

N25 Waterford to Glenmore

Phase 2: Environmental Route Options Report – Stage 2 (Project Appraisal Matrix)

Kilkenny County Council

March 2021

5190130-ATK-ZZ-ZZ-RP-EC-0001



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Client signoff

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1. Introduction

The N25 is a vital link in the national road network in the south east of Ireland. The N25 connects Cork at one end to the port of Rosslare at the other end, with a link to Waterford City from the N25 between these locations. It provides access to 4 of the country's major ports, Cork, Waterford, New Ross and Rosslare. It also provides access to 2 airports, Cork and Waterford. This section of the national road network is rural in nature and is situated between Waterford City (to the south) and the New Ross Bypass (just north of Glenmore Village), County Kilkenny.

The purpose of this report is to document the Environmental Assessment process undertaken at Phase 2 Stage 2 of the option selection process. The process is detailed within Transport Infrastructure Ireland (TII) Project Management Guidelines (PMG) and associated Project Appraisal Guidelines (PAG).

1.1. Option Selection Process

The Option Selection Process is a three-stage process as outlined within Project Appraisal Guidelines (PAG) Unit 4.0 – Consideration of Alternatives and Options and is summarised as follows:

- Stage 1 – Preliminary Options Assessment;
- Stage 2 – Project Appraisal Matrix; and
- Stage 3 – Preferred Option.

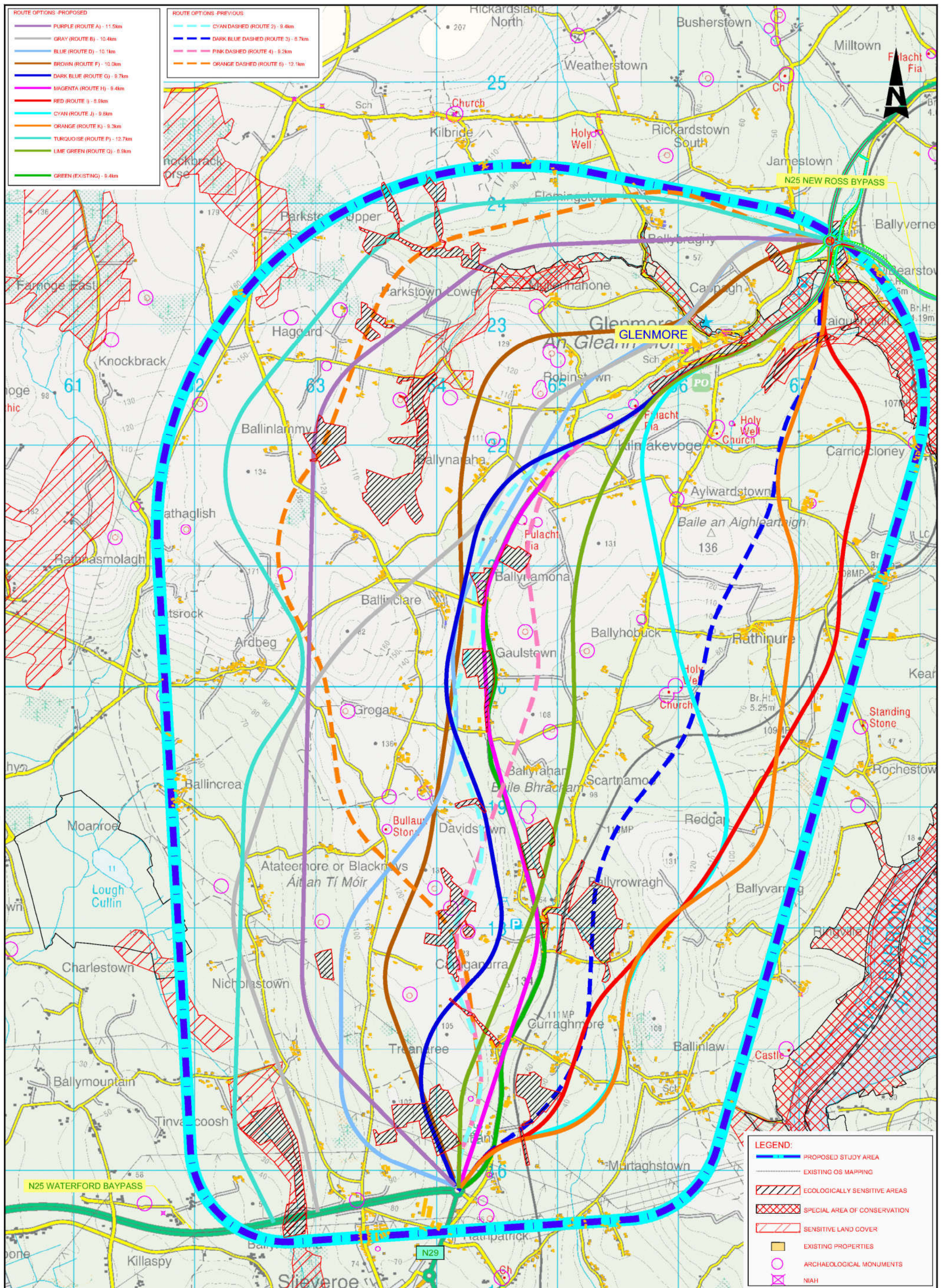
1.2. Stage 1 (Preliminary Option Assessment) Summary

For Stage 1 the Preliminary Option Assessment was carried out on all feasible options which were developed for the scheme. Fifteen routes were assessed, and these are displayed on Figure 1.1.

A1

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ROUTE OPTIONS - PROPOSED

- PURPLE (ROUTE A) - 11.5km
- GRAY (ROUTE B) - 10.4km
- BLUE (ROUTE D) - 10.1km
- BROWN (ROUTE E) - 10.2km
- DARK BLUE (ROUTE F) - 9.7km
- MAGENTA (ROUTE H) - 9.4km
- RED (ROUTE I) - 8.5km
- CYAN (ROUTE J) - 9.6km
- ORANGE (ROUTE K) - 9.3km
- TURQUOISE (ROUTE P) - 12.7km
- LIME GREEN (ROUTE Q) - 8.9km
- GREEN (EXISTING) - 9.4km

ROUTE OPTIONS - PREVIOUS

- CYAN DASHED (ROUTE 2) - 9.4km
- DARK BLUE DASHED (ROUTE 3) - 8.7km
- PINK DASHED (ROUTE 4) - 9.2km
- ORANGE DASHED (ROUTE 5) - 12.1km

LEGEND:

- PROPOSED STUDY AREA
- EXISTING OS MAPPING
- ECOLOGICALLY SENSITIVE AREAS
- SPECIAL AREA OF CONSERVATION
- SENSITIVE LAND COVER
- EXISTING PROPERTIES
- ARCHAEOLOGICAL MONUMENTS
- NAIH

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Rev	Description	By	Date	Chk'd	Auth
B	ISSUED FOR REVIEW	MM	12/19	EON	RAN
A	ISSUED FOR REVIEW	MM	11/19	EON	RAN
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Client
KILKENNY COUNTY COUNCIL

Project
N25 WATERFORD TO GLENMORE SCHEME

Purpose	ISSUED FOR REVIEW				
Title	Figure 1.1 Preliminary Route Options				
Original Scale	N.T.S.	Des/Drawn	MM	Checked	EON
Date	10/12/19	Date	10/12/19	Date	10/12/19
Status	Drawing Number	Rev			
P	5190130-ATK-ZZ-ZZ-SK-RE-0016	B			

The Environmental Assessment of each route was carried out as a comparative exercise, utilising matrices that are located in Appendix 1.1, in line with TII's PMG and PAG. The environmental sub-criteria for each preliminary option assessment are summarised as follows:

- Human Beings (including compatibility with development policy);
- Flora and Fauna (comparative impact on designated sites / species and other areas of national, regional or local ecological value);
- Water Quality (comparative impact on watercourses, water supplies and aquatic ecology);
- Geology & Hydrogeology (comparative impact on vulnerable rocks and soils, aquifers and wells of national, regional or local importance);
- Air Quality (existing air quality environment and number of sensitive receptors);
- Noise & Vibration (identification of sensitive receptors, characteristics of the prevailing noise climate and opportunities for noise mitigation);
- Landscape & Visual (comparative impact on landscape character, topography, vegetation, natural features, views and obstructions);
- Material Assets (comparative impact on utilities, properties, quarries, transport and infrastructure, etc);
- Agriculture (comparative impact on farm operations, farm types, livestock and other agri-businesses); and
- Archaeology & Cultural Heritage (comparative impact on Recorded Monuments and Places, area of archaeological potential, Arch. Heritage, and any other areas of cultural significance as per TII Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes and TII Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes).

Each impact was assessed using both a qualitative and quantitative method and was then scored on a seven-point scale as follows as detailed in PAG Unit 7.0: Multi Criteria Analysis (MCA):

- 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
- 1 – Major or highly negative

The high-level ranking of options is given by the sum of all the preference scores based on the scoring for each of the main criterion. It is not intended that the sum of each of the individual scores will be used in selecting a preferred option. The overall impact will depend on the strength of individual impacts and it is up to the assessor to weigh up the individual impacts and form a view as to the likely overall impact of the options. The environmental scoring and assessment were considered along with other assessment parameters i.e. engineering and economic. Six route corridor options were brought forward into Stage 2 for further assessment, i.e.:

- Purple (11.6 km);
- Navy (9.5 km);
- Magenta (9.3 km);
- Red (9.0 km);
- Teal (8.7 km); and
- Lime Green (8.9 km).

2. Stage 2 Assessment - Environmental Sub-criteria

A Phase 2 Stage 2 Project Appraisal has been undertaken for each of the six route options identified from the overall Stage 1 Preliminary Options Assessment.

The Stage 2 Environmental Appraisal has been undertaken by an experienced environmental team comprising Atkins' environmental consultants and specialist sub-consultants. Each consultant undertook the environmental appraisal for their discipline in accordance with relevant TII and industry standard best practice guidance.

Specific details in relation to the methodology and assessment criteria, along with the findings of each detailed environmental appraisal are presented in each of the following sub-sections (within Chapter 2) and associated appendices (where required).

A collaborative approach was adopted by the environmental team particularly where environmental interactions warranted consideration (for example between cultural heritage and landscape and visual, and between ecology and hydrology).

The Environmental Sub-Criteria assessed during Phase 2 Stage 2 is as follows:

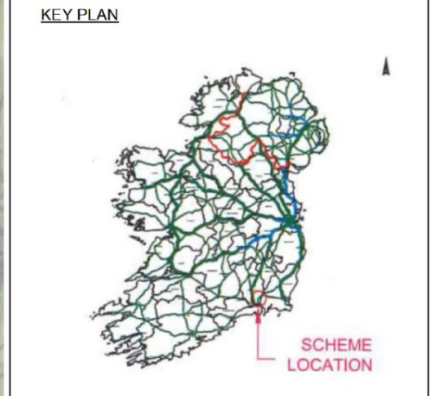
- Air quality;
- Climate;
- Noise;
- Landscape and Visual;
- Flora and Fauna;
- Waste;
- Soils and Geology;
- Hydrology;
- Hydrogeology;
- Cultural Heritage (including architectural and archaeological heritage);
- Non-agricultural properties;
- Agriculture;
- Human Beings (including compatibility with planning policy); and
- Human Health.

The sub-criteria are based on topics contained within PAG Unit 7.0: MCA. Please note that additional environmental sub-criteria have been added, i.e. human health to reflect updates in the most recent EIA directive. Human beings (including compatibility with planning policy) has also been added. The six route options assessed against the environmental sub criteria are displayed on Figure 2.1.

Each of the sub-criteria have specific methods of assessment however each sub-criterion has been scored using the seven-point scale as described in Chapter 1. Summary scores are presented in tables at the end of each sub-criteria assessment. Detailed Stage 2 Project Appraisal Matrices are included within Appendix 3.1.



- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
 2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
 3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
 4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
 5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION



- Route Options**
- Purple
 - Navy
 - Maganeta
 - Lime Green
 - Teal
 - Red
- Study Area

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Client	KILKENNY COUNTY COUNCIL		
Project	N25 WATERFORD TO GLENMORE SCHEME		

Title				Stage 2 Route Options			
Original Scale	Des/Drawn	Checked	Authorised	Date	Date	Date	Rev
Status	Drawing Number			Figure 2.1			

2.1. Air Quality

2.1.1. Introduction

AWN Consulting Limited have prepared an air quality route options assessment for six route options. This assesses the various route options in line with TII guidance and provides a comparison of the air quality impact on people of each route option.

2.1.2. Method of Assessment

2.1.2.1. Assessment Criteria

TII's document entitled "*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*"¹ provides guidance on the route selection assessment procedures in "Chapter 2 – Route Selection". The primary aspects of the assessment relate to the existing ambient air quality, proximity of sensitive locations and a review of the overall significance of potential changes in air quality.

The objective at this stage of the route selection process is to indicate whether there are likely to be significant air quality impacts associated with the proposed route options. In the current assessment, the number of residential properties within 50m of the carriageway² of each route have been identified. Traffic data obtained for the opening year of 2030 has been used in the model as per the TII guidelines³. A comparison of the proposed routes has been carried out based on a calculation of the Index of the Overall Change in Exposure to Nitrogen Oxides (NO_x) and Particulate Matter (PM₁₀) resulting from each individual route.

The calculation of the Index of Overall Change in Exposure allows a comparison of the overall air quality impact on people from each route option to be carried out. The Index is based on identifying the number of sensitive receptor locations (e.g. residential properties) within 50m of the carriageway of all road links that would experience a significant change in traffic for each of the routes. The change in emissions is influenced by changes in traffic flow, composition and speed. The analysis was carried out using the methodology of TII1 using the UK DMRB air dispersion model.

The comparison calculated as per the "*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*" was then used to inform the Stage 2 project appraisal matrix. The comparative evaluation of options was assisted by scoring of impacts to sensitive receptors using the Stage 2 project appraisal matrix similar to that shown in the Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis⁴. An assessment was undertaken on each option to include both a quantitative and qualitative assessment. Each impact is scored based on the seven-point scale as described in Chapter 1.

2.1.3. Key Findings

2.1.3.1. Air Pollution Sources

The major source of air pollution within the study area is road traffic, predominantly that from the existing N25, the New Ross Bypass at the northern end of the study area and the N29 and N25 Waterford Bypass at the southern end of the study area. Air quality is variable and subject to significant spatial variation, with concentrations generally reducing significantly with distance from major road sources. The higher levels of air pollution are experienced within 50m of the existing national roads in the study area with the remainder of the study area generally experiencing rural background concentrations of pollutants.

A review of IPPC / IED licences issued by the EPA⁵ for the region show that there are no licenced facilities with emissions to the atmosphere within the study area for this project.

2.1.3.2. Meteorological Data

A key factor in assessing temporal and spatial variations in air quality are the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels). Wind is of key importance in

¹ Transport Infrastructure Ireland (2011) Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes

² Carriageway is indicative alignment within corridor for assessment purposes

³ UK DEFRA (2007) Design Manual for Roads and Bridges Vol 11 Chapter 3 (Document & Calculation Spreadsheet)

⁴ Transport Infrastructure Ireland (2016) Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis. PE-PAG-02031.

⁵ EPA (2020) <http://www.epa.ie/Licensing/IPPCLicensing>

dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM₁₀ (particulate matter less than 10 microns), the situation is more complex due to the range of sources of this pollutant, and thus measured levels of PM₁₀ can be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Johnstown Castle meteorological station. This station is located approximately 37 km east of the existing N25. Windroses for the most recent 5 years of data collected (2014 – 2018) show that the prevailing wind is south-westerly in direction with a mean wind speed of approximate 4.0 m/s over the period 2004 – 2018⁶.

2.1.3.3. Existing Air Quality – Review of EPA Monitoring Data

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes. In terms of air monitoring, the study area is categorised as Zone D (rural areas and towns with a population of less than 15,000).

Air quality monitoring programs have been undertaken throughout Ireland in recent years by the EPA and Local Authorities. The most recent EPA annual report on air quality monitoring undertaken throughout Ireland is entitled 'Air Quality in Ireland 2018'. The TII guidelines state that the local air quality assessment should focus on NO₂ and PM₁₀, as these are the pollutants of greatest concern with respect to road traffic conditions. A review of data from representative Zone D locations in Ireland can be used to provide an indication of the prevailing air quality conditions within the study area.

NO₂ monitoring was carried out at two rural Zone D locations in Emo and Kilkitt in recent years⁶. The NO₂ annual average in 2018 was 3 µg/m³ at both rural sites. Hence long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40 µg/m³. The maximum 1-hour limit value of 200 µg/m³ (measured as a 99.8th percentile i.e. 18 exceedances are allowed per year) was not exceeded in any year for any of the Zone D locations. The average results at rural Zone D locations over the last five years suggests an average of 3 µg/m³ as a background concentration. Based on the above information, a conservative estimate of the current background NO₂ concentration for the region of the development is 5 µg/m³.

Long-term PM₁₀ measurements carried out at the rural Zone D location in Kilkitt in 2018 gave an average level of 9 µg/m³⁷. Results are also available for Kilkitt to observe the trend in concentrations over the last five years. The average result at Kilkitt over the last five years is 9 µg/m³. Based on the above information a conservative estimate of the current background PM₁₀ concentration for the region of the development is 10 µg/m³.

2.1.3.4. Traffic Pollution

Pollution from traffic sources increases at low traffic speeds and during congested traffic conditions. An improvement in the road infrastructure is likely to improve traffic flow, relative to the current alignment. In addition, the number of receptors directly impacted by the proposed routes will be less than the current route, thus all the proposed routes are preferable to the existing alignment with respect to air quality.

