

N52 TULLAMORE TO KILBEGGAN LINK

Option Selection Report

Volume F – Environmental Appendices Appendix F7 – Biodiversity

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1 INTRODUCTION

This report outlines the comparative assessment of options in relation to biodiversity for the seven options for the N52 Tullamore to Kilbeggan Link Scheme. This assessment will form part of a Phase 2 – Option Selection Report which is a deliverable under Phase 2 – Options Selection of the TII PMG 2019. The purpose of the Option Selection Report is to present the project constraints and the assessments that were undertaken in order to identify the Preferred Option for the project.

This report assesses the impact of each option shortlisted for Stage 2 from a biodiversity perspective. Each of the proposed route options will be considered in respect of the following ecological features: designated sites for nature conservation, habitats, trees, bat roost potential, bird activity and protected species activity, as well as connectivity to or intersection with watercourses.

The impacts for each of the options are identified so that those with unacceptably high levels of impact can be avoided to the extent feasible as part of the overall option assessment process.

1.1 Guidance

This analysis was undertaken by means of a desktop assessment based on the following guidance and information sources:

- The National Parks and Wildlife Service (NPWS) database (www.npws.ie), consulted for designated sites of nature conservation interest in the study area;
- The National Parks and Wildlife Service (NPWS) database (www.npws.ie), consulted for data on rare/protected/threatened species for Irish National Grid 10km square N33 and N32;
- The National Biodiversity Data Centre (NBDC) database (www.biodiversityireland.ie), consulted for records of rare, protected and invasive species for Irish National Grid 10km square N33 and N32, accessed online February 2020;
- Environmental Protection Agency – Watercourse and water quality www.epa.ie;
- Geological Survey of Ireland – www.gsi.ie;
- Information on the Shannon River Basin District;
- A review of Ordnance Survey maps and ortho-photography www.osi.ie;
- Westmeath County Development Plan 2014-2020;
- Draft Westmeath County Development Plan 2021-2027;
- Draft Offaly County Development Plan 2021 – 2027 (Currently under review);
- Transport Infrastructure Ireland “*Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis*” (2016¹);
- National Roads Authority (NRA)/Transport Infrastructure Ireland (TII) “*Guidelines for Assessment of Ecological Impacts of National Road Projects*” (2009²); and
- UK Highways Agency “*Biodiversity, Volume 11, Section 3, Ecology and Nature Conservation and IAN 130/10*” (2007) and the updated LA108 (2020³).

¹ TII, 2016. Multi-Criteria Analysis (MCA). Transport Infrastructure Ireland (TII) Publications.

² NRA, 2009. Guidelines for Assessment of Ecological Impacts of National Road Projects. National Roads Association.

³ UK Highway Agency, 2020. Design Manual for Roads and Bridges – A108 Biodiversity (formerly Volume 11, Section 3, Part 4 Ecology and Nature Conservation and IAN 130/10). Department for Infrastructure.

1.2 Project Appraisal Guidelines Requirements

The TII “*Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis*” (PAG) states the following for a Stage 2 appraisal of biodiversity should be considered in the route corridor selection:

“TII have produced an ecological guidance document called Guidelines for Assessment of Ecological Impacts of National Road Schemes (Revision 2, 1st June 2009). The aim of this document is to provide guidance on the assessment of impacts on the natural environment during the planning and design of national road schemes. It elaborates on the references to ecology (habitats, flora and fauna) contained in the National Roads Project Management Guidelines (NRPMG).

National road schemes are large developments that have potential impacts on the natural environment (habitats, flora and fauna, including fisheries) along their entire length. One of the objectives of the planning stages of road schemes is to avoid or reduce the negative impacts of the final route on the natural environment. This is achieved in part through the Environmental Impact Assessment (EIA) process. The aim of MCA is to highlight the number of sites of ecological value affected by the road project. The MCA should consider two aspects, namely, the number of significant negative impacts sites of ecological importance and the number of significant positive impacts sites of ecological importance. The categorisation of impacts should follow the TII Guidelines for Assessment of Ecological Impacts of National Road Schemes (Revision 2, 1st June 2009) from Local Importance (lower value) to sites of International Importance

According to the TII Guidelines for Assessment of Ecological Impacts of National Road Schemes (Revision 2, 1st June 2009) an adverse effect on the integrity of a European site will be expressed as a significant impact on an ecological resource of international importance (this was not necessarily the case with previous revisions of this document). This means that the project proponents have determined that the project will adversely affect the integrity of the site (note that it is the competent authority, An Bord Pleanála will ultimately make this decision) having regard to Articles 6(3) and 6(4) of the Habitats Directive and relevant Irish transposing provisions.

In such a case, the scheme project can only proceed where, inter alia, there is an ‘absence of alternative solutions’ and ‘imperative reasons of overriding public interest’ exist. The presence of a significant impact on an ecological resource of international importance will, therefore, operate as a warning flag. Appendix II of the TII Guidelines for Assessment of Ecological Impacts of National Road Schemes (Revision 2, 1st June 2009) provides guidance in relation to Appropriate Assessment.”

Therefore, the following elements are considered as part of the biodiversity assessment:

- Designated sites for nature conservation;
- Habitats;
- Trees;
- Bat roost potential;
- Bird activity and protected species activity; and
- Connectivity to or intersection with watercourses.

1.3 Assessment Criteria

The Stage 2 Appraisal Process was carried out using the full range of sub criteria recommended in PAG unit 7.0, and with regard to the objectives of the scheme, so as to take account of all the predicted impacts of each option or alternative. In many cases there is a strong overlap between the objectives of the scheme and one or more of the PAG sub criteria.

All appraisal criteria use a standard scale. Each impact is scored on a scale of 1 (major or highly negative impact) to 7 (major or highly positive impact). A score of 4 represents a neutral or not significant impact. Each impact is scored as per the system presented in **Table 1-1**.

Table 1-1: Project Appraisal Guidelines Scoring

Score	PAG Score
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

All scores refer to impacts measured relative to the Do-Minimum. The Do-Minimum consists of doing nothing further to improve the N52 route. The Do- Minimum would therefore by definition be scored as Neutral (relative to itself) under all sub criteria.

PAG 7.0 notes that simply adding up the scores of the different sub-criteria gives an indication of the overall performance of each option under a given criterion, but this is not to be used in a mechanistic way as a decision process. The performance of each option in meeting the scheme objectives was then considered to be one of the criteria presented in **Table 1-2**.

Table 1-2: Qualitative Scoring

Score	PAG Score
Preferred	The choice which most fully meets the project objectives.
Good	Where project objectives are met notably better than with the intermediate choices but notably not as well as with the best choice.
Intermediate	Where project objectives are met considerably less well than with the best choice but considerably better than with the worst choice.
Poor	Where project objectives are met notably less well than with the intermediate choices but notably not as well as with the best option.
Least Preferred	The choice which does least to achieve the project objectives.

Having regard to the full range of impacts assessed in each case. This is a high level of ranking of the options or alternatives. The scoring process allows for options or alternatives to be identified as being “Good”, falling between “Intermediate” and “Preferred”, or as “Poor”, falling between “Least Preferred” and “Intermediate”.

For some options there will be very little between their impact scores and some may even have the same impact scores. In such circumstances, the author has applied expert judgement and evaluated each option comparatively against the other options, taking into account the quantitative and qualitative assessments. This has allowed the author to determine a preference for each option. In some instances, similar options may have the same preference.

2 EXISTING ENVIRONMENT

A review of available aerial photography indicates that the following habitats⁴ and land use types are contained within the study area:

- Improved agricultural grassland (arable and pasture);
- Amenity grassland & dry meadows and grassy verges;
- Rough wet grassland, marsh;
- Hedgerows and treelines;
- Woodland and Scrub;
- Rivers;
- Lakes and Ponds; and
- Buildings, road and artificial surfaces.

