive in the area.

The N16 is the primary strategic route linking Sligo, Leitrim and the north west region to Belfast (including Belfast International Airport, Belfast Port and the Port of Larne). It was shown that an upgraded N16 would also improve these linkages, accommodate increased capacity, and improve the journey times and journey time reliability, albeit over a short section.

Therefore, in light of the above, the Preferred Option has been scored as Moderately Positive (6) with regards to Transport Integration.

The Scheme is also supported in the Leitrim County Development Plan 2015-2021 with the N16 being recognised as an important strategic transport corridor. The N16 also forms part of the Trans-European Network (TEN-T), meaning it has National and European significance and provides cross-border, international connectivity. The Preferred Option will replace an undesigned section of the existing N16 with an improved alignment with a wider cross-section, which will subsequently improve the capacity, operation, and safety of the N16 route. As a result, the Preferred Option has been scored as Moderately Positive (6) in respect to Land Use Integration.

The project will also help support the objectives of Project Ireland 2040 which outlines the importance of providing better access between Ireland's four other cities (Cork, Limerick, Galway and Waterford) separate from Dublin and to the Northern and Western region. The project also follows through with themes from the National Spatial Strategy, by improving connectivity between Hubs and Gateways. In addition to improved accessibility, the Scheme represents investment on a strategic link between urban centres and further afield supports access to international ports and airports. This in turn demonstrates the Schemes support towards regional balance and integration. For these reasons, the Preferred Option has been scored as Moderately Positive (6) with regards to Geographical Integration and Moderately Positive (6) with respect to Other Government Policy Integration: Regional Balance.

9.3.2.1.5 Physical Activity

The proposed cross section for the Scheme is a Type 2 Single Carriageway in accordance with CC-SCD-00002 of TII Publications. A requirement of this type of cross section is the provision of a walking/cycling facility on one side of the new road construction which is separated by a grass verge. Preliminary planning is also currently underway by others to develop the existing disused Sligo, Leitrim & Northern Counties Railway line (SLNCR), which passes through the North of the Study Area, into a Greenway scheme between Sligo and Enniskillen. Considering the requirements of the selected cross section together with the preliminary works underway on the planning of the SLNCR Greenway, the cycling strategy considered for the purpose of the Stage 2 Appraisal consists of two scenarios.

- **Scenario A:** The first scenario will involve using the planned SLNCR Greenway as the dedicated pedestrian/cyclist facility for the Scheme. This approach will involve providing links to the SLNCR line to allow pedestrians and cyclists within the Study Area to access the facility from the N16 and the Local Road network. This scenario will have safety benefits by diverting pedestrians and cyclists away from the N16 carriageway and onto the Greenway thereby reducing the potential for conflicts.
- **Scenario B:** The second scenario will involve the re-use of the existing N16 cross section where possible combined with the development of short sections of dedicated pedestrian/cyclist facility running parallel to the new carriageway as per the cross section requirements defined in CC-SCD-00002 of TII Publications. This scenario may include for the provisions of links to the SLNCR Greenway at a later stage however has the benefit of ensuring that facilities for pedestrians and cyclists will be provided irrespective of the SLNCR Greenway.

The transfer of cyclist and pedestrian movements onto the proposed Greenway scheme (Scenario A) or onto a dedicated pedestrian/cyclist facility or declassified section of road (Scenario B) will in turn reduce potential conflicts between such road users and vehicular traffic on the N16. This segregation will improve safety and subsequently increase the attractiveness of cycling and walking in the area.

Considering the above, the Preferred Option has been scored as Moderately Positive (6) with respect to Physical Activity.

9.4 Road Safety Audit Stage F (Part 2)

Following completion of the Road Safety Audit (RSA) Stage F Part 1 on the Stage 2 Route Corridor Options (see Section 8.4 above), an Stage F Part 2 RSA was undertaken on the Emerging Preferred Route Corridor (Option A).

The Stage F Road Safety Audit (Part 2) was carried out in accordance with TII's *GE-STY-01024 Road Safety Audit Standard and GE-STY-01027 Road Safety Audit Guidelines*. The Audit was undertaken by a TII approved Road Safety Audit Team who are external and independent from the Design Team.

As per GE-STY-01027, the Stage F Audit Report was completed in two separate parts, the first part (i.e. Stage F, Part 1) assesses and ranks all of the Stage 2 Route Corridor Options in terms of road safety impact, whilst the second part (i.e. Stage F, Part 2) is focussed only on the option selected as the Emerging Preferred Route Corridor Option. The Part 2 Audit identifies potential road safety issues with respect to the option and provides recommendations. Thereafter, these recommendations are reviewed and responded to by the Design Team, where the Auditor then determines approval of Audit. In the case of the N16 Munakill Realignment Scheme, the Part 2 Audit was successfully approved and closed-out.

The Stage F Part 2 Road Safety Audit Report is also included in **Volume H.**

9.5 Recommendation of the Preferred Option

Based on the Phase 2 process documented within this report and its associated volumes, which was undertake in accordance with the TII *Project Management Guidelines* (PE-PMG-02041, December 2020), it is concluded that Option A is the optimum solution to meet the Project Specific Need and the Scheme Objectives.

It is therefore recommended that Option A be adopted as the Preferred Option and be taken forward to Phase 3 Design and Environmental Evaluation of the TII *Project Management Guidelines.*