The residual impact on the existing N25 has been accounted for when assessing the impact of each of the route options in the 'Do Something' scenario (Table 2-1). The route with the lowest exposure index is the preferred option from an air quality perspective, as it leads to the smallest increases, or greatest decreases in air pollution at sensitive receptors. A negative score indicates an overall improvement in air quality as a result of the route option.

2.1.3.5. Purple

The purple route is of intermediate preference as it results in a slightly positive impact on local air quality at the sensitive receptors along the existing alignment. There are no residential properties within 50m of the carriageway of the purple route, however, diverting the traffic away from the properties within 50m of the carriageway of the existing route results in the overall beneficial impact calculated.

2.1.3.6. Navy

The navy route is moderately positive in terms of local air quality impacts. There is a total of 4 sensitive receptors within 50m of the navy route carriageway. These sensitive receptors are within the mostly online

⁶ Met Eireann (2020) www.met.ie

⁷ PA (2019) Air Quality in Ireland 2018 (and previous reports)

northern portion of the route option and therefore these properties will already experience a certain level of traffic related air pollutants from the existing N25. The more southerly portion of the navy route diverts traffic away from the existing N25 and therefore results in a positive impact on the existing properties on the remainder of the N25.

The resultant NO_x and PM₁₀ scores are moderately positive by diverting traffic away from the existing N25.

2.1.3.7. Magenta

The magenta route option is considered neutral in terms of air quality impacts. It is the most online option and therefore has the highest number of receptors (26) within 50m of the route carriageway, however, as these receptors are already impacted by the existing traffic along the N25 the change in NO_x and PM₁₀ concentrations is lessened.

The resultant NO_x and PM₁₀ scores are slightly positive but the overall change in emission compared with the other route options is minimal and overall results in a neutral score.

2.1.3.8. Red

The red route has a moderately positive impact on local air quality. There is a total of 3 sensitive receptors within 50m of the road carriageway of this route option, these newly impacted receptors will experience an increase in air pollutant concentrations compared with predicted baseline levels. However, the overall impact of the red route option is positive as a result of diverting the traffic away from the properties along the existing N25.

2.1.3.9. Teal

The teal route has a highly positive impact on local air quality and is the preferred route option from an air quality perspective. There are no sensitive receptors within 50m of the road carriageway of this route option and therefore no negative air quality impacts are predicted. The teal route will result in a positive impact by diverting traffic away from the sensitive receptors along the existing N25 thus, improving air quality in this area.

2.1.3.10. Lime Green

The lime green route has a moderately positive impact on local air quality. There is a total of 4 sensitive receptors within 50m of the road carriageway of this route option, these newly impacted receptors will experience an increase in air pollutant concentrations compared with predicted baseline levels. However, the overall impact of the lime green route option is positive as a result of diverting the traffic away from the properties along the existing N25.

2.1.3.11. Impacts on Sensitive Ecosystems

The EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") requires an Appropriate Assessment to be carried out where there is likely to be a significant impact upon a European protected site. TII requires the Air Quality Specialist to liaise with an ecologist on schemes where there is a European protected site within 2km of the route. However, as the potential impact of a scheme is limited to local level, detailed consideration need only be given to roads where there is a significant change to traffic flows (>5%) and the designated site lies within 200m of the road centre line. Where these two requirements are fulfilled, the assessment at the route selection stage involves a calculation of nitrogen oxides (NO_x) concentrations using the UK DMRB screening method as recommended by TII.

All route options, including the existing N25 route directly cross a section of the River Barrow & River Nore SAC (site code 002162) at the northern point of the route towards Glenmore. As the existing route already crosses this section of the SAC and all route options are also proposed to cross the same section there is no preference to any route option in terms of air quality impacts on designated sites.

Table 2-1 - Results of Air Quality Assessment

Route	Average AADT (2030)		Route Length (km)	No. Receptors (0 - 50m)	NO _x Exposure Index	PM ₁₀ Exposure Index
	Route Option	Residual Traffic on Existing N25				
Purple	6,118	8,717	11.6	0	-18,255	-1,434
Navy	14,307	730	9.5	4	-85,138	-2,736
Magenta	14,989	n/a ^{Note 1}	9.3	26	-1,138	-28
Red	13,870	969	9.0	3	-78,047	-2,497
Teal	13,871	969	8.7	0	-90,891	-2,898
Lime Green	14,310	699	8.9	4	-80,937	-2,604

Note 1 Magenta Route is online option therefore no residual traffic flows

2.1.4. Summary and Conclusion

The route option with the greatest potential improvement in pollutant exposure is the preferred option from an air quality perspective. The results of the Index of Overall Change in Exposure have been used to rank the route options in order of their potential impact on air quality. The results (see Table 2.2) show that the teal route is the preferred option in terms of air quality, however, the lime green, navy and red routes will result in moderately positive impacts and would also be suitable choices. All route options are preferred over the existing alignment as the majority of routes divert traffic away from the high numbers of receptors along the existing alignment and impact very few new additional receptors. The magenta route is the least preferred option from an air quality perspective in comparison to the other route options, excluding the existing alignment. This is due to the fact that the magenta route is a largely online option and therefore a higher number of sensitive receptors are impacted when compared with the other routes.

Table 2-2 - Summary of Route Scoring – Air Quality

Route	Scoring	Description
Purple	5	Minor / slightly positive
Navy	6	Moderately positive
Magenta	4	Not significant / neutral
Red	6	Moderately positive
Teal	7	Major / highly positive
Lime Green	6	Moderately positive

2.2. Climate

2.2.1. Introduction

AWN Consulting Limited have prepared a climate route options assessment for six route options for the proposed N25 Waterford to Glenmore scheme. This assesses the various route options in line with TII and other relevant guidance on the national impact of climate change.

2.2.2. Method of Assessment

The TII guidance document “*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*” does not provide an assessment method for route selection based on climate impacts. However, since this guidance was published there has been an increased focus on the impact of climate change and the anthropogenic contribution to it. TII have recently published a Carbon Tool (version 2.0)⁸ which allows carbon emissions associated with a road scheme to be calculated. TII recommend the use of this tool at all stages in the project, including route selection, environmental impact assessment and detailed design stages. The tool allows for inputs associated with the construction phase, operational phase and decommissioning phase to be calculated. Construction phase inputs include details on pre-construction activities such as land clearance, construction materials, construction activities and construction waste materials. Operational stage inputs include details on the number of vehicles using the route as well as ongoing maintenance of the route. Decommissioning activities were not considered relevant to this stage of the development and have not been considered within this assessment.

The TII Carbon Tool uses emission factors from recognized sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database⁹. The carbon emissions are calculated by multiplying the emission factor by the quantity of the material that will be used over the entire construction / maintenance phase. The outputs are expressed in terms of $kgCO_2e$ (kilograms of carbon dioxide equivalent).

Information on construction activities and materials as well as operational phase information was inputted into the Carbon Tool for each route option. Full detailed information for each route is not known at this stage of the project, however, inputs were kept consistent for each route option to provide for an adequate comparison across all routes. The carbon dioxide equivalent (CO_2e) concentrations calculated for each route option were compared and a score assigned using the seven-point scale.

2.2.3. Existing Environment

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details emissions up to 2018. Agriculture is predicted to be the largest contributor in 2018 at 34% of the total, with the transport sector accounting for 20.2% of emissions of CO_2 ¹⁰.

Greenhouse gas emissions from the transport sector increased by 1.6% or 0.20 Mt CO_2eq in 2018. This is the fifth year out of the last six with increased emissions in transport. Private diesel cars increased by 7.7% in 2018 while the number of passenger petrol cars decreased by 4.5%. Railways contributed 130.49 kt CO_2eq in 2018 or 0.2% of total emissions which was up 1% on 2017 emissions. Road transportation accounted for 11,677 kt CO_2eq which is 19.2% of the total 2018 emissions and an increase of 1.4% on 2017.

The data published in 2020 predicts that Ireland will exceed its 2018 annual limit set under the EU’s Effort Sharing Decision (ESD), 406/2009/EC1 by 5.17 Mt. For 2018, total national greenhouse gas emissions are estimated to be 60.51 million tonnes carbon dioxide equivalent (Mt CO_2e). This is 0.2% lower (0.14 Mt CO_2e) than emissions in 2017.

The EPA 2019 GHG Emissions Projections Report for 2018 – 2040 notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018. Implementation of these are classed as a “With Additional Measures scenario” for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 – 2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU’s Effort Sharing

⁸ Transport Infrastructure Ireland (2011) Carbon Calculator Tool, Version 2.0

⁹ MacDonald, Mott (2013) Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book

¹⁰ EPA (2020) Ireland’s Final Greenhouse Gas emissions 1990 - 2018

Decision (Decision No. 406/2009/EC) 2020 targets by approximately 10 Mt CO₂e under the With Existing Measures scenario and 9 Mt CO₂e under the With Additional Measures scenario¹¹.

There are currently no sector specific emissions targets outlined for the reduction of GHG emissions. The proposed scheme will reduce congestion and will allow for better, more efficient driving thus reducing emissions of air pollutants and CO₂ thereby reducing the impact on climate

2.2.4. Key Findings

The CO₂e emissions associated with each route option has been calculated as per the TII Carbon Tool. There is minimal difference between all route options in terms of CO₂e emissions as they are all of a similar length. No route option will result in a positive impact to climate. As the magenta route is the primarily online route option with 65% online, it has the lowest construction stage embodied CO₂ emissions due to the lower volume of materials required. The purple route option is the longest route and therefore has the highest embodied CO₂ emissions due to the greater amount of material and works involved at the construction stage.

2.2.4.1. Purple

The purple route results in a slight negative impact to climate. This is the route option with the longest length and therefore has the highest volume of construction materials and construction works involved. In addition, due to the longer length this results in a further distance to travel and a large volume of traffic remains on the existing N25 due to the longer journey time on the purple route. Therefore, there is a lesser difference between the Do Nothing and Do Something operational scenarios with the purple route. The purple route option is the least preferred in terms of climate.

2.2.4.2. Navy

The navy route results in a slight negative impact to climate as a result of embodied CO₂e emissions. The navy route is approximately 25% online. However, there is minimal difference between the emissions from the navy route and the other route options.

2.2.4.3. Magenta

The magenta route results in a slight negative impact to climate due to the CO₂ emissions from construction works and traffic on the route. However, as this is a 65% online option construction will involve less materials and therefore embodied construction stage carbon emissions will be lower than for the other route options which would involve full construction of a new road alignment.

2.2.4.4. Red

The red route results in a slight negative impact to climate due to the CO₂ emissions from construction works and traffic on the route. However, there is minimal difference between the emissions from the red route and the other route options.

2.2.4.5. Teal

The teal route results in a slight negative impact to climate due to the CO₂ emissions from construction works and traffic on the route. While there is minimal difference between the emissions from the teal route and the other route options the teal route is the preferred route in terms of climate impacts as it has the lowest overall carbon emissions of all the route options. This is due to the lesser operational emissions associated with vehicles using the route. In addition, the teal route is marginally shorter than the other routes.

2.2.4.6. Lime Green

The lime green route results in a slight negative impact to climate as a result of CO₂ emissions from construction works and traffic on the route. A portion of the lime green route remains online.

¹¹ EPA (2019) GHG Emissions Projections Report – Ireland's Greenhouse Gas Emissions Projections 2018 – 2040

Table 2-3 - Results of Climate Assessment

Route	Route Length (km)	Construction Stage (kgCO ₂ e)	Operational Stage (kgCO ₂ e)		Total excluding vehicle use (kgCO ₂ e)	Total (kgCO ₂ e)
			Maintenance	Vehicles using the infrastructure ^{Note 1}		
Purple	11.5	201,091,334	12,940,436	11,087,030	214,031,770	225,118,800
Navy	9.4	197,517,101	10,860,309	-2,954,970	208,377,410	205,422,440
Magenta	9.3	193,059,376	6,775,959	-2,568,970	199,835,336	197,266,366
Red	8.9	198,043,294	9,958,653	-20,713,970	208,001,947	187,287,977
Teal	8.7	198,691,780	10,541,728	-27,505,970	209,233,508	181,727,538
Lime Green	8.9	200,219,633	11,400,889	-17,192,970	211,620,522	194,427,552

Note 1 Operational Vehicle (Non Maintenance) Figures are the difference between the Do Nothing and Do Something scenarios.

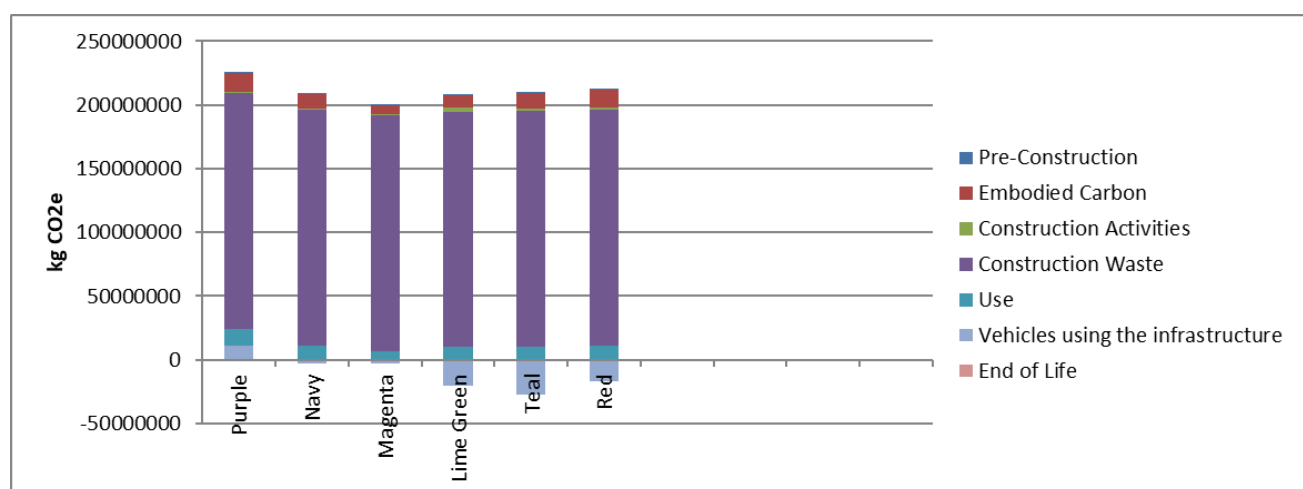


Figure 2.1 – Breakdown of Embodied Carbon for Each Route Option (Operational Figures are the difference between the Do Nothing and Do Something scenarios)

2.2.5. Summary and Conclusions

There is minimal difference in the route options (relative to national climate targets) in terms of potential climate impacts. This is due to the routes all having a relatively similar length. All routes will result in a slightly negative impact to climate as a result of embodied carbon and no positive climate impacts are predicted. The teal route is the preferred option from a climate perspective as it results in slightly lower CO₂ emissions compared with the other route options. The teal route is the shortest of the route options. The purple route is the least preferred option as it results in the highest CO₂ emissions of all the route options due to its longer length.

Table 2-4 - Summary of Route Preference – Climate

Route	Score	Description
Purple	3	Minor/slightly negative
Navy	3	Minor/slightly negative
Magenta	3	Minor/slightly negative
Red	3	Minor/slightly negative
Teal	3	Minor/slightly negative
Lime Green	3	Minor/slightly negative

2.3. Noise

2.3.1. Introduction

AWN Consulting Limited have prepared a noise route option assessment of the proposed scheme. This section presents an assessment of the route options with respect to their potential noise impact, in line with the relevant guidance set down in accordance with the TII documents “Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII 2004)”, “Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII 2014)” and the requirements of the TII Project Management Guidelines 2010 and the TII Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis PE-PAG-02031, October 2016.

2.3.2. Method of Assessment

2.3.2.1. Assessment Criteria

To establish a methodology for the options assessment, the following approach has been adopted in line with the guidelines set out in Chapter 5 of TII 2004 and Chapter 2 of TII 2014 documents.

The assessment of potential noise impacts for the Stage 2 options assessment is based primarily upon receptor counts (Quantitative), the likely changes in traffic flows and the likely requirement for mitigation measures (Qualitative). In terms of operational noise, the TII 2004 and 2014 Noise Guidelines considers it appropriate to set the design goal for road traffic noise for new national roads in Ireland as follows:

- Day-evening-night 60dB L_{den} (free field).

Both documents acknowledge that it may not always be sustainable to achieve this design goal. In such circumstances, nevertheless, a structured approach should be taken in order to as far as practicable, ameliorate road traffic noise through the consideration of measures such as the alignment, physical mitigation e.g. earth mounds, noise barriers or low noise road surfaces.

The six route options have been compared with reference to their Potential Impact Ratings (PIR) based on property counts between 0 and 300m from the road centreline. An assessment was also made of the likely range of noise levels at distances from the routes in addition to the likely requirement for noise mitigation.

Whilst the PIR assessment provides information on the number of noise properties in the vicinity of each route option, the Guidelines acknowledge that the PIR process only provides an initial high-level screening for the options assessment. This is particularly true for studies where on-line upgrades form part of the route corridor options. Consideration must also be given to the potential change in traffic noise levels at properties to further determine potential overall noise impacts. In addition to property counts, other factors which also dictate the potential noise impact from an option relate to its vertical alignment (cuttings, embankments, at grade, tunnels etc.), road traffic flows and potential for noise mitigation.

Full details of the noise assessment methodology are outlined in Appendix 2.3 of this document.

2.3.3. Existing Environment

The baseline noise environment in the vicinity of existing noise sensitive locations (NSL's) adjacent to the existing N25 road will be dominated by road traffic movements along the existing route option. The round 3 road traffic noise maps published by the EPA¹² as part of the Environmental Noise Regulations have been reviewed to determine the range of predicted traffic noise in the vicinity of the existing section of the N25 under consideration within this study area. These maps indicate that road traffic noise levels are typically greater than 60dB L_{den} , within 50m from the edge of existing section of the N25.