A large part of the study area is characterised by improved agricultural grassland and areas of pasture. These habitat types, along with built areas such as houses and roads are considered to be of low ecological value in accordance with the definition outlined in the NRA (2009) “*Guidelines for Assessment of Ecological Impacts of National Road Projects*”.

The central portion of the study area has a number of woodlands including Oak-ash-hazel, Bog woodland, as well as semi and mixed broadleaves. Linear hedgerows are also feature within the study area, which are typical boundary features in an agricultural landscape. Woodlands, groups of trees and hedgerows are of considerably greater ecological value, as they provide potential habitats for protected species. Grassland habitats are also visible from the aerial photograph which may have ecological importance depending on the diversity of species within the habitat.

Ancient Woodlands and Long-Established Woodlands were also identified using the NBDC maps. These woodlands have had a continuous history of tree cover since mid-1600’s, these woodlands are of high biological and cultural value. The woodlands identified in this study include Ballyduff Wood which is a semi-natural broadleaf site. South west of Tullamore town, there are a number of ancient woodlands to include Hands Wood (semi-natural broadleaf and conifer plantation), Charleville Killeska, Charleville North (semi-natural broadleaf), Charleville South (Mixed woodland, semi-natural broadleaf and conifer plantation) and Clonad Wood (mixed and conifer). Kiltober esker is located 20km to the east of the study area and is a semi natural broadleaf.

2.1 European Designated Sites

Special Areas of Conservation (SACs) are sites of international importance due to the presence of Annex I habitats and/or Annex II species listed under the EU Habitats Directive (92/43/EEC). Special Protection Areas are designated for the protection of bird species listed on Annex I of the Bird Directive (2009/147/EC), regularly occurring populations of migratory species and areas of international importance for migratory birds.

The general zone of influence applied is typically a 15km buffer area, which helps identify European sites which may have connectivity to the study area and as such may demonstrate a pathway for impact. In some cases, a much smaller area may be more relevant and in some instances the area may be much greater (e.g. for highly mobile species), depending on the requirements of the habitat or species for which the European site has been designated.

For this report, a 15km buffer has been applied around the study area and all SACs within this have been identified. Five (5) SACs were identified and are noted in **Table 2-1**. The five are known to have hydrological connectivity, notably: Lough Ennell SAC; Raheenmore Bog SAC; Split Hills and Long Hills Esker SAC; Clara Bog SAC; and Charleville Wood SAC. Split Hills and Long Hills Esker SAC and Pilgrims Road Esker SAC

⁴ Habitats groupings follow Fossit (2000) classification scheme.

are identified as important sites for orchids. There is potential for remnant eskers to occur within the study area that could support similar floristic assemblages.

A conservative 30km buffer area was selected as a preliminary search area for the SPA's owing to the presence of SCI Whooper swan in particular, an SPA protected bird species that is known to roam between a number of SPAs and suitable wetland features noted surrounding around the study area up to distances of approximately 30km. Ten (10) Special Protection Areas (SPAs), were identified within 30km of the study area and are noted in **Table 2-2**.

The spatial boundary data for the European sites was the most recent available online from NPWS (December 2019).

The study area is contained within the Lower Shannon catchment and spans the Brosna_SC_030, Brosna_SC_020, Silver (Tullamore)_SC_010, sub-catchments. The Brosna River is a key waterbody within this area as it is the third largest tributary of the River Shannon, it flows directly through the study area and drains into Shannon Harbour, which is located in the Shannon Callows. The Shannon Callows SAC is over 26km from the study area, but this hydrological connectivity will be an important consideration.

Table 2-1: Special Areas of Conservation within 15km of the Study Area

Site Code	Site Name	Qualifying Interest Habitats and Species (*=Priority Habitat) ⁵	Distance from Study Area (km) ⁶	Connectivity
Special Area of Conservations (SACs)				
000571	Charleville Wood SAC	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <p>Annex I Habitats</p> <ul style="list-style-type: none"> • Old Oak Woodlands [91A0] <p>Annex II Species</p> <ul style="list-style-type: none"> • Geyer's Whorl Snail (<i>Vertigo geyeri</i>) [1013] 	c. 4.5km	Yes. There is hydrological connectivity between the Silver (Tullamore) River, and this designated site. This site contains a key species - the Geyers Whorl Snail.
000572	Clara Bog SAC	<p>Conservation Objectives Specific Version 1.0 (03/08/16)</p> <p>Annex I Habitats</p> <ul style="list-style-type: none"> • Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] • Active raised bogs* [7110] • Degraded raised bogs still capable of natural regeneration [7120] • Depressions on peat substrates of the Rhynchosporion [7150] • Bog woodland* [91D0] 	c. 5.4km	No, waterbodies flow directly into this SAC. However, the River Brosna, Silver (Tullamore) River and Durrow Abbey Stream flow through the study area which may pose a potential impact to the designated site as they flow quite close to this site.
000582	Raheenmore Bog SAC	<p>Conservation Objectives Specific Version 1.0 (02/11/15)</p> <p>Annex I Habitats</p> <ul style="list-style-type: none"> • Active raised bogs* [7110] • Degraded raised bogs still capable of natural regeneration [7120] • Depressions on peat substrates of the Rhynchosporion [7150] 	c. 10 km	Yes, hydrological connectivity. This site is located 10km to the east of the study area.
001831	Split Hills and Long	<p>Conservation Objectives Specific Version 1.0 (20/06/18)</p>	c. 4.6km	Yes, there is hydrological connectivity through the River

⁵ NPWS website, accessed 03rd February 2020.

⁶ Distance measured "as the crow flies".

Site Code	Site Name	Qualifying Interest Habitats and Species (*=Priority Habitat) ⁵	Distance from Study Area (km) ⁶	Connectivity
	Hill Esker SAC	<p>Annex I Habitats</p> <ul style="list-style-type: none"> Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites) [6210] 		Brosna. However, this site is located upstream of the study area.
		<p>Conservation Objectives Specific Version 1.0 (19/07/11)</p> <p>Annex I Habitats</p> <ul style="list-style-type: none"> Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide. [1140] Salicornia and other annuals colonizing mud and sand. [1310] Atlantic salt meadows (Glaucopuccinellietalia maritima) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation. [3260] European dry heaths. [4030] Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels. [6430] * Petrifying springs with tufa formation (Cratoneurion) [7220] Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles. [91A0] * Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae. [91E0] <p>Annex II Species</p> <ul style="list-style-type: none"> Desmoulin's whorl snail (<i>Vertigo moulinsiana</i>) [1016] Freshwater pearl mussel (<i>Margaritifera margaritifera</i>) [1029] White-clawed crayfish (<i>Austropotamobius pallipes</i>) [1092] Sea lamprey (<i>Petromyzon marinus</i>) [1095] Brook lamprey (<i>Lampetra planeri</i>) [1096] River lamprey (<i>Lampetra fluviatilis</i>) [1099] Twaite shad (<i>Alosa fallax</i>) [1103] Atlantic salmon (<i>Salmo salar</i>) (only in fresh water) [1106] Killarney fern (<i>Trichomanes speciosum</i>). [1421] 		No. This European site is located within the Portlaoise groundwater body (IE_SH_G_107) and the study area is located within the Tullamore groundwater body (IE_SH_G_232), therefore, there is no hydrogeological connectivity between these sites.
002162	River Barrow and River Nore SAC		c. 13km	