NSL's in the vicinity of the off-line sections of the six route corridors are influenced by distant traffic along the N25, local traffic movements, agricultural activity, and other anthropogenic noise sources typical of rural and semi-rural areas and in turn the study area under consideration. A full and detailed baseline noise survey will be undertaken in accordance with the TII Noise Guidelines at EIAR stage to characterise the existing noise environment associated with the emerging preferred route.

¹² Environmental Protection Agency (EPA) - Noise Round 3 Road – Lden [Online Maps] Available from gis.epa.ie/EPAMaps/ [Accessed 12 June 2020]

2.3.4. Key Findings

In all cases the PIR is lower in all proposed routes when compared to the existing Do-Nothing alignment. The existing route has 78 no. NSLs that are calculated to have a traffic noise level above 60dB L_{den} , with no other route exceeding this quantity. The residual impact on the existing N25 has been accounted for when assessing the impact of each of the route options in the 'Do Something' scenario (see Table 2-5). All route options, with the exception of the Purple route, will divert traffic from the existing N25 resulting in moderate to major reductions in noise levels to existing properties along this existing route. All routes have moderate to major negative impacts along their respective route alignments in comparison to the existing route, with the exception of the Magenta route, which has no negative impacts but fewer positive impacts than the other proposed routes. With the exception of the Purple route, there are a small number of properties that require mitigation on each route.

2.3.4.1. Purple

The Purple route is the least preferred of the proposed routes as it results in the least amount of traffic diversion off the existing route. While it has the lowest PIR, it has the highest number of properties likely to experience a moderate to major negative change in noise levels compared to other routes, with no likely significant reduction in noise levels calculated at existing properties. Overall, the Purple route is determined to have a moderately negative impact.

2.3.4.2. Navy

The Navy route is considered of intermediate preference as it is determined to result in a minor negative impact, with a PIR of 247. The 60dB L_{den} traffic noise level is exceeded at 22no. NSLs along this route and mitigation is likely required at 2no. properties. The route diverts traffic from the existing route and introduces road traffic noise (RTN) as the dominant noise source in rural areas to west of the route. Nonetheless this route has the second smallest number of properties likely to experience a major negative change in noise levels, second only to the Magenta route. There is a comparable noise environment for properties to the east of the route, which were previously affected by N25 on their front facades, now relocated to the rear facades, at a greater distance. Earthworks provide screening at rear of properties along the route. This route option results in a lower number of properties likely to experience a moderate to major positive change (reduction) in traffic noise levels when compared against the Teal, Red or Lime Green routes and has a higher PIR compared to the Teal and Red routes.

2.3.4.3. Magenta

The Magenta route is considered of intermediate preference as it is determined to result in a minor negative impact, with a PIR of 360. The 60dB L_{den} traffic noise level is exceeded at 59no. NSLs along this route and mitigation is likely required at 13no. properties. This route has the highest PIR compared to the other options due to its close alignment to the existing N25. The existing noise environment at properties along sections 7, 9 and 10 (from transport model) of the existing N25 will, however, be improved (reduced) due to the realignment of the existing route away from NSL's. Similar to Navy route, the PIR is higher than Teal, Red and Lime Green routes. The number of properties likely to experience a moderate to major positive change (reduction) in traffic noise levels is, however, lower compared to the above-mentioned routes. This route is ranked higher in preference than the Navy route as it has no negative impacts unlike the Navy route which introduces RTN as dominant source to some rural areas along proposed route.

2.3.4.4. Red

The Red route is considered of intermediate preference as it is determined to result in a minor negative impact. It is the furthest eastern route in the study area and passes through a rural environment with clusters of properties, giving it a higher PIR than the proposed Teal route, also to the east of the existing route. It has a PIR of 155. The 60dB L_{den} traffic noise level is exceeded at 29no. NSLs along this route and mitigation is required at 18no. properties, the highest value along all routes. Earthworks provide screening to NSLs to the northern section of the corridor. The number of properties likely to experience a major positive change in noise levels is, however, highest along this route compared to the other route options (172no.) with Teal route second highest at 141no. NSLs. This route is ranked below Navy due to the number of mitigation clusters required. The Teal route has lower PIR with less mitigation and comparable positive impacts calculated overall.

2.3.4.5. Teal

The Teal route is considered minor negative and is the preferred route. This is determined on the basis of that it has no properties within the 0-50m PIR band, has the lowest number of NSLs exceeding the design goal of

60dB L_{den} , it has the second highest number of properties likely to experience a major positive change in noise levels when compared to all other routes (Red highest) with at least 100 more NSLs experiencing a reduction in traffic noise levels compared to other routes. Mitigation is required for 6no. NSLs towards southern end of route. This route has a lower PIR than Lime Green route. Earthworks provide beneficial screening at northern section of the route near cluster of properties.

2.3.4.6. Lime Green

The Lime Green route is considered of intermediate preference as it has a minor negative impact. The corridor passes through a rural noise environment with a higher PIR than all other proposed routes with the exception of the Magenta route. This route has a comparable number of properties likely to experience a moderate to major positive change in traffic noise to the Navy route due to extensive diversion of traffic off the existing N25. Increase in traffic noise will be experienced in this rural environment but due to earthworks screening many clusters of properties experience a likely lower moderate to major increase in noise levels compared to the Teal route. The Teal route, however, has significantly more NSLs that experience a moderate to major reduction in traffic noise levels along the existing N25. Lime Green route has slightly more properties requiring mitigation in comparison to Teal and Navy routes.

2.3.5. Summary and Conclusions

The Stage 2 noise impact assessment has been conducted in accordance with the relevant TII noise guidance documents. The PIR assessment demonstrates the range of values for each of the route corridors under assessment. Based on a count of properties within 300m of each route, the assessment has determined that the Purple Route has lowest PIR value. The Magenta route has the highest PIR with a high proportion of receivers along this route corridor in the vicinity of the existing N25 alignment.

Taking account of indicative noise levels associated with the future traffic flow along each route corridor option, the number of properties that have the potential to require noise mitigation in accordance with the criteria set out in the TII guidelines for national road schemes has been calculated. All routes have a small number of properties that require mitigation, with the exception of the Purple route.

The Teal route is the preferred route, as it has no properties within the 0-50m PIR band, lowest number of properties that exceed 60dB L_{den} and similar to the Red route it has the highest number of properties likely to experience a moderate to major positive reduction in traffic noise levels and with fewer properties requiring mitigation.

The Purple route is the least preferred route as it has the highest number of properties that exceed 60dB L_{den} and the least number of properties likely to experience moderate to major reductions in traffic noise levels.

The remaining proposed options have been determined to have a minor negative impact and are of intermediate preference.

Taking into account all of the above considerations, the matrix scoring for each of the route corridors is summarised in Table 2-5.

Table 2-5 - Summary of Scoring Assessment for each Route Corridor Option

Assessment Criteria	Purple Route	Navy Route	Magenta Route	Red Route	Teal Route	Lime Green Route
Potential Impact Rating (PIR)	98	247	360	155	107	299
No. of properties likely above 60dB L _{den}	51	22	59	29	13	24
No. of Properties likely to experience a Moderate Negative Impact	39	38	0	13	39	30
No. of Properties likely to experience a Major Negative Impact	53	1	0	33	29	13
No. of Properties likely to experience a Moderate Positive Impact	0	37	11	38	55	51
No. of Properties likely to experience a Major Positive Impact	0	25	2	172	141	24
No. of properties likely to require noise mitigation	0	2	13	18	6	8
Score description	Moderately negative	Minor or slightly negative	Minor or slightly negative	Minor or slightly negative	Minor or slightly negative	Minor or slightly negative
Score	2	3	3	3	3	3

2.4. Landscape and Visual

2.4.1. Introduction

The Landscape and Visual Assessment has been prepared by Eamonn Byrne Landscape Architects (EBLA). Landscape impact may be defined as changes in the physical landscape, which may give rise to changes in its character and how it is experienced. Visual impact comprises the change in the composition of available views from dwellings and public areas resulting from the proposals. The section provides a summary of the detailed Landscape and Visual Assessment which is included as Appendix 2.4.

2.4.2. Method of Assessment

TII are currently developing a set of guidelines with regard to landscape and visual impact assessment. In the absence of final published guidelines, landscape and visual impact assessments were carried out based on methods described in the following publications:

- Landscape Institute and Institute of Environmental Management and Assessment (2013). *Guidelines for Landscape and Visual Impact Assessment*, 3rd Edition, Oxon: Routledge;
- Department for Transport (UK). *TAG (Transport Analysis Guidance) Unit A3, Environmental Impact Appraisal*;
- Highways England (2020). *LA107 Landscape and Visual Effects (formerly DMRB Volume 11 Section 3 Part 5 Landscape Effects and IAN 135/10)*, Revision 2;
- Environmental Protection Agency (EPA) (2017). *Draft Guidelines on the information to be contained in Environmental Impact Assessment Report*; and
- Transport Infrastructure Ireland (2016). *Project Appraisal Guidelines for National Roads Unit 7.0- Multi Criteria Analysis*.

Detailed methodologies are included within Appendix 2.4.

2.4.3. Key Findings

This section summarises the effects of the proposed development on landscape and visual receptors, and the significance of the effects identified.

2.4.3.1. Comparison of Route Options

Landscape Effects

The assessment of landscape impact is based on the division of character areas derived from the county landscape character assessment. The effect of each route option on the individual landscape character area is considered in the context of local landscape sensitivity to derive an overall impact score for the proposals in accordance with the TAG criteria that are set out in Appendix 2.4. The eight-point scale used to judge is Slight, Moderate or Large Beneficial or Adverse, Very Large Adverse plus Neutral as set out in TAG.

The overall impact score of the route options on landscape character areas within the study area are summarised in the following table.

Table 2-6 - Summary of Landscape Effect

Route Option	Summary
Purple	<p>Landscape Character Area E: South Eastern Uplands</p> <ul style="list-style-type: none"> • The proposed route travels through greenfield land for circa. 7.1km through this character area. • Horizontal alignment of carriageways travels in close proximity to narrow stream valleys west of Glenmore. The straight alignment at odds with the pattern of these valleys. Some field pattern severance. • Vertical alignment cutting and embankment slopes would lead some disruption to existing landform. • The route travels in close proximity to the lower slopes and wooded vegetation of the system of narrow stream valleys north and west of Glenmore (travels close to this intimate valley system especially at Mullennahone).

- Significant adverse effects on landscape character of this valley system.
- From south of Ardbeg towards Grogan and Nicholastown the route travels across/ sidelong on the steep side slopes of a locally prominent ridge of higher ground (a Principal Ridgeline, Refer to Figure 8.3 Landscape Sensitivities, Kilkenny County Development Plan). The side slopes are integral to the ridge and provide large scale views over the surrounding countryside. The side slopes of this ridge are visible from a wide surrounding area extending far to the west, and the route in this location may be widely visible.
- Will lead to adverse effects on the tranquillity of land and wooded stream valleys currently located to the west of the existing N25 road and other lands located far to the west of the existing N25.
- Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land.

Landscape Impact Significance: Large adverse (negative) effect

Landscape Character Area C: South Western Uplands

- The proposed route travels through greenfield land for circa. 4km through this character area.
- Long straight sections of route alignment are at odds with the curved landscape pattern. Some field pattern severance. Vertical alignment cutting and embankment slopes would lead to some limited disruption to existing landform.
- Immediately east of Ardbeg this route travels close to a prominent hill of high ground at Ballinclare. From south of Ardbeg towards Grogan and Nicholastown the route travels across/ sidelong on the steep side slopes of a locally prominent ridge of higher ground (a Principal Ridgeline, Refer to Figure 8.3 Landscape Sensitivities, Kilkenny County Development Plan). The side slopes are integral to the ridge and provide large scale views over the surrounding countryside. The side slopes of this ridge are visible from a wide surrounding area extending far to the west, and the route in this location may be widely visible. Significant adverse effects on side slopes of ridge of high ground from Ardbeg to Grogan and Nicholstown.
- Will lead to adverse effects on the tranquillity of land currently located to the west of the existing N25 road.
- Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land.

Landscape Impact Significance: Large adverse (negative) effect

Landscape Character Area C2: South Hills Transition Area, South

- The proposed route travels through greenfield land for circa. 400m through this character area.
- Route travels across/ sidelong on the steep side slopes of a locally prominent ridge of higher ground (a Principal Ridgeline, Refer to Figure 8.3 Landscape Sensitivities, Kilkenny County Development Plan). The side slopes are integral to the ridge and provide large scale views over the surrounding countryside. The side slopes of this ridge are visible from a wide surrounding area extending far to the west, and the route in this location may be widely visible.
- Loss of some areas of woodland, hedgerows and hedgerow trees.
- Will lead to adverse effects on the tranquillity of land currently located to the west of the existing N25 road.
- Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land.

Landscape Impact Significance: Moderate adverse (negative) effect.

Overall Landscape Impact Significance (all landscape character areas combined): Large adverse (negative) effect.

Navy	Landscape Character Area E: South Eastern Uplands
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- The proposed route travels for circa. 9.5km through this character area of which circa. 6.8km of carriageway will cross through greenfield land and circa. 2.6km online.
- Vertical alignment cutting and embankment slopes would lead to no significant disruption to existing landform. No significant areas of cut and fill except for one area of large fill between chainage; 5800 and 6280 (Max depth fill 14m). In general, the route follows existing contours/ levels very well.
- Follows the existing N25 road alignment south of Glenmore, thus avoiding effects on Glenmore and adjacent narrow stream valleys.
- From Ballinclare to south of Davidstown the route continues generally parallel to the existing N25 road corridor and travels along the lower side slopes of a ridge of high ground, avoiding the higher contours.
- Travels on higher contours of ridge of higher ground from Davidstown to Carriganurra, however vertical alignment follows existing contours well and cut and fill is generally not significant.
- Limited effects to no change on tranquillity. The route travels through areas already on/ adjacent to the existing N25 road corridor. The traffic on the existing N25 road already affects tranquillity.
- Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land.

Overall Landscape Impact Significance: Slight adverse (negative) effect

Magenta

Landscape Character Area E: South Eastern Uplands

- The proposed route travels for circa. 9.3km through this character area of which circa. 4.1km of carriageway will cross through greenfield land and circa. 5.2km online. Generally, the route follows the existing N25 alignment towards Ballyrownagh. Thus, avoiding effects on; Glenmore, narrow stream valleys and ridges of surrounding higher ground either side of the existing N25 Road.
- The route diverts west from the existing N25 towards Carriganurra. At Carriganurra the route travels close to a local rock outcrop (with cross on top) which is a prominent local landmark. With mitigation this landmark may be successfully integrated.
- Limited effects to no change on tranquillity. The route travels through areas already on/ adjacent to the existing N25 road corridor. The traffic on the existing N25 road already affects tranquillity.
- Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land.

Overall Landscape Impact Significance: Slight adverse (negative) effect

Red

Landscape Character Area E: South Eastern Uplands

- The proposed route travels for circa. 9.0km through this character area of which circa. 8.65km of carriageway will cross through greenfield land. Most of the route within this character area travels in lands to the east of the existing N25 Road (up to 2.8km distance to the east of the existing N25 Road in places). Horizontal alignment of carriageways would be in keeping with existing route patterns. However vertical alignment cutting, and embankment slopes would disrupt existing landform. In particular; where the route travels up a steep hillside and over a stream valley from Craiguenaikil to Carrickcloney, there would be significant adverse effects on the landscape character from fill embankments within this sloping land which also connects visually with the River Barrow valley.
- Where the route cuts through the side of a ridge of high ground at Aylwardstown and south to Rathinure, there would be significant adverse effects on this ridge of high ground and to the character of the wider River Barrow valley landscape.
- Where the route travels through a local valley on embankments between Rathinure and Redgap and sidelong of a hill in a cutting at Redgap there is likely

to be significant adverse effects on the hill at Redgap and also on views through this local valley and on landscape character of the wider river Barrow valley.

- There would be adverse effects rural tranquillity as the route travels in existing tranquil land to the east of the existing N25 road and close to the River Barrow.
- Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land.

Overall Landscape Impact Significance: Large adverse (negative) effect

Teal	<p>Landscape Character Area E: South Eastern Uplands</p> <ul style="list-style-type: none"> • The proposed route travels for circa. 8.7km through this character area of which circa. 8.3km of carriageway will cross through greenfield land. Most of the route within this character area travels in lands to the east of the existing N25 Road (up to 1.8km distance to the east of the existing N25 Road in places). Horizontal alignment of carriageways would be in keeping with existing route patterns. However vertical alignment cutting, and embankment slopes would significantly disrupt existing landform. In particular; where the route travels up a steep hillside and over a stream valley from Craigenakil to Carrickcloney (in a combination of fill embankments and cutting) there would significant adverse effects on landscape character of this sloping land which connects with the River Barrow valley. • The route forms a large cutting though some the highest contours of a ridge of high ground at Aylwardstown and south to Rathinure: A Principal Ridgeline (Refer to Figure 8.3 Landscape Sensitivities, Kilkenny County Development Plan). There would be significant adverse effects on this ridge of high ground. • Travels through a local valley (mostly on fill embankments) between Rathinure and Redgap, which is visually connected with the River Barrow valley corridor and views from along this corridor. Thus, potential significant adverse effects on views through this valley and on the landscape character of the wider River Barrow valley. • From Ballyrownagh to Slieveroe roundabout the route (mostly on fill embankments) follows a local stream valley parallel to the existing N25. Following these areas of lower ground will help reduce potential wider visibility of this section of the route. However, it will affect the setting of this stream valley itself and associated wetland vegetation. • There would be adverse effects rural tranquillity as the route travels in existing tranquil land to the east of the existing N25 road. • Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land. <p><u>Overall Landscape Impact Significance: Large adverse (negative) effect</u></p>
Lime Green	<p>Landscape Character Area E: South Eastern Uplands</p> <ul style="list-style-type: none"> • The proposed route travels for circa. 8.9km through this character area of which circa. 6.8km of carriageway will cross through greenfield land and circa. 2km online. Most of the route within this character area travels in lands to the east of the existing N25 Road (up to 0.7km distance to the east of the existing N25 Road in places). 2.3km of the route travels to the west of the existing N25. • Horizontal alignment of carriageways would be in keeping with existing route patterns. Some field pattern severance. Vertical alignment cutting and embankment slopes would disrupt existing landform. The route follows the existing N25 alignment to south of Glenmore, thus, avoiding effects on Glenmore and adjacent narrow stream valleys. • From south of Glenmore, the route will cut though some of the highest contours of a ridge of high ground between Ballynamona and Aylwardstown and south to Gaulstown. Significant adverse effects on this ridge of high ground and the landscape character of this elevated area.