Table 2-2: Special Protection Areas within 30km of the Study Area

Site Code	Site Name	Special Conservation Interest	Distance from Study Area (km) ⁷	Connectivity
004017	Mongan Bog SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] 	c. 20.1km	<p>Yes.</p> <p>There is potential for SPA birds to utilise the habitats within the study area.</p>
004043	Lough Derravaragh SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> Whooper Swan (<i>Cygnus cygnus</i>) [A038] Tufted Duck (<i>Aythya fuligula</i>) [A061] Coot (<i>Fulica atra</i>) [A125] Pochard (<i>Aythya farina</i>) [A059] 	c. 30km	<p>Yes.</p> <p>There is potential for SPA birds to utilise the habitats within the study area.</p>
004044	Lough Ennell SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> Tufted Duck (<i>Aythya fuligula</i>) [A061] Coot (<i>Fulica atra</i>) [A125] Pochard (<i>Aythya farina</i>) [A059] 	c. 12.5km	<p>Yes.</p> <p>There is potential for SPA birds to utilise the habitats within the study area</p>
004045	Glen Lough SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> Whooper Swan (<i>Cygnus cygnus</i>) [A038] 	c. 30km	<p>Yes.</p> <p>At outer edge of 30km buffer identified ZOI. There is potential for SPA birds to utilise the habitats within the study area</p>
004046	Lough Iron SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas Penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Shoveler (<i>Anas clypeata</i>) [A056] Coot (<i>Fulica atra</i>) [A125] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] 	c. 27.7km	<p>Yes.</p> <p>There is potential for SPA birds to utilise the habitats within the study area</p>
004047	Lough Owel SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> Coot (<i>Fulica atra</i>) [A125] Shoveler (<i>Anas clypeata</i>) [A056] 	c. 23.1km	<p>Yes.</p> <p>There is potential for SPA birds to utilise the habitats within the study area</p>
004064	Lough Ree SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> Little Grebe (<i>Tachybaptus ruficollis</i>) [A004] Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wigeon (<i>Anas Penelope</i>) [A05] Teal (<i>Anas crecca</i>) [A052] Mallard (<i>Anas platyrhynchos</i>) [A053] Shoveler (<i>Anas clypeata</i>) [A056] Tufted Duck (<i>Aythya fuligula</i>) [A061] 	c.28.5km	<p>Yes.</p> <p>There is potential for SPA birds to utilise the habitats within the study area</p>

⁷ Distance measured “as the crow flies”.

Site Code	Site Name	Special Conservation Interest	Distance from Study Area (km) ⁷	Connectivity
		<ul style="list-style-type: none"> • Common Scoter (<i>Melanitta nigra</i>) [A065] • Goldeneye (<i>Bucephala clangula</i>) [A067] • Coot (<i>Fulica atra</i>) [A125] • Golden Plover (<i>Pluvialis apricaria</i>) [A140] • Lapwing (<i>Vanellus vanellus</i>) [A142] • Common Tern (<i>Sterna hirundo</i>) [A193] 		
004096	Middle Shannon Callows SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> • Whooper Swan (<i>Cygnus cygnus</i>) [A038] • Wigeon (<i>Anas penelope</i>) [A050] • Golden Plover (<i>Pluvialis apricaria</i>) [A140] • Corncrake (<i>Crex crex</i>) [A122] • Lapwing (<i>Vanellus vanellus</i>) [A142] • Black-tailed Godwit (<i>Limosa limosa</i>) [A156] • Black-headed Gull (<i>Larus ridibundus</i>) [A179] 	c. 26.1km	Yes. There is potential for SPA birds to utilise the habitats within the study area
004102	Garriskil Bog SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> • Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) [A395] 	c.30km	Yes. There is potential for SPA birds to utilise the habitats within the study area
004160	Slieve Bloom Mountain SPA	<p>Conservation Objectives Generic Version 6.0 (21/02/18)</p> <ul style="list-style-type: none"> • Hen Harrier (<i>Circus cyaneus</i>) [A082] 	c. 17.5km	No It is unlikely to impact as it is not an upland site.

2.2 National Designated Sites

There are sixteen (16) proposed Natural Heritage Areas (pNHAs) and seven (7) Natural Heritage Areas (NHAs) located within 15km of the proposed development. These are listed in **Table 2-3** and the pNHAs within the study area are displayed in **Figure 2-1**.

NHAs are sites deemed to be of national ecological importance and are afforded protection under the Wildlife Amendment Act 2000, with many NHA boundaries overlapping with European Sites. The pNHAs have not been statutorily proposed or designated under the Wildlife Act; however, they do have some protection under schemes such as Rural Environment Protection Scheme (REPS), Agri-Environmental Options Scheme (AEOS) and County Development Plans.

Table 2-3: Nationally Designated Sites within 15km of the Study Area

Site code	Site Name	Site Features of Note	Distance from Study Area (km) ⁸	Connectivity
Natural Heritage Area (NHA)				
002033	Daingean Bog NHA	<p>Site Synopsis (14/11/02) Includes both areas of high bog and cutover bog. The bog is of particular interest as it is one of the most easterly remaining raised bogs in the country.</p>	c. 10.3km	No. There is no hydrological connectivity between this nationally designated site and the study area.
002355	Hawkswood Bog NHA	<p>Site Synopsis (20/11/02) The site comprises a raised bog that includes both areas of high bog and cutover bog and adjoins Clonard Wood NHA (574) to the west. The high bog has pools present and is still wet and quaking in places with very little drainage and no forestry.</p>	c. 8.6km	Potential connectivity through the grand canal.
000921	Screggan Bog NHA	<p>Site Synopsis (14/11/02) The site comprises a raised bog that includes areas of high-and cutover bog. It also contains a mix of coniferous, deciduous and scrub areas. There are areas with occasional small pools, and some poorly developed hummock/hollow systems in the largest section. Much of the bog is quite dry due to drainage and peat cutting at the margin. An unusual feature is the extensive colonisation of its southeast portion by Scots Pine (<i>Pinus silvestris</i>).</p>	c. 9.1km	No. This site is located to the south west of Tullamore and has no direct connectivity through waterbodies. However, it is in the same groundwater body – Geashill (IE_SH_G_103)
000572	Clara Bog NHA	<p>Site Synopsis (04/02/2020) Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (<i>Sphagnum</i> spp.). Clara Bog has long been regarded as one of the most important raised bogs in the country, being the largest remaining example of the true midland sub-type. It has well-developed hummock and hollow complexes, and one of the few remaining soak systems.</p>	c. 5.7km	No connectivity. This designated site is located within its own groundwater body. However, it does have the rivers Brosna and Silver (Tullamore) flowing close to the site from the study area. There was less than 1km distance between this designated site and the rivers, however, neither of the rivers flow directly into the site.

⁸ Distance measured “as the crow flies”.

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Site code	Site Name	Site Features of Note	Distance from Study Area (km) ⁸	Connectivity
001725	Nure Bog NHA	Site Synopsis (14/11/02) Nure Bog NHA is located 11 km south-west of Mullingar. The site comprises a raised bog that includes both areas of high bog and cutover bog and adjoins Lough Ennell to the east.	c. 10.4km	No connectivity The site is located upstream of the study area.
000677	Cloncrow Bog NHA	Site Synopsis (14/11/02) Cloncrow Bog (New Forest) NHA is situated approximately 1 km west of Tyrellspass, in the townlands of Cloncrow and Tyrellspass in Co. Westmeath. The site comprises a raised bog that includes both areas of high bog and cutover bog.	c. 7km	No connectivity. The site is located upstream of the study area.
000685	Lough Ennell NHA	No site description provided. However, it overlaps with Lough Ennell SAC & SPA whose qualifying features are described in Table 1.1 .	c. 11.2km	Yes. There is direct hydrological connectivity between this designated site and the study area. Although it is located upstream of the study area.
Proposed Natural Heritage Areas (pNHA)				
000571	Charleville Wood pNHA	Site Synopsis (29/08/13) An area of deciduous woodland situated on low-lying agricultural land bordering the Clodiagh River. The rare Alder Buckthorn (<i>Frangula alnus</i>) and Bird Cherry (<i>Prunus padus</i>) are found in the woodland, while Irish Whitebeam (<i>Sorbus hibernica</i>) is also abundant.	c.4.5 km	Yes. This designated site is located downstream of the study area. The groundwater body is shared with that of the study area.
000586	Woodfield Bog pNHA	Site Synopsis (11/11/09) It lies in a geographical area which contains two highly-rated raised bog nature reserves – Clara Bog and Raheenmore Bog. Woodfield Bog is important as a good example of Midland Raised Bog. This habitat type is increasingly rare in Ireland and Europe. Furthermore, Woodfield Bog is the only midland station for the threatened Marsh Clubmoss (<i>Lycopodiella inundata</i>).	c. 7.3 km	Yes. Potential connectivity from the Gageborough River. The River Brosna flows through the Split Hills and Long Hill Esker site which could potentially be linked with the Gageborough River.
000896	Derrygolan Esker pNHA	Site Synopsis (13/11/09) A nationally important population of the rare Green-winged Orchid (<i>Orchis morio</i>) is reported as thriving at this site. This site is also of conservation importance because it is one of the few remaining examples of an unexploited esker, a habitat which is	c. 5.6km	Potential connectivity as this protected site is located within the study area and specifically 1km east of the N52 road.

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Site code	Site Name	Site Features of Note	Distance from Study Area (km) ⁸	Connectivity
		becoming increasingly rare due to the extraction of glacial sands and gravel.		
000916	Pallas Lough pNHA	<p>Site Synopsis (13/11/09) Limestone-rich gravel drift over Lower limestone. The aquatic component of the lake vegetation is reputed to be rich, with Charophytes (<i>Chara</i> spp. and <i>Nitella</i> spp.) and pondweeds (<i>Potamogeton</i> spp.). Significant numbers of wildfowl and waders use the lake. This area is of botanical interest due to the diversity of plant habitats and the species richness of those habitats.</p>	C 11km	Yes. There may be overlap here as groundwater body spans up into the study area therefore may be impacted.
001711	Ardan Wood pNHA	<p>Site Synopsis (25/11/09) Crescent shaped woodland on a steep slope. Forming the edge to a broader deposit of glacial drift than the normal eskers. It is wooded mostly by large Pedunculate Oak (<i>Quercus robur</i>) with a mixed and varied ground flora. This wood is likely to house nesting Sparrowhawks, and Long-eared Owls.</p>	c. 4km	No connectivity. However, this site is located to the east side of the study area. Two rivers Ardnaglew and Tanaphort flow around this site but do not flow through the site. The direction of flow is flowing towards the site indicating low potential.
001777	Ballyduff Wood pNHA	<p>Site Synopsis (26/11/09) This is a small area of Beech (<i>Fagus sylvatica</i>) woodland on glacial drift. The woodland is situated on an esker ridge and patches of typical grassland communities can be seen alongside the road. The abundance of Spindle (<i>Euonymus europaeus</i>) is of particular note.</p>	c. 2km	Potential connectivity as this site is within the immediate vicinity of the study area. This site is approximately 330m from the Silver River however, impacts are unlikely as there is no direct connectivity between the river and the site.
000689	Lough Sewdy pNHA	<p>Site Synopsis (11/11/2009) Shallow lake over glacial drift with alkaline fen on margins. The threatened Red Data Book species, Round-leaved Wintergreen (<i>Pyrola rotundifolia</i>), has been noted from the site.</p>	c. 19.6km	No connectivity. Due to the distance from the study area and no hydrological connectivity.
001775	Murphy's Bridge Esker pNHA	<p>Site Synopsis (26/11/09) This elongated gravel ridge is a feature of glaciation. It was formed under the ice mass which covered the Irish Midlands during the last Ice Age. The ridge runs in a north-east/south-west direction and is bisected</p>	c. 4.8km	Yes, there is hydrological connectivity. The study area is located to the east of this site and the Silver (Tullamore) River flows through

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Site code	Site Name	Site Features of Note	Distance from Study Area (km) ⁸	Connectivity
		by the Grand Canal approximately 7km north-east of Tullamore. The rare and legally protected Red Hemp-nettle (<i>Galeopsis angustifolia</i>) has recently been recorded in this site. This species grows on eskers in arable fields and in waste places. It has been recorded at only seven sites in four counties in the Republic since 1970. Another rare plant, Blue Fleabane (<i>Erigeron acer</i>) has also been recorded on this site along with Red Hemp-nettle.		this site, however, the location of the site and direction of the flow should not impact the protected site.
000413	Annaghmore Lough fen (Offaly) pNHA	<p>Site Synopsis (06/11/09) Situating about 10km south of Tullamore, on the border of Laois and Offaly below the Slieve Blooms, Annaghmore Lough Fen is a Natural Heritage Area (NHA). Annaghmore Lough itself is a small remnant pool, barely 2ha and only a couple of centimetres deep. It is not clear whether the lake shrinkage has been purely the result of the natural process of sediment accumulation, or whether this has been accelerated by drainage. However, the area once occupied by the lake, is now a peat accumulating, calcareous fen.</p>	c. 12.3km	Yes. Potential connectivity through groundwater Geashill (IE_SH_G_103)
000574	Clonad Wood pNHA	<p>Site Synopsis (11/11/09) Clonad Wood is an area of deciduous woodland situated on low-lying agricultural land bordering the Clodiagh River, 5km south of Tullamore in Co. Offaly.</p>	c. 6km	Yes there is hydrological connectivity through the groundwater body Geashill (IE_SH_G103), which covers part of the study area.
000906	Kilcormac Esker pNHA	<p>Site Synopsis (13/11/09) Eskers are long ridges of glacial till which were deposited at the end of the last ice age. As geomorphological features, these relicts of the retreating ice are of great importance. However, the well-drained, calcium-rich soils of eskers often support interesting and species-rich vegetation.</p>	c. 9.7km	Yes. There connectivity for this site through the Tullamore groundwater body (IE_SH_G_232).
000917	Raheen Lough pNHA	<p>Site Synopsis (13/11/09) Raheen Lough lies 10km north of Mountmellick in Co. Offaly. It is set in pasture grazed by cattle and sheep. There is an inflowing stream, and the absence of a surface outfall may indicate that there is underground drainage. This may help to explain the</p>	c. 14.5km	No connectivity. No waterbodies flow into this protected site and the groundwater body is to different to the study area.