- Descends into local stream valley at Ballyrahan including an ecological sensitive area of land cover. Significant adverse effects on local stream valley at Ballyrahan.
- Crosses over the existing N25 towards Carriganurra. At Carriganurra the route goes through a local rock outcrop (with cross on top) which is a prominent local landmark. Significant adverse effects on this feature.
- Limited effects on tranquillity. The route travels through areas on/ near the existing N25 road corridor. The traffic on the existing N25 road already affects tranquillity. The most adverse effects will be experienced in the elevated lands furthest to the east from the existing N25 road (including Aylwardstown and Ballyhobuck).
- Loss of some areas of woodland, hedgerows and hedgerow trees and loss of agricultural land.

Overall Landscape Impact Significance: Moderate adverse (negative) effect

Visual Effects

The number of receptors (dwellings and community buildings) judged to have significant adverse effects according to each route option is summarised below.

Table 2-7 - Summary of Visual Effects: Number of receptors experiencing significant visual effects.

Route Option	The number of receptors judged to have significant adverse effects (i.e. those categorised between the range of Moderate to Very Large)
Purple	22
Navy	3
Magenta	27
Red	29
Teal	10
Lime Green	32

2.4.3.2. Summary and Conclusions

The following table summarises the overall landscape and visual scoring for the various route options according to the seven-point scale. The overall scoring is based on combining the significance of effect scores for landscape (elements/ landscape character) and visual receptors (dwellings and community buildings) and professional judgment.

Table 2-8 - Landscape and Visual Scoring

Route Option	Score	Description
Purple	1	Major Negative
Navy	3	Minor or slightly negative
Magenta	3	Minor or slightly negative
Red	1	Major negative
Teal	1	Major negative
Lime Green	1	Major negative

2.5. Flora and Fauna

2.5.1. Introduction

The Flora and Fauna section is an appraisal of the potential impacts of each of the proposed route corridors on ecological receptors of International, National, County and Local importance. This assessment is supplemented with the information contained with the technical data sheets and drawings that are contained within Appendix 2.5.

2.5.2. Method of Assessment

An appraisal of the potential ecological impacts of each proposed route corridor (600m) is discussed below. 600m corridors are the focus of the current phase of the route selection process. Ecological receptors considered at this point include: European designated sites (Special Areas of Conservation (SAC) and Special Protection Areas (SPA)); national sites (Natural Heritage Areas (NHA) and proposed NHAs (pNHA)); Ecologically Sensitive Areas (ESAs) of county, higher local and lower local value; and waterbodies. The drawings located in Appendix 2.5 display ecological receptors within the study area and interactions with proposed route corridors. Preliminary appraisals of potential impacts to birds and bats are also included.

The appraisal is primarily an exercise that involves a desktop review of all available resources and information in order to establish the baseline of the existing environment, identify key habitats and species, and determine the potential quantitative and qualitative impact on them.

The ecological appraisal of the six route options within the study area of the proposed scheme followed methodologies outlined in the following guidelines:

- National Roads Authority (2010). *2010 Project Management Guidelines*;
- Transport Infrastructure Ireland (2019). *Project Management Guidelines PE-PMG-02041*;
- National Roads Authority (2009). *Guidelines for Assessment of Ecological Impacts of National Roads Scheme*;
- Environmental Protection Agency (EPA) (2017). *Guidelines on the Information to be contained in Environmental Impact Assessment Reports*. (Draft, August 2017);
- CIEEM (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine*. (Version 1.1 - Updated September 2019); and
- CIEEM (2017). *Guidelines for Preliminary Ecological Appraisal*. 2nd Edition.

2.5.3. Key Findings

2.5.3.1. Purple

The Purple route is the longest route (11.6km) and is the most westerly of all proposed routes. As with all other routes, drainage is likely either to the River Barrow & River Nore SAC (002162) to the east (via the Glenmore River); or the Lower River Suir SAC (002137) to the south (via the Nicholastown/Lough Cullin/Smartcastle Stream) (drainage to be finalised at detailed design). The route would cross the Glenmore River or its tributaries at up to 3 no. locations. The Purple route differs in its interaction with the River Barrow & River Nore SAC to all other routes - as it swings to the north of Glenmore. It would cross a tributary of the Glenmore River in a small river valley in the townland of Ballybraghy. The SAC is also located within the route corridor to the west in Mullennahone as well as where the route intercepts the existing N25 to the northeast of Glenmore (at the roundabout built as part of the New Ross Bypass scheme). There are no direct impacts to SPAs or to Natural Heritage Areas.

The Purple route is the closest route to Lough Cullin pNHA located to the west. Depending upon final design, the Purple route could drain to Lough Cullin pNHA via the Nicholastown Stream. Lough Cullin is a site of importance to birds. Preliminary bird survey work suggests that there no field-feeding sites present along the Purple route that could result in indirect impacts upon bird populations of Lough Cullin. The Barrow River Estuary pNHA largely overlaps with the River Barrow & River Nore SAC.

The Purple route would impact upon 6 no. Ecologically Sensitive Areas (ESAs): 1 is of County Importance; 3 are of High Local importance; and 2 are of Low Local importance. ESA 1, Ballybrahy, is of County importance and includes an area of wet woodland (WN6); the potential for equivalence with the Annex I habitat - alluvial woodland 91A0 - is a consideration. ESA 4 and 19 are of higher local importance and comprise habitats including riparian woodland, wet woodland and wet grassland, of potential local importance to bird and mammal species. The

Purple route, being the longest, has the greatest potential for negative impacts on linear features such as hedgerows.

Based on expert judgement of a contracted bat-specialist, the Purple route poses the worst risk to bats and their potential roosting and feeding sites.

2.5.3.2. Navy

The Navy route is one of a number of routes which run more centrally through the study area with a length of 9.5km. It approaches Glenmore from the southeast and merges back onto the alignment of the existing N25 as it approaches Glenmore. Again, drainage is likely either to the River Barrow & River Nore SAC (002162) to the east (via the Glenmore River); or the Lower River Suir SAC (002137) to the south (via the Luffany Stream). There are no direct impacts to SPAs or to Natural Heritage Areas - the nearest such site is Lough Cullin pNHA located to the west and largely outside the study area. The proposed corridor would not drain to Lough Cullin pNHA. The Barrow River Estuary pNHA largely overlaps with the River Barrow & River Nore SAC.

The Navy route would not impact upon any ESAs of County Importance. It could potentially impact on 4 ESAs of High Local importance and 6 ESAs of Low Local importance. ESAs 10, 11, 12, 15 and 17 are likely to be directly impacted by this route given their spatial distribution within the corridor; direct interaction with the remaining ESAs is likely to be avoided. ESAs 11 and 17 are of higher local importance and comprise areas of scrub, broadleaved woodland, wet woodland and wet grassland which may also be of local importance to mammal species. The Navy route is 9.5km, with less potential for negative impacts on linear features such as hedgerows than the Purple route. Existing habitats provided by landscape planting along the N25 would, however, be lost.

Based on expert judgement of a contracted bat-specialist, the Navy route poses the joined-second worst risk to bats and their potential roosting sites, with the Magenta route.

2.5.3.3. Magenta

The Magenta route is one of a number of routes which run more centrally through the study area with a length of 9.3km. As with the Navy route, it approaches Glenmore from the southeast and merges back onto the alignment of the existing N25. Again, drainage is likely either to the River Barrow & River Nore SAC (002162) to the east (via the Glenmore River); or the Lower River Suir SAC (002137) to the south (the Luffany Stream). There are no direct impacts to SPAs or to NHAs - the nearest such site is Lough Cullin pNHA located to the west and largely outside the study area. The proposed corridor would not drain to Lough Cullin pNHA. The Barrow River Estuary pNHA largely overlaps with the River Barrow & River Nore SAC.

The Magenta route would not impact upon any ESAs of County Importance. It could potentially impact on 5 ESAs of High Local importance and 6 ESAs of Low Local importance. The only ESA where direct impacts would be unavoidable is ESA 11, which is of higher local importance and comprises scrub, broadleaved woodland, wet woodland and wet grassland which could be of local importance to mammal and field-feeding bird species. The Magenta Route impacts 3 of the same sites of high local importance to the Navy route; as well as 5 of the same sites of local importance. The Magenta route is 9.3km, with less potential for negative impacts on linear features such as hedgerows than the Purple route; similar to the Navy route. Existing habitats provided by landscape planting along the N25 would, however, be lost. Based on expert judgement of a contracted bat-specialist, the Magenta route poses the joined-second worst risk to bats and their potential roosting sites, with the Navy route.

2.5.3.4. Red

The Red route is the most easterly of the proposed routes; located closest to the valley of the River Barrow. It is 9.0km long. Drainage is likely either to the River Barrow & River Nore SAC (002162) to the east (via the Glenmore River); or the Lower River Suir SAC (002137) to the south (via the Luffany Stream). The corridor intersects the SAC at two points. The Red route merges onto the alignment of the existing N25 as it approaches the northern terminus from the south through Graiguenakill. At this point the route may utilise structures already built as part of the New Ross Bypass, avoiding additional impact to the SAC at the northern intersection. There are no direct impacts to SPAs or to Natural Heritage Areas - the nearest such site is Lough Cullin pNHA located to the west and largely outside the study area. The proposed corridor would not drain to Lough Cullin pNHA. Any impact to the Barrow River Estuary pNHA will be dependent upon the final design and the level of interaction with wetland habitats along the river at Graiguenakill following detailed design.

The Red route would not impact upon any ESAs of County Importance. It would impact on 2 ESAs of High Local importance and 4 ESAs of Low Local importance. ESA 3 comprises a tributary of the Glenmore River, and associated bankside scrub, over which a water crossing would be required. This ESA may be of local importance to mammal and aquatic species, while also being hydrologically connected to the SAC. The Red route is 9.0km, with less potential for negative impacts on linear features such as hedgerows than longer routes, such as Purple.

The Red route is located closest to the Barrow Estuary which supports important populations of roosting and feeding birds. Further surveys of the route would be required to determine if there is habitat that would be impacted that may be of importance to field-feeding birds associated with the Barrow Estuary.

Based on expert judgement of a contracted bat-specialist, the Red route poses least risk to bats and their potential roosting sites.

2.5.3.5. Teal

The Teal route is one of a number of routes which run more centrally through the study area with a length of 8.7km. Drainage is likely either to the River Barrow & River Nore SAC (002162) to the east (via the Glenmore River); or the Lower River Suir SAC (002137) to the south (via the Luffany Stream). The Teal route approaches Glenmore from the southeast (between the Navy / Magenta / Lime Green and the Red Route) crossing a tributary of the Glenmore River before re-joining the existing N25. There are no direct impacts to SPAs or to Natural Heritage Areas - the nearest such site is Lough Cullin pNHA located to the west and largely outside the study area. The proposed corridor would not drain to Lough Cullin pNHA. Any impact to the Barrow River Estuary pNHA will be dependent upon further design and the level of interaction with wetland habitats along the river at Graiguenakill.

The Teal route would not impact upon any ESAs of County Importance. It would impact on 2 ESAs of High Local importance (same two as the Red option) and 4 ESAs of Low Local importance (same four as the Red option); though the Teal route is likely to intersect more of these than the Red route. ESA 3 comprises a tributary of the Glenmore River, and associated bankside scrub, over which a water crossing would be required. This ESA may be of local importance to mammal and aquatic species, while also being hydrologically connected to the SAC. ESA 16 comprises broadleaved and wet woodland, wet grassland and scrub, which may be of local importance to mammals and field-feeding birds. The Teal route is 8.7km, with less potential for negative impacts on linear features such as hedgerows than longer routes, such as Purple. As noted, the Teal route merges back onto the alignment of the existing N25 as it approaches the northern terminus. Thus, existing habitats provided by landscape planting along the N25 would be lost.

Based on expert judgement of a contracted bat-specialist, the Teal route poses the second least risk to bats and their potential roosting sites.

2.5.3.6. Lime Green

The Lime Green route runs centrally through the study area with a length of 8.9km. Again, drainage is likely either to the River Barrow & River Nore SAC (002162) to the east (via the Glenmore River); or the Lower River Suir SAC (002137) to the south (via the Luffany Stream). As with the Navy and Magenta routes, the Lime Green route approaches Glenmore from the southeast, merging with the alignment of the existing N25. There are no direct impacts to SPAs or Natural Heritage Areas - the nearest such site is Lough Cullin pNHA located to the west and largely outside the study area. The proposed corridor would not drain to Lough Cullin pNHA. Any impact to the Barrow River Estuary pNHA will be dependent upon further design and the level of interaction with wetland habitats along the river at Graiguenakill.

The Lime Green route would not impact upon any ESAs of County Importance. It would impact on 5 ESAs of High Local importance and 2 ESAs of Low Local importance, all of which are shared with the Magenta Route. The Lime Green route is 8.9km, with less potential for negative impacts on linear features such as hedgerows than longer routes, such as Purple. As noted, the Lime Green route merges back onto the alignment of the existing N25 as it approaches the northern terminus. Thus, existing habitats provided by landscape planting along the N25 would be lost.

Based on expert judgement of a contracted bat-specialist, the Lime Green route ranked in the middle in terms of risk to bats and their potential roosting sites.

Summary and Conclusions

Each route corridor potentially directly impacts upon the River Barrow and River Nore SAC, with drainage also possible to the Lower River Suir SAC (via hydrological connections). However, based on the appraisal of potential impacts of each route corridor on known ecological receptors, at this phase of the assessment the Purple route would pose the highest impact on receptors of International, National and Local importance. In the absence of further surveys, it appears that the Lime Green route would be the preferred route option from an ecological perspective. It is important to note that there are 2 sites of importance for birds in the vicinity of the study area – Lough Cullin and the Barrow Estuary. Both are outside the study area. While the Purple route is the closest to Lough Cullin and the Red route is closest to the Barrow Estuary, preliminary bird survey work found no evidence

of significant field-feeding birds associated with these routes. Further surveys will highlight the potential impact of routes on watercourses, birds, bats and mammals.

Table 2-9 – Flora and Fauna Scoring

Route Option	Score	Description
Purple	1	Major Negative
Navy	1	Major Negative
Magenta	1	Major Negative
Red	1	Major Negative
Teal	1	Major Negative
Lime Green	1	Major Negative

2.6. Waste

2.6.1. Introduction

The waste assessment has been undertaken by Atkins. Road schemes have the potential to produce significant amounts of waste where a cut/fill balance cannot be achieved. Disposal of this material can have adverse effects on the environment in terms of transport of material to/from site causing increased vehicle trip with increased air pollution, noise levels along existing roads and also issues with regard to disposal to licensed sites.

Waste is a significant criterion in route selection for the reasons outlined above. This assessment therefore aims to provide a comparative appraisal of each of the six proposed routes with respect to a number of quantitative waste related measures, in identifying the most favourable route.

2.6.2. Method of Assessment

For the purposes of Multi Criteria Analysis (MCA), guidance contained within PE-PAG-02031 (TII: Project Appraisal Guidelines for National Roads Unit 7.0 – MCA) has been used.

For the purposes of MCA three quantitative statements need to be provided, two with reference to the quantities of material to be disposed of off-site (suitable and unsuitable material (U1 and U2) as defined within TII Publication CC-SPW-00600 Specification for Road Works Series 600 Clause 601) and whether any contaminated land/hazardous material is being left in situ.

It should be noted that a detailed appraisal of the acceptability of material for onsite reuse will be undertaken at the Phase 3 Design stage following the completion of a detailed Ground Investigation along the emerging preferred route corridor.

2.6.3. Key Findings

There will be a requirement for significant volumes of unsuitable material disposed of off-site, for some route options more than others. Estimated material quantities are summarised in the following table.

Table 2-10 - Route comparison: Quantitative waste measures.

Route Option	Estimated Excavation & Disposal of Surplus Suitable and Unacceptable Material (U1) (m ³)	Estimated Excavation & Disposal of Hazardous Unacceptable Material (U2) (m ³)	Total Material (m ³)
Purple	312,029	16,423	328,452
Navy	140,604	7,400	148,004
Magenta	95,077	5,004	100,081
Red	488,362	25,703	514,065
Teal	712,095	37,479	749,574
Lime Green	227,502	11,974	239,476

Please note that no quantities of Class U2 material are known of at this stage, therefore the above is assumed to be 5% of overall ‘unsuitable material’ anticipated along each route. Class U1 values are based on a detailed desk study review, a windscreen survey comprising visual inspection as well as being estimated as a common percentage of the overall excavated volume. Areas of contaminated land have not been identified at this stage so the quantitative value of zero is assigned to all options.

2.6.4. Summary and Conclusions

A review of the quantities of material to be disposed of off-site has identified the Magenta and Navy Routes as the Preferred and highest scoring. The Lime Green and Purple have been identified as intermediate with the Red and Teal options as the Least Preferred.

Table 2-11 – Waste Scoring

Route Option	Score	Description
Purple	2	Moderately negative
Navy	3	Minor or slightly negative
Magenta	3	Minor or slightly negative
Red	1	Major negative
Teal	1	Major negative
Lime Green	2	Moderately negative

2.7. Soils and Geology

2.7.1. Introduction

This assessment has been undertaken by Atkins and is an appraisal of the route corridors in terms of the underlying soils and geology. This section provides a summary of a more detailed assessment which is contained within Appendix 2.7.

2.7.2. Method of Assessment

This assessment has been carried out in accordance with the 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (National Roads Authority (NRA), 2009).

This desk-based assessment has been prepared following a detailed review of available data sources including;

- GSI Datasets Public Viewer and Groundwater web-mapping, 2020 (GSI, 2020);
- Environmental Protection Agency (EPA) Envision mapping, 2020 (EPA, 2020);
- Ordnance Survey Ireland (OSI) web-mapping 2020 (OSI, 2020); and
- All available information for the site (including topographic surveys, and preliminary engineering information).

Consultation was undertaken with Kilkenny County Council (KCC) with regards to groundwater supplies, active quarries, and any unauthorised / unregulated landfills within the general vicinity of the scheme. Throughout the Route Option Selection process, regular liaison and consultation was undertaken between the engineering design team and the geologist within the environmental team.

The findings of the initial desk-based review were further supplemented by non-intrusive surveys. Relevant assessment criteria for the rating of potential environmental impacts on the soils and geology environment are presented in Appendix 2.7.

2.7.3. Key Findings

2.7.3.1. Purple

The purple route corridor is underlain by quaternary sediments, predominantly till derived from Lower Palaeozoic shales, with small sections of alluvium, lacustrine sediments and, locally within the south till derived from Devonian sandstones. Bedrock is mapped outcropping throughout the route corridor.

Bedrock below the route corridor consists of green and red-purple buff slate and siltstone of the Oaklands formation in the north and travelling south it moves through sections of green and grey slate with thin siltstone of Ballylane formation, red- brown conglomerate and sandstone of Carrigmaclea formation and yellow and red sandstone and green mudstone of the Kiltorcan Formation.

Three isolated pockets of alluvium are intersected by the route in the north which could give rise to potential soft ground requiring excavation. The route terminates in the south within an area of Lacustrine sediments which may also contain soft, compressible sediments. Additional potential soft ground areas have also been identified from a review of historical OS maps.

The following features have not been identified within or in close proximity to the 'Purple' route:

- Geological Heritage Sites;
- Landfills;
- Extractive Industrial Sites;
- Pits or Mines;
- Mineral Localities;
- Major Areas of Peat;
- Urban Wastewater Treatment Plants; and
- Karst Features.

One potential historical backfilled quarry has been identified approximately 37m from the centreline of the alignment along the north of the route as presented in Appendix 2.7. The susceptibility to landslides for majority of the route option is classified as “Low

Appropriate environmental management and checks, in addition to annual audits, should therefore be in place, although this site is unlikely to be a significant source of contamination

2.7.3.2. Navy

The navy route corridor is underlain by quaternary sediments, predominantly till derived from Lower Palaeozoic shales, with small sections of alluvium, lacustrine sediments and till derived from cherts.

Bedrock is mapped outcropping throughout the route corridor, particularly in the north and south. Bedrock below the route corridor consists of green and red-purple buff slate and siltstone of the Oaklands formation towards the north. It also intersects sections of green and grey slate with thin siltstone of Ballylane formation and red- brown conglomerate & sandstone of Carrigmaclea formation.

The route intersects a linear deposit of alluvium along the centre of the route along with 3no. localised deposits within the north and mid-section of the route which could give rise to potential soft ground requiring excavation. The route terminates in the south within an area of Lacustrine sediments which may also contain soft, compressible sediments. (GSI, 2020).

A geotechnical ground investigation was carried out in this area by Glover Site Investigations during 2012 and identified a general thickness of overburden across the site ranging from 0.1m bgl (BH121R) to 18.94m bgl in BH136R. A localised area of lacustrine deposits is within the southwest of the study area, which may be characterised by weak sediment with low permeability.

The following features have not been identified within or in close proximity to the ‘Navy’ route corridor:

- Geological Heritage Sites;
- Landfills;
- Extractive Industrial Site;
- Major Areas of Peat;
- Karst Features; and
- Urban Wastewater Treatment Plants.

An unnamed historic quarry was noted approximately 50m to the west of the navy route corridor and a historic pit (dated early to mid-20th century) is noted within this route corridor.

A mineral locality is noted approximately 50m west of the route corridor. The key mineral is slate, and the mineral location reference is 5,033.00 as presented in Appendix 2.7. The susceptibility to landslides for majority of the route option is classified as “Low”.

Appropriate environmental management and checks, in addition to annual audits, should therefore be in place, although this site is unlikely to be a significant source of contamination.

2.7.3.3. Magenta

The magenta route corridor is predominantly underlain by quaternary sediments, predominantly till derived from Lower Palaeozoic shales, with small sections of alluvium, lacustrine sediments and till derived from cherts. Bedrock is mapped outcropping throughout the route corridor.

Bedrock below the route corridor consists of green and red-purple buff slate and siltstone of the Oaklands formation within the north and mid-section of the route, and green and grey slate with thin siltstone of Ballylane formation along the centre and southern section. The route locally intersects the red- brown conglomerate & sandstone of the Carrigmaclea formation in the south.

The route intersects a linear deposit of alluvium in the central Glenmore region along with 3no. localised deposits in the north and south which could give rise to potential soft ground requiring excavation. The route terminates in the south within an area of Lacustrine sediments which may also contain soft, compressible sediments. Additional potential soft ground areas have also been identified from a review of historical OS maps.

The following features have not been identified within or in close proximity to the ‘Magenta’ route corridor:

- Geological Heritage Sites;
- Landfills; Backfilled Quarries;
- Extractive Industrial Site;

- Quarries or Mines;
- Major Areas of Peat;
- Urban Wastewater Treatment Plants; and
- Karst Features.

A historic pit (dated early to mid-20th century) is noted within this route corridor as presented in Figure 3.5.

A mineral locality is noted approximately 200m west of the route corridor. The key mineral is slate, and the mineral location reference is 5,033.00 as presented in Appendix 2.7.

Three potential historical backfilled quarries have been identified within 65m of the centreline of the route along the north and mid-section of the route as presented in Appendix 2.7. The susceptibility to landslides for the majority of the route option is classified as “Low”.

Appropriate environmental management and checks, in addition to annual audits, should therefore be in place; although this site is unlikely to be a significant source of contamination.

2.7.3.4. Red

The red route corridor is predominately underlain by quaternary sediments, predominantly till derived from Lower Palaeozoic shales, with small sections of alluvium, and lacustrine sediments.

Bedrock is also mapped to be outcropping regularly throughout sections of route corridor. Bedrock below the route corridor consists of green and red-purple buff slate and siltstone of the Oaklands formation within the north, and predominantly green and grey slate with thin siltstone of Ballylane formation along the north, centre and south of the route. The route locally intersects the red- brown conglomerate & sandstone of the Carrigmaclea formation in the south.

Four isolated pockets of alluvium are intersected by this route. 2no in the central region and 2no. in the north which could give rise to potential soft ground requiring excavation. The route terminates in the south within an area of Lacustrine sediments which may also contain soft, compressible sediments. Additional potential soft ground areas have also been identified from a review of historical OS maps.

The following features have not been identified within or, in close proximity to the ‘Red’ route corridor:

- Geological Heritage Sites;
- Landfills;
- Backfilled Quarries;
- Mineral Localities;
- Extractive Industrial Site;
- Pits; Quarries or Mines;
- Major Areas of Peat;
- Urban Wastewater Treatment Plants; and
- Karst Features.

The susceptibility to landslides for majority of the route option is classified as “Low”.

Appropriate environmental management and checks, in addition to annual audits, should therefore be in place although, this site is unlikely to be a significant source of contamination.

2.7.3.5. Teal

The teal route corridor is predominately underlain by quaternary sediments, predominantly till derived from Lower Palaeozoic shales, with small sections of alluvium, lacustrine sediments and till derived from cherts. Bedrock is mapped outcropping throughout the route corridor.

Bedrock below the route corridor consists of green and red-purple buff slate and siltstone of the Oaklands formation at 2no. locations in the north, and predominantly green and grey slate with thin siltstone of Ballylane formation along the north, centre and south of the route. The route locally intersects the red- brown conglomerate & sandstone of the Carrigmaclea formation in the south.

Four isolated pockets of alluvium are intersected by the route, 1no. in the southern region, 2no. in the central region and 1no. in the north which could give rise to potential soft ground requiring excavation. The route terminates in the south within an area of Lacustrine sediments which may also contain soft, compressible sediments.

The following features have not been identified within or in close proximity to the 'Teal' route corridor:

- Geological Heritage Sites;
- Landfills;
- Backfilled Quarries;
- Extractive Industrial Site;
- Pits; Quarries or Mines;
- Mineral Localities;
- Major Areas of Peat;
- Urban Wastewater Treatment Plants; and
- Karst Features.

One potential historical backfilled quarry has been identified within 70m of the centreline of the alignment within the north as presented in Appendix 2.7.

The susceptibility to landslides for majority of the route option is classified as "Low".

Appropriate environmental management and checks, in addition to annual audits, should therefore be in place although this site is unlikely to be a significant source of contamination.

2.7.3.6. Lime Green

The lime green route corridor is predominately underlain by quaternary sediments, predominantly till derived from Lower Palaeozoic shales, with small sections of alluvium and lacustrine sediments.

Bedrock is mapped outcropping regularly particularly in the north and south of the route corridor.

Bedrock below the route corridor consists of green and red-purple buff slate and siltstone of the Oaklands formation in the north, and predominantly green and grey slate with thin siltstone of Ballylane formation along the north, centre and south of the route. The route also intersects the red- brown conglomerate & sandstone of the Carrigmaclea formation at 2no. locations in the south.

Two isolated pockets of alluvium are intersected by the route in the north which could give rise to potential soft ground requiring excavation. The route terminates in the south within an area of Lacustrine sediments which may also contain soft, compressible sediments. Additional potential soft ground areas have also been identified from a review of historical OS maps.

Several datasets have been examined and the following features have not been identified within or in close proximity to the 'Lime Green' route corridor:

- Geological Heritage Sites;
- Landfills;
- Backfilled Quarries;
- Extractive Industrial Site;
- Quarries or Mines;
- Mineral Localities;
- Major Areas of Peat;
- Urban Wastewater Treatment Plants; and
- Karst Features.

A historic pit (dated early to mid-20th century) is noted within this route corridor. One potential historical backfilled pit has been identified within 20m of the centreline of the alignment within the north.

The susceptibility to landslides for the majority of the route option is classified as "Low".

Appropriate environmental management and checks, in addition to annual audits, should therefore be in place, although this site is unlikely to be a significant source of contamination.

2.7.4. Summary and Conclusions

All six routes have been evaluated for the key soil / geological attributes, specifically condition of existing soils and potential sources of contamination. Based on this impact assessment the overall ranking or preference for each route has been determined, with respect to Soils and Geology.

The majority of each route is underlain by glacial till, with localised occurrences of sands and gravels, alluvium, made ground and lacustrine deposits. Bedrock underlying all route option comprises green, red-purple, buff slate, siltstone of the Oaklands Formation, green and grey slate with thin siltstone from the Ballylane Formation, red, brown conglomerate & sandstone of Carrigmaclea Formation and Dolerite and Rhyolitic volcanics, grey & brown slates of Campile formation. No evidence of any karst features was identified during the desk-based review or preliminary ground investigation. No Geological Heritage Areas are identified within the study area of each of the route options.

All 6no. route options will involve excavation or cut into existing alluvium and lacustrine deposits, the lateral and extent of which has not been defined. The impact levels for each route option is presented in the following table:

Table 2-12 – Summary of Soil and Geology Impacts

Impact Level	Navy Route	Teal Route	Purple Route	Magenta Route	Red Route	Lime Green Route
Severe Negative	0	0	0	0	0	0
Major Negative	1	0	0	1	0	1
Moderate Negative	4	2	3	5	2	3
Minor Negative	2	4	2	2	3	3
Neutral	0	0	1	0	0	0
Minor Positive	0	0	0	0	0	0
Moderate Positive	0	0	0	0	0	0
Major Positive	0	0	0	0	0	0

The Red, Teal and Purple Routes have been identified as the lowest impacting routes with the Lime Green and Navy options performing better than Magenta. The Magenta route is the lowest scoring as datasets identified for the route as having a medium proportion of its route “high” landslip susceptibility classification.

Table 2-13 – Soils and Geology Scoring

Route Option	Score	Description
Purple	3	Minor or slightly negative
Navy	2	Major or highly negative
Magenta	1	Major or highly negative
Red	3	Minor or slightly positive
Teal	3	Not significant or neutral
Lime Green	2	Moderately negative

2.8. Hydrology

2.8.1. Introduction

The hydrology assessment has been conducted by Atkins. The objective of this assessment is to assess and evaluate the potential impacts of each route option on the hydrological aspects of the receiving environment, and to identify the preferred route in terms of these considerations. The section provides a summary of more detailed assessment that is contained within Appendix 2.8.

2.8.2. Method of Assessment

This assessment has been conducted in accordance with relevant best practice guidance, 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (National Roads Authority (NRA), 2008). The criteria for estimating the importance of hydrological importance includes surface water quality, drainage and flooding.

Relevant background information was compiled from a number of sources including the following:

- Environmental Protection Agency (EPA) Envision mapping, 2020 (EPA, 2020);
- Ordnance Survey Ireland (OSI) web-mapping 2020 (OSI, 2020);
- Water Framework Directive (WFD) Ireland web-mapping (OPW, 2020);
- National Parks and Wildlife Service (NPWS) Map viewer 2020 (NPWS, 2020); and,
- All available information for the site (including topographic surveys, review of site-specific records (GSIL, 2012) and preliminary engineering information)

2.8.3. Key Findings

2.8.3.1. Purple

This route has the potential to directly impact current surface water quality at the Oakland River and its tributaries. It therefore has the potential to directly impact the following internationally protected / ecologically sensitive sites (NPWS, 2020):

- River Barrow and River Nore SAC (route corridor intersected at the northern extent); and
- Barrow River Estuary pNHA (intersected at the northern extent of this route);

This route also has the potential (via identified hydrological linkages) to indirectly impact the current surface water quality at the following ecologically sensitive site (NPWS, 2020);

- Waterford Harbour Shellfish Area (Cheekpoint/Arthurstown/Creadan) which is hydrologically connected through the Oakland River and River Barrow; and
- Lower River Suir SAC (Catchment link).

2.8.3.2. Navy

This route has the potential to directly impact current surface water quality at the Oakland River and its tributaries and the Luffany River. It has the potential to directly impact the following internationally protected / ecologically sensitive sites (NPWS, 2020):

- River Barrow and River Nore SAC (intersected at the northern extent of this route corridor); and
- Barrow River Estuary pNHA (intersected at the northern extent of this route).

This route also has the potential (via identified hydrological linkages) to indirectly impact the current surface water quality at the following internationally protected / ecologically sensitive sites (NPWS, 2020);

- Lower River Suir SAC which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir; and
- Waterford Harbour Shellfish Area (Cheekpoint/Arthurstown/Creadan) which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir.

2.8.3.3. Magenta

This route has the potential to directly impact current surface water quality at the Oakland River and its tributaries and Luffany River: It has the potential to directly impact the following internationally protected / ecologically sensitive sites (NPWS, 2020):

- River Barrow and River Nore SAC (intersected at the northern extent of this route corridor);
- Barrow River Estuary pNHA (intersected at the northern extent of this route); and
- Lower River Suir SAC which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir.

This route also has the potential (via identified hydrological linkages) to indirectly impact the current surface water quality at the following ecologically sensitive site (NPWS, 2020);

- Waterford Harbour Shellfish Area (Cheekpoint/Arthurstown/Creadan) which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir.

2.8.3.4. Red

This route has the potential to directly impact current surface water quality at the Oakland River and its tributaries and Luffany River: It has the potential to directly impact the following internationally protected / ecologically sensitive sites (NPWS, 2020):

- River Barrow and River Nore SAC (intersected at the northern extent of this route corridor);
- Barrow River Estuary pNHA (intersected at the northern extent of this route); and
- Lower River Suir SAC which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir.

This route also has the potential (via identified hydrological linkages) to indirectly impact the current surface water quality at the following ecologically sensitive site (NPWS, 2020);

- Waterford Harbour Shellfish Area (Cheekpoint/Arthurstown/Creadan) which is hydrologically connected through the Oakland River, River Barrow, River Luffany.

2.8.3.5. Teal

This route has the potential to directly impact current surface water quality at the Oakland River and its tributaries and Luffany River. It has the potential to directly impact the following internationally protected / ecologically sensitive sites (NPWS, 2020):

- River Barrow and River Nore SAC (intersected at the northern extent of this route corridor);
- Barrow River Estuary pNHA (intersected at the northern extent of this route); and
- Lower River Suir SAC which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir.