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Site code	Site Name	Site Features of Note	Distance from Study Area (km) ⁸	Connectivity
		fluctuating water levels that sometimes inundate the immediate shore. The basin is stoney bottomed and shallow. The water appears to be clean, supporting the pollution intolerant Alternate Water-milfoil (<i>Myriophyllum alterniflorum</i>). However, its main interest lies in the variety and numbers of wildfowl and waders that it attracts. In this it has a particularly important role because open water bodies are infrequent in the area.		
000885	Ballyduff Esker pNHA	<p>Site Synopsis (12/11/09) Ballyduff Esker in Co. Offaly runs from north of Rahan to south of Tyrellspass. As a feature of glacial deposition, the whole structure is of interest, but around Trumpet Hill a Natural Heritage Area has been proposed for designation because the area is also, of considerable ecological interest. Here the eastern end comprises three high ridges with two steep sided and deep depressions. West of the road there are two main ridges with several short side branches which reflect the path of meltwater channels within the retreating ice at the end of the last ice age. The result is a well-drained glacial till.</p>	c. 4.1km	Yes, possible connectivity from the Silver (Tullamore) River.
000918	Rahugh Ridge pNHA	<p>Site Synopsis (13/11/09) This proposed Natural Heritage Area starts about 9km north-east of Tullamore and runs for about 2.5km in a north-easterly direction. It is a particularly fine esker ridge covered for almost its entire length in woodland.</p>	c. 4.7km	Yes, there is hydrological connectivity. The study area is located to the east of this site and the Silver (Tullamore) River flows through this site, however, the location of the site and direction of the flow should not impact the protected site.
000586	Woodfield Bog pNHA	<p>Site Synopsis (11/11/09) Woodfield Bog is located approximately 3km north of Clara town in Co. Offaly. It is a medium-sized raised bog which was formerly approximately 250ha in extent, but has been reduced to approximately 135ha due to turf-cutting and land reclamation. It lies in a</p>	c. 7.1km	Yes. Possible connectivity through Clara groundwater body.

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Site code	Site Name	Site Features of Note	Distance from Study Area (km) ⁸	Connectivity
		geographical area which contains two highly-rated raised bog nature reserves – Clara Bog and Raheenmore Bog.		
002104	Grand Canal pNHA	<p>Site Synopsis (2012-2018)</p> <p>Various habitats are found within the canal boundaries – hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland.</p>	<i>c. 4.5km</i>	Yes. There is direct hydrological connectivity between this designated site and the study area through the Silver (Tullamore) River.

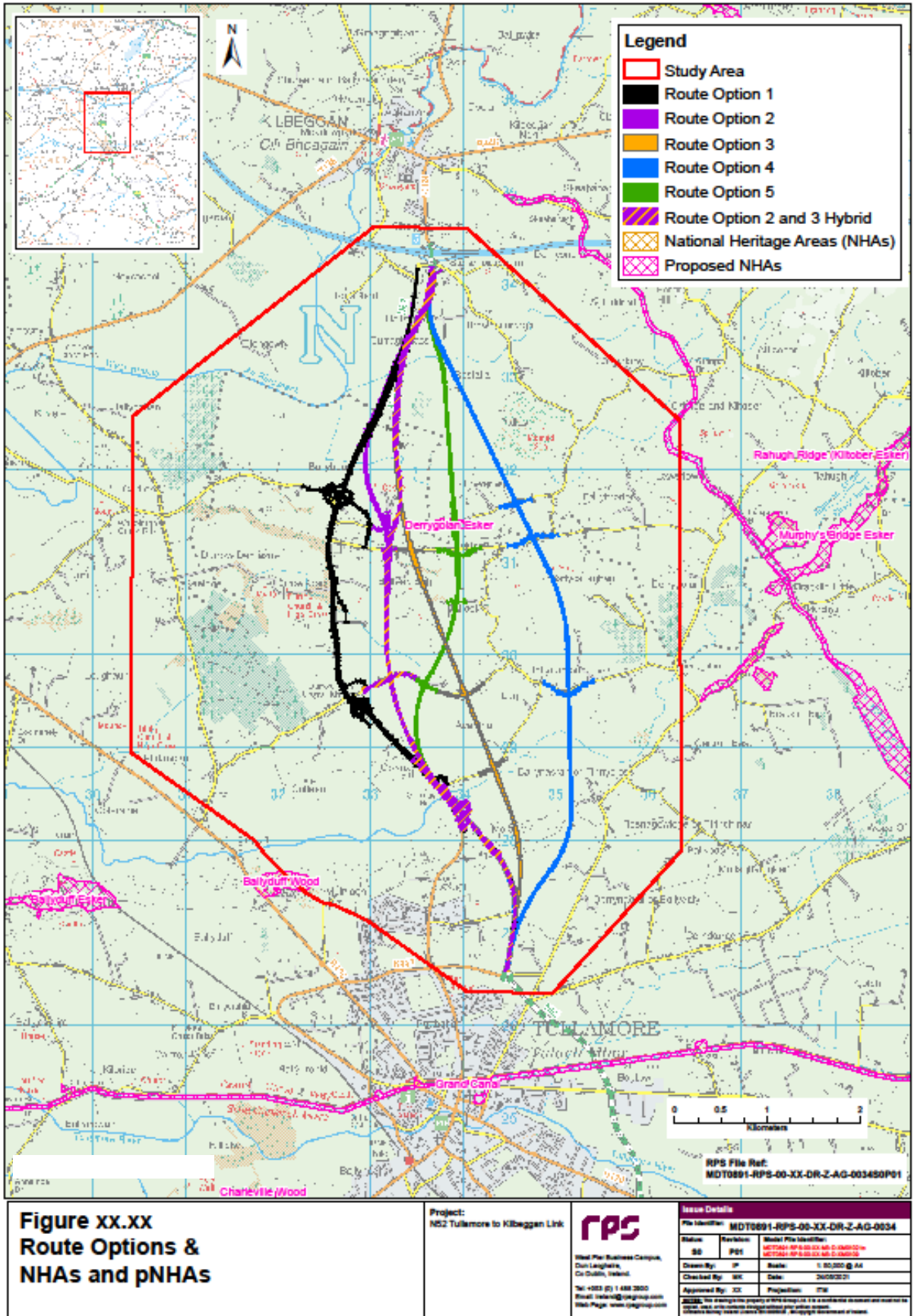


Figure 2-1: National Designated Sites (Source: NPWS, 2021)

2.3 Fisheries and Aquatic Environment

Following an examination of the EPA envision database (River Network Routes), the following watercourses were noted as intersecting the study area:

- Brosna River;
- Silver (Tullamore) River;
- Tanaphort River
- Durrow Abbey stream;
- Ballinderry River;
- Balleek Beg;
- Aghuldred;
- Ardnaglew; and
- Tullamore River.

In addition, the following five watercourses are located a short distance outside the study boundary area.

- Corndarragh Stream;
- Grangibbon;
- Doory;
- Aghalusky; and
- Puttaghan.

All of these water features, rivers and streams are contained within the Lower Shannon catchment and form part of the Shannon River system. Chief among them is the River Brosna, which is the third largest tributary of the River Shannon. It rises in Lough Owel and flows directly through the study area. The River Brosna is a key river to consider as it is one of the largest within the study area therefore is connected with many important sites.

In 2006, Inland Fisheries Ireland recorded White Clawed Crayfish in the Brosna/Tullamore rivers. The White-clawed Crayfish is listed on Annex II and Annex V of the Habitats Directive and the species is protected in Ireland under the Wildlife Acts. In 2008, the Environmental Protection Agency recorded White-clawed crayfish in various locations across the river Brosna. This includes Lahinch Station, which is located upstream of Clara, approximately 4.2km from the study area and the station named the 'bridge near Lismoyney'. The White-clawed Crayfish has been affected in recent years from the introduction of other species of crayfish species and the arrival of the crayfish plague. The most recent outbreak of the crayfish plague was on the River Slate at Rathangan in May 2019, which is located 28.9km from the site. The River Barrow also had previous outbreaks in 2017 and 2018, Other records of crayfish plague have been recorded in Co. Longford and in Co. Westmeath. Considering that Westmeath is part of the study area it is important to note that crayfish plague may be a constraint within this region due to a hydrological link between the Shannon upper and lower, biosecurity measures are essential to prevent further spread.

Wetlands

There are a number of wetland areas located within and in the immediate vicinity of the study area⁹: Data was obtained from wetland surveys Ireland website and accessed in February 2020. The presence of these wetlands, some of natural origin, are considered of national importance. Others are manmade or modified

⁹As per Wetland Surveys Ireland maps. Accessed at: <http://www.wetlandsurveysireland.com/wetlands/map-of-irish-wetlands--/map-of-irish-wetlands---map/index.html> (accessed February 2020)

and are largely unclassified in terms of biodiversity potential as indicated from the Wetlands Surveys Ireland database. However, they increase the potential for waterbird habitat within the study area.

- Rostalla created Wetland (WMI_WM398) is located approximately 1.89km south east of Kilbeggan town. It is comprised of an artificial pond and reed swamp. This site has not yet been classified.
- Grand Canal pNHA (Westmeath)(WMI_WM48) is located approximately 3.84km south east of Kilbeggan town. The Kilbeggan Branch is dry at present, but it is hoped to restore it in the near future. Habitats within the site include canal, alkaline fen, reed swamp, cutover bog and scrub. This site is classified as being ‘Nationally Important’.
- Durrow Demesne (WMI_OF256) is located approximately 0.14km west of the N52 midway between Kilbeggan town and Tullamore. Habitats within the site include wet grassland, wet woodland (oak, ash or willow alder) and scrub. This site has not yet been classified.
- Ballycallaghan Ballynamona Bog Woodland (WMI_OF257) is located centrally to the east of the study area. Habitats include wet grassland, cutover bog and bog woodland. This site has not yet been classified.
- Murphy’s Bridge Esker (Westmeath)(WMI_WM16) is located approximately 5km north east of Tullamore. Habitats include reed swamp, alkaline fen and scrub. This site is classified as being ‘Nationally Important’.
- Cappancur (WMI_OF261) is located approximately 2.5km east of Tullamore. The habitats include canal, marsh, wet grassland, bog woodland and scrub. This site has not yet been classified.
- Colehill West Cutover (WMI_OF260) is located approximately 3.6km east of Tullamore. The habitats include river, wet grassland, cutover bog, fen, bog woodland and scrub. This site has not yet been classified.

2.3.1.1 Protected Species and Invasive Species

The study area lies within the Ordnance Survey 10km x 10km grid squares N32 and N33. Records of rare and protected species of flora and fauna from this grid square were obtained from the National Biodiversity Data Centre (NBDC) online database and the NPWS online database. Invasive species occurring within the area are presented in **Table 2-4**.

Table 2-4: Records of Invasive Species of Flora and Fauna

Scientific Name	Common Name	Date of Last Record	Location/ Grid Square Ref	Designation
Invasive Species				
<i>Mustela vison</i>	American Mink	09/01/1980	N33	High Impact Invasive Species; and listed on S.I. 477
<i>Sciurus carolinensis</i>	Eastern Grey Squirrel	03/12/1968	N33	High Impact Invasive Species; and listed on S.I. 477
<i>Dama</i>	Fallow Deer	27/02/1991	N33	High Impact Invasive Species; and listed on S.I. 477
<i>Hyacinthoides hispanica</i>	Spanish Bluebell	25/05/2013	N32	Invasive Species >> Regulation S.I. 477

2.4 Key Species Identified

Pine Marten (*Martes martes*)

As a protected species it should be considered as a possible constraint in this project. The Pine Marten is important to consider as a potential constraint, as there were sightings in the Kilbeggan area in 2013, 2017 and 2018. Some of the habitats where there were sightings recorded included woodland areas such as Charleville Wood, and Charleville Demesne.

Badger (*Meles meles*)

It is likely, given the agricultural nature of the study area, that Eurasian Badger (*Meles meles*) occurs within the study area. This is borne out by records of sightings of badger throughout the study area, with the most recent record taken in 2018.

Otter (*Lutra lutra*)

Otters were recorded as qualifying interests in two of the SAC sites within the 30km buffer zone, of the study area. The sites include Lough Ree SAC and Shannon Callows SAC. Given the number of watercourses within the study area, the most recent records for the otter was in 2012 when three individuals were recorded. There is potential for otter to occur throughout the study area.

White-clawed Crayfish (*Austropotamobius pallipes*)

Lough Owel SAC is designated for this Annex II species within the 30km buffer zone, which is hydrologically connected to the study area, however, the study area is located downstream of this site. There have also been sightings of the White-clawed Crayfish along the River Brosna which flows through this SAC. The freshwater White-clawed Crayfish has been recorded at various sites along the River Brosna identified by the Environmental Protection Agency in 2008 and the Tullamore river, which was identified by Inland Fisheries Ireland in 2006, both of which are connected to the study area. Another consideration is the Lough Owel SAC which designated for this Annex II species, it is also connected to the study area through the river Brosna.

Geyer's Whorl Snail (*Vertigo geyeri*)

This snail is listed as a qualifying feature for Charleville Wood SAC, located approximately 4.5km to the south west of the study area. There is a hydrological connection between this site and the study area through the Tullamore River. The most recent record identified from the NBDC database was in identified in 2005.

Whooper Swan (*Cygnus cygnus*) and Birds

According to the National Parks and Wildlife and NBDC database, many areas surrounding the study area contain Wintering Wildfowl. The Whooper Swan was recorded in several of the SPA's in the area as locally abundant throughout the region, although the numbers fluctuate with each season. As a result, wintering wildfowl are found in a number of areas surrounding the study area, which have been designated as SPAs. It is important to consider that birds can travel large distances foraging and breeding.

To inform this assessment, RPS engaged in a series of overwintering bird surveys in early 2021 with the following findings noted:

- No large flocks of target species were observed during surveys.
- Waders: Individual snipe and woodcock were noted on several dates and a small flock of lapwing and golden plover were recorded in fields adjacent to the existing N52. Further small flocks of lapwing and 19 curlew were recorded in the southern section of the survey area.
- Wildfowl: Individual or small numbers of mallard were noted on water courses on a number of dates during survey.
- Raptors: Buzzards were a regular observation within the survey area. Individual peregrine, sparrowhawk and kestrel were observed hunting over the survey area on several dates.
- Passerines: Several large flocks of passerines, mostly chaffinch, were noted feeding on stubble. These are highly mobile species and their presence and is influenced by the presence of suitable feeding.

Blue Fleabane (*Erigeron acer*)

The Blue Fleabag is a rare plant that favours calcium rich substrates and is found on eskers and dry grasslands, sandy pastures and walls. This species is considered threatened within Ireland. This should be taken into consideration, as it is found in Murphy's Bridge Esker pNHA, which is located approximately 3.8km from the study area.

2.5 Study Area and Options

2.5.1 “Do-Something” Options

Each of the six route “Do-Something” options brought forward for Stage 2 assessment are described below:

- Proposed Option 1 (8.54km) follows existing N52 closely in horizontal and vertical alignment. The proposed cross section is wider than the existing carriageway in sections and will involve land take along the edges of the road. Multiple existing field accesses along N52 will be joined by parallel collector roads or diverted to the local roads minimizing field access points to the new carriageway.
- Proposed Option 2 (8.17km) follows the existing N52 closely in horizontal and vertical alignment from the Tullamore Bypass roundabout until chainage 2050. At chainage 2050 it diverges east from the existing N52 and joins back to the existing alignment at chainage 6400. The 4350m new offline road allows for elimination of substandard junctions at Four Roads and Durrow Village. The Option 2 will cross Derrygolán Esker at chainage 5050 to 5200. Option 2 contains the shortest offline section, trying to utilise as much as possible of the existing road. Option 2 skirts to the left of the national monument of Meeneglish avoiding direct impact on the monument at chainage 5700. Four crossings of waterbodies will be required on Option 2 at chainages: 2150, 3850, 5900 and 7000.
- Proposed Option 3 (7.90km) diverges east from the existing N52 at chainage 600. It crosses Molloy’s Quarry at chainage 1250-1600 and the source protection area at chainage 1000-2100. Three road crossings are proposed along the Option 3: at chainage 2240 with L2003, at chainage 3120 with L2005 and at chainage 4790 with L2006. Three crossings of waterbodies will be required on the Option 3 at chainages: 2150, 5780 and 6800. Option 3 joins the existing N52 alignment at chainage 7000 following to the M6 junction.
- Proposed Option 4 (8.09km) is an eastern option and diverges east from existing N52 at chainage 250. It crosses Molloy’s Quarry at chainage 1750-1950 and the source water protection area at chainage 1000-2400. Two road crossings are proposed along Option 4: at chainage 3200 with L2005 and at chainage 4900 with L2006. Option 4 avoids crossing Derrygolán Esker passing it on the east at chainage 4900. It then goes north west passing west of Pallas forest at chainage 6000. Two crossings of waterbodies will be required on Option 4 at chainages: 2730 and 7050. Option 4 joins the existing N52 alignment at chainage 7850 and follows to the M6 interchange.
- Proposed Option 5 (8.05km) diverges east from the existing N52 at chainage 2300 making use of an already upgraded alignment of N52 up to this point. The proposed alignment east of the existing N52 replaces two substandard junctions at Four Roads and Durrow Village and substandard horizontal and vertical alignment of N52 at the middle section. Two road crossings are proposed at Option 5: at chainage 3480 with L2005 and at chainage 4990 with L2006. Option 5 crosses Derrygolán Esker at chainage 4900-5000. Two crossings of waterbodies will be required on Option 5 at chainages: 2150 and 7050. Option 5 joins the existing N52 alignment at chainage 7850 and follows to the M6 interchange.
- Proposed Option 2-3 (8.10km) was developed during the course of the scheme development and appraisal as a combination of Options 2 and 3 above. This option combines the southern part of Option 2 with the northern part of Option 3 and has been developed as a means of further minimising impact on the Ballybought Castle site identified for Option 2.

2.5.2 Management Option

As a result of the TII review process (July 2021), an additional “Management Option” has been put forward for consideration/assessment within the Stage 2 Options Assessment Phase. The proposed “Management Option” follows the existing N52 Tullamore to Kilbeggan alignment (8.54km) and would involve upgrading a number of sections, mainly along the centre of the existing scheme. This would result in a single carriageway in each direction with roundabouts at junctions, including the following elements:

- Three roundabout junctions proposed; at R42-N52 junction, at Four Roads Cross / L2005, and Durrow Village / Balleek Beg;
- Priority junctions at L2003-N52 Junction north of existing Silver River Bridge and at the L2006-N52 junction north of Durrow Village / Balleek Beg;
- Carriageway to be upgraded to Type 1 Single Carriageway Cross Section (circa chainage 2500);

- Proposed *cul de sac* at L2005-N52 Junction; and
- Carriageway to be upgraded to Type 1 Single Carriageway Cross Section with localised green verge narrowing between proposed *cul de sac* at L2005-N52 Junction and Durrow Village / Balleek Beg.

Regarding the context of this additional option, this is a Management Option as opposed to a Do-Minimum option. This option sits between a Do-Minimum and the Do-Something options proposed. This Management Option considers a short to medium term solution that may be able to achieve some of the objectives of the scheme.

In comparison to Option 1 (Brown), while the Management Option will follow the same centre line (i.e. the existing N52 Tullamore to Kilbeggan alignment), it is proposed as a single carriageway (Type 1 single) rather than a dual-carriageway as per the other Do-Something options. This option provides at-grade roundabouts at the key junctions, rather than grade separated junctions. However, this Management Option does not address the significant private accesses onto the N52 while Option 1 (Brown) requires a significant number of parallel roads to accommodate private accesses.

The southern and northern sections will require only minimal intervention as these have been recently upgraded, and it is essentially the middle section of the route that requires the most intervention (from the R421 junction to a point approx. halfway between the L2006 High Road and the M6 interchange). Across this section there is still likely to be hedge line loss to accommodate the wider carriageway (on both sides), although the extent of this loss will be considerably lower than Option 1.

In terms of impacts on Durrow Demesne, while Option 1 will potentially directly impact on the boundary at Durrow Demesne with tree and hedge line loss and the design can try to reduce the impacts on the wall, there is potential that there would be direct impact to the boundary wall with Option 1. This tree and hedge line loss impact would be more limited for the Management Option with less road widening and no impact on the boundary walls.

3 OPTION SELECTION

3.1 Methodology

MapInfo software and online sources such as Geological Survey Ireland Spatial Resources, NPWS maps and EPA Maps have been used to perform a geographic information system (GIS) analysis on biodiversity.

The options were assessed with respect to their likely impact on biodiversity attributes. Each of the proposed route options will be considered in respect of designated sites for nature conservation, habitats, trees, bat roost potential, bird activity and protected species activity, as well as connectivity to or intersection with watercourses. Birds are assumed to be using the area along all route options where suitable habitat is present, such as grassland. Initial wintering bird surveys have indicated the presence of raptors, finch and waders (lapwing, curlew and woodcock).

3.2 Management Option

The management option is characterised by the existing road and would require upgrading a number of sections, mainly along the centre of the existing scheme, and involve land take along the edges of the road, including development of local road access routes. This route option would involve the removal of up to 5km of hedgerow either side the existing road in order to accommodate widening.

In terms of potential impacts, an area of mature wood (High Wood) is located to the west alongside the existing N52 boundary and proposed L2006 roundabout. High Wood is part of Durrow Abbey Demesne. Mature tree removal would also be required at the proposed L2005 roundabout and link roads.

This route option may cause potential disturbance to bat commuting and/or loss of roosts, particularly within High wood and the corridors to which it is linked.

Disturbance to the River Brosna via connectivity of ditches may also occur without adequate drainage measures. The management option may impact water quality within four river water bodies, namely; the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Tullamore Silver River. The Brosna River is an important site for salmonids and crayfish. All mentioned watercourses provide downstream connectivity (30km) to the Shannon Callows SAC and SPA, where Otter and several protected bird species are features of interest.

Breeding bird activity may also be temporarily disturbed throughout this route and the surrounding area. This route is located <1km from Derrygolan Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich, e.g. grassland wildflowers including wild orchids.

3.3 Option 1

Option 1 is characterised by the existing road and would require significant localised widening of the existing carriageway involving land take along the edges of the road, including development of local road access routes. This route option would involve the removal of up to 8km of hedgerow either side the existing road in order to accommodate widening.

In terms of potential significant impacts, an area of mature wood (High Wood) is located to the west alongside the existing N52 boundary. High Wood is part of Durrow Abbey Demesne. Five other wooded areas are also located along this route. One of these, located along the L2006 High Road and north of Saint Colmcille Church Durrow, would become fragmented as a result of the construction of a local link road which would tie into the existing N52.

This route option may cause potential disturbance to bat commuting and/or loss of roost, particularly within High wood and the corridors to which it is linked, depending on the extent of land take and disturbance. This is also true for those more discrete wooded habitats and an identified mature beech tree line alongside the existing N52. A 6m parallel link road would additionally increase the loss of the identified mature beech tree line and adjacent hedgerows.

Disturbance to the River Brosna via connectivity of ditches may also occur without adequate drainage measures. This could also involve widening/replacement of crossing points with four river water bodies,

namely; the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Tullamore Silver River. The Brosna River is an important site for salmonids and crayfish. Durrow Abbey Stream would be intersected twice due to a proposed local access road opposite Durrow Abbey Demesne and the Silver River would require bridge upgrades in addition to road widening to include a parallel link road and realignment of the L2003. All mentioned watercourses provide downstream connectivity (30km) to the Shannon Callows SAC and SPA, where Otter and several protected bird species are features of interest.