This route also has the potential (via identified hydrological linkages) to indirectly impact the current surface water quality at the following ecologically sensitive site (NPWS, 2020);

- Waterford Harbour Shellfish Area (Cheekpoint/Arthurstown/Creadan) which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir

2.8.3.6. Lime Green

This route has the potential to directly impact current surface water quality at the Oakland River and its tributaries and Luffany River: It has the potential to directly impact the following internationally protected / ecologically sensitive sites (NPWS, 2020):

- River Barrow and River Nore SAC (intersected at the northern extent of this route corridor);
- Barrow River Estuary pNHA (intersected at the northern extent of this route); and
- Lower River Suir SAC which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir.

This route also has the potential (via identified hydrological linkages) to indirectly impact the current surface water quality at the following ecologically sensitive site (NPWS, 2020);

- Waterford Harbour Shellfish Area (Cheekpoint/Arthurstown/Creadan) which is hydrologically connected through the Oakland River, River Barrow, River Luffany and River Suir.

2.8.4. Summary and Conclusions

A Hydrology (and Hydrogeology) Appraisal of six route options has been undertaken by Atkins and is located in Appendix 2.8. The key findings of the hydrological assessment, which has been undertaken in accordance with relevant best practice guidance (NRA, 2009; IGI, 2013; EPA, 2017) are outlined below.

No significant adverse (i.e. major negative), or profound adverse (i.e. severe negative) hydrological or hydrogeological impacts have been identified associated with any of the 6no. routes assessed.

While all six routes are broadly comparable in terms of impact levels, the Purple Route does not directly impact the surface water quality of Lower River Suir SAC (or tributaries) but could potentially have a temporary direct impact to surface water quality at River Barrow and River Nore SAC (albeit any impacts would be minor).

The Navy Route, Lime-Green Route, Teal Route, Magenta Route and Red Route are identified as 'intermediate' and ranked 2nd, 3rd, 4th and 5th in order of preference. This is primarily based on the fact that all 5no. routes could potentially impact surface water quality at River Barrow and River Nore SAC, Lower River Suir SAC, Barrow River Estuary pNHA, Waterford Harbour Shellfish Area to varying degrees.

Table 2-14 – Hydrology Scoring

Route Option	Score	Description
Purple	4	Not significant or neutral
Navy	3	Minor or slightly negative
Magenta	3	Minor or slightly negative
Red	3	Minor or slightly negative
Teal	3	Minor or slightly negative
Lime Green	3	Minor or slightly negative

2.9. Hydrogeology

2.9.1. Introduction

The hydrogeological assessment has been prepared by Atkins and is summarised within this section. Further detailed appraisal is contained within Appendix 2.8. The objective of this assessment is to assess and evaluate the potential impacts of each route option on the hydrogeological aspects of the receiving environment, and to identify the preferred route in terms of these considerations.

2.9.2. Method of Assessment

This assessment has been conducted in accordance with relevant best practice guidance, 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (National Roads Authority (NRA), 2008). The criteria for estimating the importance of hydrogeological importance includes groundwater vulnerability, use and quality.

Relevant background information was compiled from a number of sources including the following:

- GSI Datasets Public Viewer and Groundwater web-mapping, 2020 (GSI, 2020);
- Environmental Protection Agency (EPA) Envision mapping, 2020 (EPA, 2020);
- Ordnance Survey Ireland (OSI) web-mapping 2020 (OSI, 2020);
- Water Framework Directive (WFD) Ireland web-mapping (OPW, 2020);
- National Parks and Wildlife Service (NPWS) Map viewer 2020 (NPWS, 2020); and,
- All available information for the site (including topographic surveys, review of site-specific records (GSIL, 2012) and preliminary engineering information).

2.9.3. Key Findings

2.9.3.1. Purple

The purple route corridor is underlain by a locally important bedrock aquifer with sections of poorly productive bedrock aquifer and regionally important bedrock aquifer.

Groundwater flow paths in the area of the Mullinavat Groundwater Bodies (GWB) are considered to be short because the bedrock is not considered to constitute a major aquifer. Therefore, it is likely that most groundwater flow circulates in the upper tens of meters, recharging and discharging in local zones. The groundwater flow in this area may be quite fast since the hydraulic gradient, a reflection of the mountainous topography, will be high.

There are no Group Water Scheme Abstraction Points or Group Scheme Preliminary Source Protection Areas within the route corridor.

A search of the GSI groundwater well database has identified 6no. registered wells within the route corridor.

Based on a review of available GSI (2020) and historic OSI (2020) mapping there are no springs or holy wells reported within the route corridor.

2.9.3.2. Navy

The navy route corridor is underlain predominately by a locally important bedrock aquifer with sections of poorly productive bedrock aquifer.

There are a number of historic wells located within the study area and adjacent to a number of the routes which have not been monitored as part of this investigation.

Groundwater flow paths in the area of the Mullinavat GWB are considered to be short because the bedrock is not considered to constitute a major aquifer. Therefore, it is likely that most groundwater flow circulates in the upper tens of meters, recharging and discharging in local zones. The groundwater flow in this area may be quite fast since the hydraulic gradient, a reflection of the mountainous topography, will be high.

There are no Public Supply Source Protection Area, Group Water Scheme Abstraction Points or Group Scheme Preliminary Source Protection Areas within the route corridor.

A search of the GSI groundwater well database has identified 3no. registered wells within the route corridor.

Based on a review of available GSI (2020) mapping no springs were identified within the route corridor but historic OSI (2020) mapping reported a spring within the route corridor.

2.9.3.3. Magenta

The magenta route corridor is underlain by locally important bedrock aquifer with sections of poorly productive bedrock aquifer.

Groundwater flow paths in the area of the Mullinavat GWB are considered to be short because the bedrock is not considered to constitute a major aquifer. Therefore, it is likely that most groundwater flow circulates in the upper tens of meters, recharging and discharging in local zones. The groundwater flow in this area may be quite fast since the hydraulic gradient, a reflection of the mountainous topography, will be high.

There are no Public Supply Source Protection Area, Group Water Scheme Abstraction Points or Group Scheme Preliminary Source Protection Areas within the route corridor.

A search of the GSI groundwater well database has identified 5no. registered wells within the route corridor.

Based on a review of available GSI (2020) mapping no springs were identified within the route corridor but historic OSI (2020) mapping reported a spring within the route corridor.

2.9.3.4. Red

The red route corridor is underlain by a poorly productive bedrock aquifer with sections of locally important bedrock aquifer generally towards the north and south and a very small area of regionally important bedrock aquifer in the south.

Groundwater flow paths in the area of the Mullinavat GWB are considered to be short because the bedrock is not considered to constitute a major aquifer. Therefore, it is likely that most groundwater flow circulates in the upper tens of meters, recharging and discharging in local zones. The groundwater flow in this area may be quite fast since the hydraulic gradient, a reflection of the mountainous topography, will be high.

There are no Public Supply Source Protection Area, Group Water Scheme Abstraction Points or Group Scheme Preliminary Source Protection Areas within the route corridor.

A search of the GSI groundwater well database has identified 3no. registered wells within the route corridor.

Based on a review of available GSI (2020) mapping no springs were identified within the route corridor but historic OSI (2020) mapping reported a spring within the route corridor.

2.9.3.5. Teal

The teal route corridor is underlain by locally important bedrock aquifer with sections of poorly productive bedrock aquifer and regionally important bedrock aquifer.

Groundwater flow paths in the area of the Mullinavat GWB are considered to be short because the bedrock is not considered to constitute a major aquifer. Therefore, it is likely that most groundwater flow circulates in the upper tens of meters, recharging and discharging in local zones. The groundwater flow in this area may be quite fast since the hydraulic gradient, a reflection of the mountainous topography, will be high.

There are no Public Supply Source Protection Area, Group Water Scheme Abstraction Points or Group Scheme Preliminary Source Protection Areas within the route corridor.

A search of the GSI groundwater well database has identified 5no. registered wells within the route corridor.

Based on a review of available GSI (2020) mapping no springs were identified within the route corridor but historic OSI (2020) mapping reported two springs within the route corridor.

2.9.3.6. Lime Green

The lime green route corridor is underlain by a poorly productive bedrock aquifer with sections of locally important bedrock aquifer located to the north central and south of the proposed route.

Groundwater flow paths in the area of the Mullinavat GWB are considered to be short because the bedrock is not considered to constitute a major aquifer. Therefore, it is likely that most groundwater flow circulates in the upper tens of meters, recharging and discharging in local zones. The groundwater flow in this area may be quite fast since the hydraulic gradient, a reflection of the mountainous topography, will be high.

There are no Public Supply Source Protection Area, Group Water Scheme Abstraction Points or Group Scheme Preliminary Source Protection Areas within the route corridor.

A search of the GSI groundwater well database has identified 2no. registered wells within the route corridor.

Based on a review of available GSI (2020) mapping no springs were identified within the route corridor but historic OSI (2020) mapping reported one spring within the route corridor.

2.9.4. Summary and Conclusions

No significant adverse (i.e. major negative), or profound adverse (i.e. severe negative) hydrological or hydrogeological impacts have been identified associated with any of the 6no. routes assessed.

The Red Route and The Teal Route are identified as ‘preferred’ routes with least potential impacts with respect to hydrogeology (i.e. groundwater). These routes have been ranked 1st in order of preference. While both routes are broadly comparable in terms of impact levels, this ranking is primarily due to the estimated c.3.2km and 3.5km of the total length of cut required in areas of Extreme/High/Rock at or near Surface or Karst’ groundwater vulnerability along these routes respectively (albeit any impacts would be on a local scale).

The Navy Route, The Magenta Route and The Lime-Green Route are all identified as ‘intermediate’ routes with respect to hydrogeology while The Navy Route and The Magenta Route are ranked 2nd, The Lime green Route is ranked 3rd. All 3no. routes are broadly comparable in terms of impact levels, with potential impacts to River Barrow and River Nore SAC and Lower River Suir SAC arising from groundwater pathways. Therefore, this ranking is primarily due to the estimated c.4.3km, 4.5km and 5.9km of the total length of cut required in areas of Extreme/’High/’ ‘Rock at or near Surface or Karst’ groundwater vulnerability along these routes respectively (albeit any impacts would be on a local scale).

The remaining route option (The Purple Route) is identified as ‘least preferred’ route with respect to hydrogeology. This has been ranked 4th, based on the fact that this could potentially impact the River Barrow and River Nore SAC and Lower River Suir SAC via groundwater pathways (as with all route options), along with potential impact to the groundwater quality of Regionally Important Bedrock Aquifer. In addition, this poses a potential risk of localised impacts to existing groundwater quality of Regionally Important Bedrock Aquifer along sections of cut. An estimated 4.3km of the total length of cut required in areas of Extreme/High Rock at or near Surface or Karst’ groundwater vulnerability along this route.

Once the emerging preferred route has been identified, a door to door well survey (along with an inventory of septic tanks) should be undertaken. Based on a review of measured surface water levels, groundwater strike levels, and regional and site-specific geological records, surface water and groundwater regimes in the vicinity of the scheme are closely linked. Therefore, a detailed hydrological and hydrogeological impact assessment may be required to further consider potential impacts to surface water and groundwater quality and resources, once the emerging preferred route has been identified. Potential impacts on identified key receptors (bedrock aquifer, gravel aquifer, any private/ agricultural / industrial / commercial wells in the vicinity, Groundwater Dependant Terrestrial Ecosystems (GWDTE), rivers, streams, and lakes) may warrant further evaluation as part of any future assessment.

Table 2-15 – Hydrogeology Scoring

Route Option	Score	Description
Purple	2	Moderately negative
Navy	3	Minor or slightly negative
Magenta	3	Minor or slightly negative
Red	4	Not significant or neutral
Teal	4	Not significant or neutral
Lime Green	3	Minor or slightly negative

2.10. Cultural Heritage

2.10.1. Introduction

This assessment has been undertaken by Moore Group. The assessment followed on from work undertaken during the constraints study and a preliminary Phase 2 Stage 1 route corridor assessment of 15 possible routes.

This chapter should be read in conjunction with the Phase 2 Stage 2 Route Selection report and drawings (Cultural Heritage Maps 1-17) located in Appendix 2.10. The drawings were compiled utilising the Geographical Information System (GIS) shapefiles detailed in the table below.

Table 2-16 – GIS Shapefiles

Shapefile	Description
Walled Town.shp	Walled towns within and in the vicinity of the study area
Demesne Landscapes and Historic Gardens.shp	Demesne landscapes and historic gardens
National Monument in State Care.shp	National Monuments in State Care located within or in the vicinity of the study area
National Inventory of Architectural Heritage.shp	National Inventory of Architectural Heritage
Religious Site.shp	Religious sites within or in the vicinity of the study area
Register of Historic Monuments.shp	Register of Historic Monuments within or in the vicinity of the study area
Archaeological Monument.shp	Known archaeological monuments downloaded from www.archaeology.ie
RMP Zone of Notification.shp	Zones of Notification as indicated on the paper versions of the Record of Monuments and Places.
SMR Zone of Notification.shp	Zones of Notification made available for download from www.archaeology.ie
Protected Structure.shp	Protected Structures located within and in the vicinity of the study area
Preservation Order.shp	Sites subject to Preservation Orders located within and in the vicinity of the study area
BurialGroundsKilkenny_190906.shp	Historic graveyards identified by Kilkenny County Council in their inventory
Kilkenny_MemorialsAndPlaques.shp	Data derived from the audit of plaques, memorials and significant signs in County Kilkenny completed by Kilkenny County Council in 2015
Townlands.shp	Townland boundaries
CHS_Points_200514.shp	Point data generated by the authors indicating extant or potential archaeological, architectural, or cultural heritage sites not included in the above inventories

Shapefile	Description
CHS_Lines_200514.shp	Line data showing linear features of extant or potential archaeological, architectural, or cultural heritage interest, such as rivers & streams, disused railways, roads, townland boundaries etc.
CHS_Polygons_200514.shp	Area data indicating the extent of extant or potential archaeological, architectural, or cultural heritage interest, such as settlement areas indicated on historic maps,

2.10.2. Method of Assessment

The evaluation of the potential effects of the proposed development upon the archaeological, architectural, and cultural heritage resource is based on a desktop study of written, graphic, photographic, cartographic, and electronic information sources, followed by a windscreen and field survey of selected cultural heritage sites where possible. Considering the legislative protection afforded to the cultural heritage resource, this report evaluates the archaeological, architectural, cultural, and historical importance of the subject area and examines the potential effects of the proposed development on that resource.

In total six route options are under consideration. For the purposes of this study, a route design option as depicted in the accompanying cultural heritage maps (Appendix 2.10) was considered in terms of potential direct physical impacts on the cultural heritage resource, while a corridor 200m wide was considered for a quantitative analysis of additional potential direct and indirect impacts where sites or features intersect with this buffer. The 200m corridors were generated by applying a 100m buffer to the six route option centrelines and the centrelines of any side roads where the project team indicated that works would be required. The assessment of the potential routes as depicted in maps 1- 17 and the 200m wide corridor was considered the most efficient method to present a fair representation of potential impacts along each corridor. An assessment of the potential impacts on setting, indirect impacts or no potential impacts was carried out in a wider corridor of 600m. Consideration was also given to sites in the wider landscape beyond the 600m corridor. Only sites or features in the wider landscape where the impact is considered moderate or greater are addressed in this report. While all impacts within the footprint of each route option as depicted in the accompanying figures (Appendix 2.10) are considered direct for the purposes of this report, it should be noted that there is certain amount of flexibility within the wider route corridors to facilitate avoidance of any significant impacts as identified herein.

This was followed by a qualitative review of the archaeological, architectural, and cultural heritage of the wider area (i.e. sites outside the 600m corridor which may experience an impact on setting). The qualitative review also addresses the potential effects that the proposed development may have on the setting of archaeological, architectural, and cultural heritage sites, structures, deposits, or features.

Known cultural heritage sites were mapped in GIS along with aerial photography and Ordnance Survey Ireland (OSI) First Edition/6 Inch (1837-1842) and Second Edition/25 Inch (1888-1913) historic mapping.

A windscreen and walkover survey of the study area was carried out on the 13th and 14th of November 2019 by archaeologists Will Anderson and Billy Quinn. This involved uploading GIS mapping with cultural heritage constraints onto a mobile device and visiting selected accessible monuments to appraise the possible affects that the proposal would have on the receiving archaeological, architectural, and cultural heritage environment as well as to determine sites' current extent and condition.

2.10.3. Key Findings

Based on a standardized criterion the six proposed routes were assessed on both their respective direct and indirect potential effects on the local cultural heritage resource. In determining these effects consideration was given to both the quantitative aggregation of sites along each route and the qualitative effect the development would have on recorded monuments and structures, features identified on historic mapping and areas of archaeological potential derived from various sources including aerial and LiDAR imagery.

The analysis concluded that in terms of effects on Cultural Heritage the most preferred option is the Purple Route. This route, although the longest option, has a potentially slight to moderate adverse impact on the setting of two archaeological monuments, a univallate ringfort in Nicholastown and another at Grogan. The

route passes several vernacular features identified on historic mapping but will not impact any protected structures. The route may have a direct impact on two possible archaeological sites and a potential direct impact on the designed landscape associated with Frazer’s Hall demesne.

The second most preferred options are jointly the Magenta, Red and Teal Routes. All three are relatively coequal in terms of effects. The Magenta Route runs through the centre of the study area and is the option that most closely follows the existing N25 alignment. Along the Magenta route there is one archaeological monument which may experience a direct impact of slight to moderate significance. In addition, this route will have a large adverse impact on the setting of O’Donovan’s Mill, a moderate adverse impact on the setting of the standing stone at Robinstown and a moderate adverse impact on the setting of the Holy Year cross at Carriganurra. The Red Route, the most easterly option, would have a very large adverse impact on the setting of Aylwardstown house, listed as both a protected structure and monument, moderate direct impacts on a largely now no longer extant clachan at Luffany, Bearstown Bridge and a possible enclosure at Rochestown and moderate direct impact on the designed landscape associated with Aylwardstown House. The Teal Route would run behind this historic property through the western extents of the demesne lands and would have a moderate adverse impact on its setting as well as a potentially moderate direct impact on the designed landscape associated with the demesne. Further south it would have a large adverse impact on the setting of ecclesiastical remains at Kilcolumb; a complex comprising a church, graveyard, bullaun stone, holy well and an associated ringfort. The teal route would also potentially have a direct significant impact and a moderate impact on the setting of a possible ringfort at Ballyrowragh. The Teal Route would also have a potentially moderate direct impact on a largely no longer extant clachan at Luffany.

The least preferred options were both the Lime Green and Navy Routes assessed as having highly negative effects on various features. The Lime Green Route, the least preferred route, would have a profound direct impact on a Holy Year Cross erected by the local community on Carriganurra Hill as well as a significant direct impact on a ringfort at Ballyrahan and a moderate direct impact on a possible archaeological feature (a mound) at Luffany. This route would also have a very large adverse impact on the setting of O’Donovan’s Mill, a Protected Structure, and a moderate adverse impact on the settings of two archaeological sites. The Navy Route would have large adverse impacts on the setting of two of a series of three, inter-visible, recorded monuments set on a ridgeline in Davidstown/Carriganurra. This area contains several potentially significant features identified from a review of LiDAR imagery and confirmed by a geophysical survey that have variously been interpreted as two enclosure ditches and settlement activity in the form of linear and pit responses. These sites would be directly impacted upon. The Navy Route would also impact the settings of five additional known or suspected archaeological sites.

2.10.4. Summary and Conclusions

It is recommended that the preferred scheme avoids direct impacts, where feasible, on the archaeological, architectural, and cultural heritage sites and features noted in this report to ensure their continued protection. Where this is not possible mitigation strategies to reduce significant adverse effects will need to be devised. Detailed mitigation will be addressed Phase 3 Design and Environmental Evaluation following identification of a preferred route. It should be noted that there is potential across all six route options to encounter previously unknown subsurface archaeological sites or features. It should also be noted that the preferred route (Purple) is the longest route.

Table 2-17 – Architectural Heritage Scoring

Route Option	Score	Description
Purple	4	Not significant or neutral
Navy	3	Major or highly negative
Magenta	3	Moderately negative
Red	3	Major or highly negative
Teal	2	Moderately negative
Lime Green	1	Major or highly negative

Table 2-18 – Archaeological and Cultural Heritage Scoring

Route Option	Score	Description
Purple	2	Not significant or neutral
Navy	1	Major or highly negative
Magenta	2	Moderately negative
Red	2	Moderately negative
Teal	2	Moderately negative
Lime Green	1	Major or highly negative

2.11. Non-agricultural Properties

2.11.1. Introduction

This assessment has been undertaken by Atkins. Road schemes have the potential to significantly impact non-agricultural properties. All affected properties and types of land classed as commercial, recreational, open space, minerals and public facilities (hospitals, schools, and religious institutions) which are not of an agricultural nature are considered under the heading of Non-Agricultural Properties.

2.11.2. Method of Assessment

An appraisal of the potential impacts to non-agricultural properties, has been prepared through a desk-based review of all available information, including available Ordnance Survey mapping and aerial photography.

The assessment has taken account of the following within 300m of the main route options:

- Residential properties;
- Local businesses; and
- Community, Health and Recreational Areas.

2.11.3. Key Findings

The following table provides a summary of the estimated number and type of non-agricultural properties located within 300m of the proposed route centrelines:

Table 2-19 – Non-agricultural Properties Within 300m of Route Centreline

Route	Property Type and Number
Purple	Residential - 56
	Local Business - 4
Navy	Residential - 128
	Schools - 1
	Church/Cemetery - 1
	Community Facility - 1
	Sports Pitches - 1
	Garda Stations - 1
	Local Business - 14
Magenta	Residential - 127
	Schools - 1
	Church/Cemetery - 1
	Community Facility - 1
	Garda Stations - 1
	Local Business - 14
Red	Residential - 56
	Local Business - 4
Teal	Residential - 36
	Church/Cemetery - 1
	Local Business - 4
Lime Green	Residential - 127
	Schools - 1
	Church - 1
	Community Facility - 1
	Garda Stations - 1
	Local Business - 8

Each of the six routes avoid centres of population. The respective route study areas consist of mainly agricultural land of improved pasture, with main receptors being scattered dwellings. As such, each of the route study areas have relatively low levels of population.

None of the options are anticipated to result in loss of recreational assets. The proximity of the Glenmore GAA club to the Navy Route Option has the potential to result in a loss of amenity and increased noise pollution but may also lead to improved accessibility for the site.

Glenmore National School, Glenmore Community Hall, St James Church and Glenmore Garda Station are within the 300m study area for the Navy, Magenta, and Lime Green routes. These receptors are all located in the village of Glenmore. The only other community receptor identified was Rathinure Old Graveyard, which is within the Teal route study area. None of the options are anticipated to result in loss of community assets.

The Navy, Magenta and Lime Green Routes have the most amount of properties within 300m of the route centreline and Teal has the least.

2.11.4. Summary and Conclusions

Based on the number of properties within 300m of each of the route centrelines the following scoring has been allocated. Navy, Magenta and Lime Green have the most properties in proximity to the centreline and are therefore allocated the lowest score. Teal has the least amount of properties and receives the highest score.

Table 2-20 – Non-agricultural properties Scoring

Route Option	Score	Description
Purple	2	Moderately Negative
Navy	1	Major or highly negative
Magenta	1	Major or highly negative
Red	2	Moderately Negative
Teal	3	Minor or slightly negative
Lime Green	1	Major or highly negative

2.12. Agriculture

2.12.1. Introduction

As part of the works associated with the proposed N25 Waterford to Glenmore Road Scheme, Philip Farrelly & Co. were engaged to assess the agricultural impact of the route options. The detailed appraisal is presented in Appendix 2.12 and should be read in conjunction with the summary overview presented in this section.

2.12.2. Method of Assessment

The assessment of the potential impact of the route options on agriculture was prepared having regard to the following documents:

- Draft guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2017); and
- Project Management Guidelines (TII, 2017).

The assessment of the agricultural impact consisted of a desktop survey of available aerial photography, land folio information obtained from the Property Registration Authority, Census of Agricultural Data, a roadside survey of publicly accessible lands and local knowledge of the Study Area. Land Registry data was used to determine boundaries of land holdings affected by the various route options. It should be noted that the number of land holdings identified on each route option may not reflect the total number of farms affected due to fragmentation of farms.

Consultation with landowners was not undertaken at this stage therefore specific information in relation to farming systems is not known. Consultation with affected landowners will take place during Phase 3 of the project.

Both qualitative and quantitative assessments of the impacts to key agricultural enterprises within the Study Area were carried out. The agricultural enterprises considered most sensitive to a proposed scheme development consists mainly of dairy and equine enterprises. The route options assessment considered the impact each route option has on agriculture. Land use, soil type, and key agricultural enterprises were considered in the qualitative assessment. Land use (% of holdings), land take (approx. ha), route length (km), land severance (% of holdings) and the number of farmyards/facilities in close proximity to route options were considered in the quantitative assessment. The assessment of the proposed scheme under the above categories (i.e. land use) was based on the number of land holdings falling within each sub-category.

In general, negative impacts from the development of a proposed scheme are mainly due to the level of land take and access problems to land and farmyard facilities. This assessment identified the key agricultural enterprises that would be considered most sensitive to the construction and operation of a proposed scheme. Intensive farm enterprises may be particularly affected by the loss of direct access to lands. This is particularly important in the case of dairy enterprises where daily access is required from the grazing platform to milking facilities on a twice daily basis during the grazing season.

Dairy farms are known to be particularly sensitive to the location of a major road. A dairy farm is one of the most intensive land-based farming enterprises and is entirely dependent on the land holding or grazing paddocks adjacent to the farmyard.

Equine farms also have the potential to be severely impacted as equine stock are of more a nervous disposition than other stock types and are prone to stress caused by irregular noise and moving vehicles. Beef and sheep farms are not as sensitive as horses to the noise impact of a major road. Where there is a significant impact on a grassland farm, the farming practices on these farms need to be adapted to mitigate the overall impact. A road scheme will have a lower impact on a tillage farm or enterprise than on a livestock farm. Land take and land severance may also occur on tillage farms although the impact will largely consist of access problems for machinery to a severed area. It is preferable for the route option to pass through tillage and beef and or sheep farms rather than through dairy or equine farms

2.12.3. Key Findings

Land use is almost entirely grass based and farming practices are predominately mixed livestock with dairy and beef farming with some sheep and tillage farming practised within the Study Area. There are some equine farms located throughout the Study Area in particular 'Beacon Hill'.

The farmland is good quality suited to intensive farming. Intensive farming is carried out in the region with some intensive dairy and beef and tillage farms located throughout the Study Area.

2.12.3.1. Purple

The Purple option is 11.6km and impacts on 58 farm holdings some of which are classified as sensitive farm holdings such as dairy farms. Of the 58 farm holdings, 76% are classified as grazing, 14% are classified as dairy farms, 3% are classified as forestry and 7% are classified as tillage. 26% of holdings are classified as resulting in Major Severance, 27% of holdings are classified as Moderate Severance, while 47% of holdings are classified as Minor or Not Significant Severance.

2.12.3.2. Navy

The Navy option is 9.5km and impacts on 46 farm holdings. Of the 46 farm holdings, 85% are classified as grazing, 6% are classified as dairy farms and 9% are classified as tillage. There are no forestry holdings impacted by the route. 22% of holdings are classified as resulting in Major Severance, 28% of holdings are classified as Moderate Severance, while 50% of holdings are classified as Minor or Not Significant Severance.

2.12.3.3. Magenta

The Magenta option is 9.3km and impacts on 48 farm holdings some of which are classified as sensitive farm holdings such as dairy farms. Of the 48 farm holdings, 92% are classified as grazing and 8% are classified as dairy farms. There are no forestry or tillage holdings impacted by the route. The online nature of the route results in lower severance to land holdings. No holdings are classified Major Severance, 6% of holdings are classified as Moderate Severance, while 94% of holdings are classified as Minor or Not Significant Severance.

2.12.3.4. Red

The Red option is 9.0 km and impacts on 44 farm holdings. Of the 44 farm holdings, 75% are classified as grazing, 16% are classified as dairy farms, 7% are classified as tillage and 2% are classified as equine. 25% of holdings are classified as resulting in Major Severance, 14% of holdings are classified as Moderate Severance, while 61% of holdings are classified as Minor or Not Significant Severance.

2.12.3.5. Teal

The Teal option is 8.7km and impacts on 37 farm holdings. Of the 37 farm holdings, 76% are classified as grazing, 5% are classified as dairy farms, 8% are classified as forestry and 11% are classified as tillage. 24% of holdings are classified as resulting in Major Severance, 25% of holdings are classified as Moderate Severance, while 51% of holdings are classified as Minor or Not Significant Severance.

2.12.3.6. Lime Green

The Lime Green option is 8.9km and impacts on 39 farm holdings some of which are classified as sensitive farm holdings such as dairy farms. Of the 39 farm holdings, 79% are classified as grazing, 8% are classified as dairy farms, 3% are classified as forestry and 10% are classified as tillage. 13% of holdings are classified as resulting in Major Severance, 31% of holdings are classified as Moderate Severance, while 56% of holdings are classified as Minor or Not Significant Severance.

2.12.4. Summary and Conclusions

The land quality under all route options is predominately good quality land suited to intensive agriculture. None of the farms are identified as being of national or regional importance. The permanent loss of agricultural land in the Study Area would affect agriculture at a local level only. An overall summary of the agricultural assessment of the route options is presented in the following table. Based on the information contained within Appendix 2.12, the following scoring has been assigned to the 7 route options based on the agricultural impact of each of the route options.

The Magenta option given the online nature of the route it will not result in significant severance on holdings. It impacts on 48 farm holdings but no holdings are classified as resulting in Major Severance because the route is predominantly online. 6% of holdings are classified as Moderate Severance, while 94% of holdings are classified as Minor or Not Significant Severance.

The Lime Green option is ranked as intermediate. It impacts on 39 farm holdings, and results in Major severance on 5 holdings and Moderate severance on 12 holdings. It impacts on 3 holdings that are used for dairying.

The Teal option is ranked as intermediate. It impacts on 37 farm holdings, and results in Major severance on 9 holdings, and Moderate severance on 9 holdings. It impacts on 2 holdings that are used for dairying.

The Navy option is ranked as Intermediate. It impacts on 46 farm holdings, and results in Major severance on 10 holdings, and Moderate severance on 13 holdings. It impacts on 3 holdings that are used for dairying.

The Red option is ranked as Least Preferred. It impacts on 44 farm holdings, and results in Major severance on 11 holdings, and Moderate severance on 6 holdings. It impacts on 7 holdings that are used for dairying, and it impacts on 1 intensive equine enterprise.

The Purple option is ranked as Least Preferred. It impacts on 58 farm holdings, and results in Major severance on 15 holdings, and Moderate severance on 16 holdings. It impacts on 8 holdings that are used for dairying.

Table 2-21 – Agriculture / Agronomy Scoring

Route Option	Score	Description
Purple	1	Major or highly negative
Navy	2	Moderately negative
Magenta	2	Moderately negative
Red	1	Major or highly negative
Teal	2	Moderately negative
Lime Green	2	Moderately negative

2.13. Planning / Human Beings

2.13.1. Introduction

This assessment has been undertaken by Coakley O'Neill Town Planning Limited. It assesses the impact of the proposed route options from a planning perspective and takes into account human impacts, for example in terms of existing and permitted dwellings, and land uses, in the immediate vicinity of the proposed routes.

2.13.2. Method of Assessment

The assessment initially involved the review of all relevant statutory plans for the proposed study area, which include the following; The National Planning Framework (2018); National Development Plan (2019-2027); Regional Spatial and Economic Strategy for the Southern Region (RSES); and the Kilkenny County Development Plan 2014-2020. It is noted that a draft Kilkenny County Development Plan 2021-2027 is to be published in Q3 2020.

Following a review of the national and regional policies pertaining to the subject development, a review of the current Kilkenny County Development Plan was carried out to determine if there are any constraints to the proposed routes from a planning perspective. In addition, a review of planning applications in the vicinity of the subject routes was carried out along with an analysis of existing properties. Other resources including Myplan.ie and Archaeology.ie were utilised to attain accurate information relating to designated sites, national monuments, architectural heritage, and residential dwellings in the vicinity of the route.

2.13.3. Key Findings

2.13.3.1. Purple

This proposed route is outside the area designated to be kept free from development for the provision of the re-aligned N25 as per Figure 11.1 of the Plan. However, there is no specific policy/objective outlined in the Plan which states that routes will need to be within this defined corridor.

Of note, is that there are 2 no. monuments included within the Record of Monuments and Places (Ref. KK043-039 and KK043-005) along the subject route. It is noted that the Plan seeks the protection of such RMPs (Section 8.3 and Objective 8I refer). (Refer to Section 2.10 above). The proposed route also traverses the River Barrow and River Nore SAC. (Refer to Section 2.5 above)

In terms of human impact, it is noted that the subject route traverses 2 no. sites where there is live planning permission for dwellings under application register reference 18/689 and 16/861, which do not expire until 9th July 2024 and 23rd March 2022 respectively. Furthermore, the proposed route traverses an access road serving 1 no. agricultural holding and a dwelling. There are 8 no. dwellings within 100m of the route centre line which is significantly lower than the majority of the other route options, which will likely have a lesser impact on humans. (Refer to section 2.1 and 2.3 for noise/air quality implications on human beings).

Notwithstanding the potential significant negative impact on an existing agricultural holding, an existing dwelling and a permitted dwelling, which represents a significant negative impact in terms of human beings, it is noted that having regard to the potential adverse impact of the route on the Qualifying Interests of the SAC, which cannot be ruled out at this stage, that the proposed route is considered to be highly negative from a planning perspective. However, the potential impact on the SAC are assessed in detail within Section 2.5 above, On this basis, this route is considered in light of the potential impact on existing and permitted dwellings and having regard to the comparatively low no. of dwellings impacted, this route is considered to be slightly negative in terms of impact on human beings.

2.13.3.2. Navy

This proposed route is largely within the area designated to be kept from development for the provision of the re-aligned N25 as per Figure 11.1 of the Plan.

The proposed route also traverses 6 no. monuments (Ref. KK 043-021, KK041-025, KK041-055, KK043-013, KK043-014 and KK043-021) which are included in the Record of Monuments and Places. It is noted that the Plan seeks the protection of such RMPs (Section 8.3 and Objective 8I refer). (Refer to Section 2.10 above)

There are 4 no. dwellings located within 50m of the route centreline, and a further 13 no. dwellings located within 100m of the proposed route centre line. In comparison to other routes, there is a relatively low number of dwellings in close proximity to this proposed route option. In this context, the impact on human beings from this route option would be minorly negative. (Refer to section 2.1 and 2.3 above for noise/air quality implications)

It is noted that the proposed route traverses land to which there is a live planning permission in place (application register reference 18573) for the upgrading of overhead cables, which may be negatively impacted by the proposed development. The proposed route also traverses the River Barrow and River Nore SAC. (Refer to Section 2.5 above)

Having regard to the potential adverse impact of the route on the Qualifying Interests of the SAC, which cannot be ruled out at this stage, and on 2 no. RMPs, this route is considered to be highly negative from a planning perspective. However, the built and natural heritage designations along the route are assessed in detail under Section 2.5 and 2.10 above. On this basis, this route is considered in light of the potential impact on existing and permitted dwellings and having regard to the comparatively low no. of dwellings impacted, this route is considered to be slightly negative in terms of impact on human beings.

2.13.3.3. Magenta

This proposed route is largely within the area designated to be kept from development for the provision of the realigned N25 as per Figure 11.1 of the County Development Plan 2014-2020.

The proposed route corridor intersects with 10 no. monuments which are included in the Record of Monuments and Places. It is noted that the Plan seeks the protection of such RMPs (Section 8.3 and Objective 8I refer). (Refer to Section 2.10 above).

In terms of dwellings in the vicinity, it is stated that there are 26 no. dwellings within 50m of the route centre line, with a further 31 no. dwellings within c. 100m of the route centreline. This is a high volume of dwellings relative to other potential route options. However, this route is close to the existing N25 alignment, so any impacts would, in general, be similar to the current situation. Nevertheless, it is considered there could be a relatively minor impact on human beings relative to the other route options. (Refer to section 2.1 and 2.3 above for noise/air quality implications). It is noted that the proposed route traverses land to which there is a live planning permission in place (application register reference 18573) for the upgrading of overhead cables and a dwelling house (app. reg. ref. 18/191) which may be negatively impacted by the proposed development. The proposed route also traverses the River Barrow and River Nore SAC. (Refer to Section 2.5 above)

Having regard to the potential adverse impact of the route on the Qualifying Interests of the SAC which cannot be ruled out at this stage, and on 2 no. RMPs, this route is considered to be highly negative from a planning perspective. However, the built and natural heritage designations along the route are assessed in detail under Section 2.5 and 2.10 above. On this basis, this route is considered in light of the potential impact on existing and permitted dwellings and having regard to the comparatively high no. of dwellings impacted, this route is considered to be highly negative in terms of impact on human beings.

2.13.3.4. Red

This proposed route is located outside the area designated to be kept free from development for the provision of the realigned N25 as per Figure 11.1 of the County Development Plan 2014-2020. However, there is no specific policy/objective outlined in the Plan which states that routes will need to be within this defined corridor.

The proposed route corridor also traverses the site of 4 no. monuments (Ref. KK041-032, KK044-022, KK044-023 and KK044-024) which are included within the Record of Monuments and Places. It is noted that the Plan seeks the protection of such RMPs (Section 8.3 and Objective 8I refer). (Refer to Section 2.10 above).

Of note in relation to this route is that it traverses the access road to Beacon Hill Equine centre, a disused railway line (South-east Greenway) and the River Barrow and River Nore SAC (refer to Section 2.5 above). In addition, there are 3 no. dwellings located within 50m of the route centreline, with a further 20 within 100m of the route centreline. This is a high volume of dwellings relative to other potential route options, which potentially will have a higher impact negative impact on human beings. (Refer to section 2.1 and 2.3 above for noise/air quality implications)

It is noted that the proposed route traverses land to which there is a live planning permission in place (app. reg. ref. 18573) for the upgrading of overhead cables, as well as a dwelling house (app. reg. ref. 18577) which may be negatively impacted by the proposed development.

Having regard to the potential negative impact on the Beacon Hill Equine Centre, the presence of a high number of dwellings within 100m of the route, the impact on the disused railway line (South-east Greenway), the potential impact on an RMP and the Qualifying Interests of the SAC which cannot be ruled out at this stage, this route is considered to be highly negative from a planning perspective. However, the built and natural heritage designations along the route are assessed in detail under Section 2.5 and 2.10 above. On this basis, this route is considered in light of the potential impact on existing and permitted dwellings and having regard to the moderately higher number of no. of dwellings impacted, this route is considered to be moderately negative in terms of impact on human beings.

2.13.3.5. Teal

This proposed route is located outside the area designated to be kept free from development for the provision of the realigned N25 as per Figure 11.1 of the County Development Plan 2014-2020. However, there is no specific policy/objective outlined in the Plan which states that routes will need to be within this defined corridor.

The proposed route corridor passes through the Zone of Notification of 4 no. monuments included in the Record of Monuments and Places (Ref. KK044-022, KK044-023, KK044-024, KK041-030). It is noted that the Plan seeks the protection of such RMPs (Section 8.3 and Objective 8I refer). (Refer to Section 2.10 above).

It is noted that the proposed route traverses land on which there is a live planning permission in place (application register reference 18573). This permission relates to the upgrading of overhead cables, which may be negatively impacted by the proposed development. This route has the least number of dwellings in close proximity to the route centre line. There are no dwellings within 50m of the route centre line, with 12 no. dwellings located within 100m of the route centreline. This is a significantly low number relative to the other route options and therefore is considered to be slightly positive in terms of impacts to human beings. (Refer to Section 2.1 and 2.3 above for noise/air quality implications). The route crosses a disused railway line (South-east Greenway). The proposed route also traverses the River Barrow and River Nore SAC (refer to Section 2.5 above).

Notwithstanding the fact this route impacts the least number of dwellings within 100m of its centre line, it traverses an RMP and the SAC. Unless it can be demonstrated that there will be no adverse impact on the Qualifying Interests (QIs) of the SAC, this route is considered to be highly negative from a planning perspective.

However, the natural and built heritage designations along the route are assessed in detail under Section 2.5 and 2.10 above. On this basis, this route is considered in light of the potential impact on existing and permitted dwellings and having regard to the comparatively low no. of dwellings impacted, this route is considered to be slightly negative in terms of impact on human beings.

2.13.3.6. Lime Green

The proposed route is located outside the area designated to be kept free from development for the provision of the realigned N25 as per Figure 11.1 of the County Development Plan 2014-2020. However, there is no specific policy/objective outlined in the Plan which states that routes will need to be within this defined corridor.

It is noted that there are 4 no. dwelling located within 50m of the centreline of the proposed route, with a further 25 no. dwellings located within 100m of the centre line. This is relatively high number relative to the other route options and is therefore considered to be moderately negative in terms of human impacts. (Refer to section 2.1 and 2.3 above for noise/air quality implications). However, the route traverses 2 no. sites with live planning permission in place for dwelling houses (App. Reg. Ref. 18191 and 17553), as well as an application for upgrading of overhead cables (App. Reg. Ref. 18573) which may be negatively impacted. The proposed route also traverses the River Barrow and River Nore SAC (refer to Section 2.5 above). The route also traverses 4 No. archaeological monuments included in the Record of Monuments and Places

The built and natural heritage designations along the route are assessed in detail under Section 2.5 and 2.10 above. On this basis, this route is considered in light of the potential impact on existing and permitted dwellings and having regard to the moderately higher number of no. of dwellings impacted, this route is considered to be moderately negative in terms of impact on human beings.

2.13.4. Summary and Conclusions

This report has assessed each of the proposed route options in terms of planning and human impacts. It is highlighted that the main constraint for the proposed development is that each route traverses the River Barrow and River Nore SAC. At this stage potential adverse impacts on the SAC cannot be ruled out for any route and on this basis, each of the proposed routes are considered to be highly negative from a planning perspective. The potential for direct and/or indirect impacts on the River Barrow and River Nore SAC will be further assessed as the route design is progressed. However, the impact on the SAC is assessed in detail under Section 2.5 above. On this basis this assessment has proceeded based on impact on human beings, where the Magenta route was considered to be highly negative, the lime green and red route were considered to be moderately negative, while the purple, navy and teal route were considered to be slightly negative from a human beings perspective.

Table 2-22 – Planning / Human Beings Scoring

Route Option	Score	Description
Purple	3	Minor or slightly negative
Navy	3	Minor or slightly negative
Magenta	1	Major or highly negative
Red	2	Moderately negative
Teal	3	Minor or slightly negative
Lime Green	2	Moderately negative

2.14. Human Health

2.14.1. Introduction

This section sets out key findings in and provides the basis for the preference awarded to each of the six route options with respect to human health considerations.

For the purposes of this investigation a study area of 300m around each route centreline has been considered. These study areas are used to report baseline conditions and provide the basis of consideration.

2.14.2. Method of Assessment

This report documents the assessment on how each of the route options may interact with sensitive receptors and the environment, and ultimately provide a recommendation on preference, it was necessary to establish a baseline against which likely human health effects can be identified and assessed.

TII's Project Appraisal Guidelines for National Roads (Multi Criteria Analysis) does not make provision for the undertaking of a Human Health assessment. There is a requirement to consider 'population and human health' as per the 2017 EIA Directive, however this does not establish the way in which the topic is to be addressed and there is no prescribed EIA definition for 'population and human health'. The human health part of this assessment is therefore based upon Institute of Environmental Management and Assessment (IEMA) guidance contained in 'Health in Environmental Impact Assessment: A Primer for a Proportionate Approach' (IEMA 2017) and the World Health Organisation (WHO) definition of health used by the public health profession in the UK, health is defined as 'a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity'. Consideration was also made of the Design Manual for Roads and Bridges (DMRB) 'LA112 Population and Human Health' (January 2020).

2.14.3. Key Findings

2.14.3.1. Purple

It is anticipated that there is the potential for an adverse health impact on the wider population group through increased noise and air pollution although with the potential for beneficial effects to be realised such as increased access to recreational facilities and reduced traveller stress. There are no care homes, schools, hospitals, dental practices, opticians, GP surgeries or libraries within the study area for this route option. It is anticipated that there could potentially be adverse health impacts for the families with children and adolescents, people who are physically or mentally disadvantaged and people who are materially disadvantaged. Overall, it is considered that this route option is likely to result in Minor or Slight Adverse impact, with no significant impacts in terms of human health identified for this route option at this stage.

2.14.3.2. Navy

It is anticipated that there is the potential for an adverse health impact on the wider population group through increased noise and air pollution although with the potential for beneficial effects to be realised such as increased access to recreational facilities and reduced traveller stress. Although Glenmore GAA, Glenmore National School and Community Hall are within the route study area, there are no care homes, hospitals, dental practices, opticians, GP surgeries or libraries within the study area for this route option. The proposed route of the new Kilkenny Greenway falls partially within the study area for this route option. It is anticipated that there could potentially be adverse health impacts for the families with children and adolescents, people who are physically or mentally disadvantaged and people who are materially disadvantaged. Overall, it is considered that this route option is likely to result in Minor or Slight Adverse impact, with no significant impacts in terms of human health identified for this route option at this stage.

2.14.3.3. Magenta

It is anticipated that there is the potential for an adverse health impact on the wider population group through increased noise and air pollution although with the potential for beneficial effects to be realised such as increased access to recreational facilities and reduced traveller stress. Although Glenmore National School and Community Hall are within the route study area, there are no care homes, hospitals, dental practices, opticians, GP surgeries or libraries within the study area for this route option. The proposed route of the new Kilkenny Greenway falls partially within the study area for this route option. It is anticipated that there could potentially be adverse health impacts for the families with children and adolescents, people who are physically or mentally disadvantaged and people who are materially disadvantaged. Overall, it is considered that this route option is

likely to result in Minor or Slight Adverse impact, with no significant impacts in terms of human health identified for this route option at this stage.

2.14.3.4. Red

It is anticipated that there is the potential for an adverse health impact on the wider population group through increased noise and air pollution although with the potential for beneficial effects to be realised such as increased access to recreational facilities and reduced traveller stress. There are no care homes, schools, hospitals, dental practices, opticians, GP surgeries or libraries within the study area for this route option. It is anticipated that there could potentially be adverse health impacts for the families with children and adolescents, people who are physically or mentally disadvantaged and people who are materially disadvantaged. The Red route crosses the proposed Kilkenny Greenway at two locations. Consideration of the proposed Greenway and its finalised design at the identified intersections will therefore be required during detailed design of this route option in order to ensure opportunities to improve accessibility to the Greenway and avoid impeding movement along the Greenway are realised. Overall, it is considered that this route option is likely to result in Minor or Slight Adverse impact, with no significant impacts in terms of human health identified for this route option at this stage.

2.14.3.5. Teal

It is anticipated that there is the potential for an adverse health impact on the wider population group through increased noise and air pollution although with the potential for beneficial effects to be realised such as increased access to recreational facilities and reduced traveller stress. Although the community facility of Rathinure Old Graveyard is within the route study area, there are no care homes, schools, hospitals, dental practices, opticians, GP surgeries or libraries within the study area for this route option. It is anticipated that there could potentially be adverse health impacts for the families with children and adolescents, people who are physically or mentally disadvantaged and people who are materially disadvantaged. The Teal route crosses the proposed Kilkenny Greenway at two locations. Consideration of the proposed Greenway and its finalised design at the identified intersections will therefore be required during detailed design of this route option in order to ensure opportunities to improve accessibility to the Greenway and avoid impeding movement along the Greenway are realised. Overall, it is considered that this route option is likely to result in Minor or Slight Adverse impact, with no significant impacts in terms of human health identified for this route option at this stage.

2.14.3.6. Lime Green

It is anticipated that there is the potential for an adverse health impact on the wider population group through increased noise and air pollution although with the potential for beneficial effects to be realised such as increased access to recreational facilities and reduced traveller stress. Although Glenmore National School and Community Hall are within the route study area, are no care homes, hospitals, dental practices, opticians, GP surgeries or libraries within the study area for this route option. The proposed route of the new Kilkenny Greenway falls partially within the study area for this route option. It is anticipated that there could potentially be adverse health impacts for the families with children and adolescents, people who are physically or mentally disadvantaged and people who are materially disadvantaged. Overall, it is considered that this route option is likely to result in Minor or Slight Adverse impact, with no significant impacts in terms of human health identified for this route option at this stage.

2.14.4. Summary and Conclusions

This assessment examined the six potential route options in terms of anticipated impacts on human health, with particular reference to the wider population and a range of identified sensitive sub-groups.

Each of the six routes avoid centres of population. The respective route study areas consist of mainly agricultural land of improved pasture, with main receptors being scattered dwellings, many of which are related to agriculture such as farmhouses and associated outbuildings. As such, each of the route study areas have relatively low levels of population. While it was not possible to determine at this stage precise numbers of individuals within sensitive sub-groups, it is anticipated that given the relatively low numbers of receptors, absolute numbers will be low.

Numbers of businesses / commercial properties are also low throughout the study area, though there are a small number within 50m of both the navy and magenta routes. These routes are also in close proximity to a small number of community / education facilities, including Glenmore National School, a community Hall and St. James' Church. In addition, the magenta route is also in proximity to a Garda station. No health, or other similar community facilities are noted within 300m of any route.

While there is a potential for safety issues in respect of properties in close proximity to each route option, no marked differences in effects on road safety between each of the route are anticipated – each could lead to loss / impact on some receptors, but also provide opportunities for safety improvements to a greater number of receptors. It is to be emphasised that any new road would be designed to the latest highway standards and would include all relevant safety measures. This would act to mitigate any increased risk to safety.

No existing cycle routes or walking trails have been identified as intersecting any of the six route study areas however it should be assumed that walkers, cyclists and horse rides do use the minor road network in capacities including recreational. Differences in the nature and number of intersections with minor roads/lanes have been identified between each route study area however this is not considered significant.

The proposed Kilkenny Greenway falls within the study areas for each of the route options with the exception of the Purple Route. Both the Teal and Red routes cross the proposed Kilkenny Greenway at two locations. Consideration of the proposed Greenway and its finalised design at the identified intersections will therefore be required during detailed design of this route option in order to ensure opportunities to improve accessibility to the Greenway and avoid impeding movement along the Greenway are realised.

Note that potential impacts in relation to Air Quality, Climate Change and Noise are addressed within their individual sections, in order to avoid ‘double counting’ in this route comparison exercise.

While there are differences between each of the six route options in precise numbers of receptors and their proximity, it is anticipated that for each of the identified population groups, the development of any of the six route options will result in Minor, or Slight Adverse impacts, with no significant issues in terms of human health identified at this stage. It is also the case that for each of the potential routes, careful final route alignment will provide opportunities for beneficial impacts such as increased access to community facilities (including recreational facilities), reduced traveller stress and similar.

Table 2-23 – Human Health Scoring

Route Option	Score	Description
Purple	3	Minor or slightly adverse
Navy	3	Minor or slightly adverse
Magenta	3	Minor or slightly adverse
Red	3	Minor or slightly adverse
Teal	3	Minor or slightly adverse
Lime Green	3	Minor or slightly adverse

3. Summary of Stage 2 Assessment Matrices

A copy of the full environmental matrices is located in Appendix 3.1. The following table provides summary scores for all options assessed against the environmental sub-criteria:

Table 3-1 – Stage 2 Matrix Summary

Environmental Sub-criteria	Purple	Navy	Magenta	Red	Teal	Lime Green
Air Quality	5	6	4	6	7	6
Climate	3	3	3	3	3	3
Noise	2	3	3	3	3	3
Landscape and Visual (including light)	1	3	3	1	1	1
Biodiversity- Flora and Fauna	1	1	1	1	1	1
Waste	2	3	3	1	1	2
Soils and Geology	3	2	1	3	3	2
Hydrology	4	3	3	3	3	3
Hydrogeology	2	3	3	4	4	3
Architectural Heritage	4	3	3	3	2	1
Archaeological and Cultural Heritage	2	1	2	2	2	1
Non-agricultural properties	2	1	1	2	3	1
Agriculture	1	2	2	1	2	2
Human Beings	3	3	1	2	3	2
Human Health	3	3	3	3	3	3
Total	38	40	36	38	41	34

As described earlier it is not the intention that the sum of each individual score will be used in selecting the preferred option. The overall impact depends on the strength of the individual impact. The Stage 2 Environmental Assessment findings must also be considered along with the findings from other criteria including:

- Safety;
- Physical Activity;
- Economy;
- Accessibility and Social Inclusion; and
- Integration.