Breeding bird activity may also be disturbed throughout this route and the surrounding area. Land take from local side roads may alter their access to the N52 and additional road networks may be required to do so. This route is located <1km from Derrygolán Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich, e.g. grassland wildflowers including wild orchids.

3.4 Option 2

Option 2 is the shortest greenfield option and follows the existing N52 alignment in a southerly direction before veering in a south easterly direction across agricultural land – managed grasslands and tillage fields.

This route option would involve the severance of 43 hedgerows, habitat loss (albeit of potentially low ecological value agricultural land) and the removal several hedgerows to accommodate overbridges and local access link roads in addition to up to 4km of hedgerow removal either side of the existing N52. This option traverses four watercourses and intersects with three woodland areas. One of these wooded areas was found to contain a considerable number of installed bat boxes.

Bat roosting potential was identified along this route option, included a number of mature oak and beech trees in hedge lines and as discrete features. This route option may cause potential disturbance to bat commuting and/or loss of roosts.

There is evidence of mammal activity along this route including that of badger where a number of active badger setts were noted 120m east of the route and 280m north of the L2006. The local access overbridge proposed at this location is <100m from the identified Badger setts.

Four watercourses would be intersected by the route option, namely; the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Silver River. The Silver River would require bridge upgrades and would be subject to road widening to include a parallel link road and realignment of the L2003. The Brosna is an important site for salmonids and crayfish. All mentioned watercourses provide downstream connectivity (30km) to the Shannon Callows SAC and SPA, where Otter and several protected bird species are features of interest.

Bird activity may also be disturbed throughout this route and the surrounding area such as breeding, wintering and wading birds. This route is located <500m from Derrygolán Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich, e.g. grassland wildflowers including wild orchids.

3.5 Option 3

Option 3 diverges from the N52 at its northern end and largely crosses improved agricultural grassland habitat and tillage fields.

This route option intersects four woodland areas and severs 55 hedgerows in addition to up to 1.5km of hedgerow removal either side of the existing N52. The wooded areas intersected by the route option are characterised by mature, broadleaf species and would increase the potential for bat and other protected species. Given the number of tree-dominated hedgerows, bat roost potential was estimated as moderate in specific areas. This route option may cause potential disturbance to bat commuting and/or loss of roost.

There is evidence of mammal activity throughout including badger, where an active badger sett was noted 180m west of the route option, close to Belmont. The dormant quarry which is intersected along the southern part of the route option increases the biodiversity significance of and potential for species such as amphibians which cannot be ruled out owing to its size and relative current abandonment.

Three watercourses are intersected by the proposed route option, namely; the Durrow Abbey Stream, the Tonaphort (a tributary of the Brosna), and the Tullamore Silver River. The Brosna River and its tributaries are

important sites for Salmonids and Crayfish. All mentioned watercourses provide downstream connectivity (30km) to the Shannon Callows SAC and SPA, where Otter and several protected bird species are features of interest. Bird activity may also be disturbed throughout this route and the surrounding area such as breeding, wintering and wading birds, particularly where this option intersects a motorway attenuation pond which has the potential to provide habitat for wintering birds and/or Otter and other protected species.

This route option is additionally located <300m from Derrygolan Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). However, where more detailed design shows ramping up to overbridges and overbridges themselves, this route option becomes closer to the Derrygolan Esker pNHA (<200m). Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich, e.g. grassland wildflowers including wild orchids. Bird activity may also be disturbed throughout this route and the surrounding area, such as breeding, wintering and wading birds.

3.6 Option 4

Option 4 would require considerable green field development. It intersects two woodland areas and would sever up to 59 hedgerows. It would also intersect two watercourses. Large areas were difficult to access during biodiversity walkovers however, habitats are largely managed - pasture and tillage (low ecological value), although there was considerable diversity noted among hedge line structure and composition. Mature trees were present throughout which increases bat potential in terms of commuting and connectivity to feeding areas.

This route option may cause potential disturbance to bat commuting and/or loss of roosts. A number of artificial bat roost boxes were noted in localised areas. The route option intersects or passes closely by areas of mature woodland and impacts to them and supported flora/fauna cannot be ruled out.

While the route avoids Derrygolan Esker pNHA (site code: 000896), it still intersects the wider esker landscape Clonmacnoise Esker in the north and Ballyduff esker to the south. Ballyduff Esker is already currently impacted by the presence of a Quarry. Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich e.g. grassland wildflowers including wild orchids.

Mammal activity was locally abundant, particularly badger, with evidence of both prints and trails at a number of locations.

Two watercourses would be intersected by this route option, namely; the Tullamore Silver River and the Tonaphort (a tributary of the Brosna). The Brosna and its tributaries are important sites for Salmonids and Crayfish. All mentioned watercourses provide downstream connectivity (30km) to the Shannon Callows SAC and SPA, where Otter and several protected bird species are known to occur.

Additionally, the route option crosses along the eastern boundary of a dormant quarry which is intersected along the southern part of the route option. This increases the biodiversity significance of and potential for species such as amphibians and cannot be ruled out owing to its size and relative current abandonment. South of this and as the route option ties back in with the existing N52 in a south westerly direction, it intersects the southern end of a road attenuation pond which could provide habitat for wintering birds and/or Otter and other protected species. Bird activity may also be disturbed throughout this route and the surrounding area such as breeding, wintering and wading birds.

3.7 Option 5

Option 5 requires green field development to the east of the existing N52 corridor where it diverges offline. Diverging at the northern end of the existing N52, the route option heads in a southerly direction, where it crosses a range of agriculturally managed lands – intensive grazing pasture and tillage as well as agricultural wet grassland.

It severs up to 44 hedgerows and two watercourses to addition to up to 2.7km of hedgerow removal where this route is located along the existing N52. This route is also located <120m from four discrete wooded habitats. Large areas of this option were not accessible during the site survey walkover; however, habitats were largely managed and of low ecological value.

Discrete areas for bat potential occur such as mature trees and pockets of wooded areas in close proximity. This route option may cause potential disturbance to bat commuting and/or loss of roosts, particularly where local access overbridges are introduced in close proximity to pockets of discrete wooded habitat.

The route intersects a site designated for nature conservation, Derrygolan Esker proposed Natural Heritage Area (pNHA) (site code: 000896) and the wider mosaic of esker landscape, Clonmacnoise Esker in the north and Ballyduff esker to south. Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich e.g. grassland wildflowers including wild orchids. Derrygolan Esker pNHA is described as containing a nationally important population of the rare green-winged orchid *Anacamptis morio* (previously *Orchis morio*), This site contains one of the largest known populations of this species and is one of the few remaining examples of an unexploited esker. This species is also listed as vulnerable in the Irish red data list for vascular plant. The extent of the works to include a 200m corridor for the proposed route option, may result in up to a 75% loss of habitat within the Derrygolan Esker pNHA.

Mammal activity is apparent including the identification of two badger setts to the west <100m from the proposed route.

Two watercourses are intersected, the Tonaphort (a tributary of the Brosna which is an important site for salmonids and crayfish and the Tullamore Silver River. This option is also located <120m from Durrow Abbey Stream. The Silver River may additionally require bridge upgrades and may be subject to road widening to include realignment of the L2003. All mentioned watercourses provide downstream connectivity (30km) to the Shannon Callows SAC and SPA, where Otter and several protected bird species are features of interest. Bird activity may also be disturbed throughout this route and the surrounding area, such as breeding birds and wintering and wading birds.

3.8 Option 2-3

The Combination Option 2-3 is a mixture of both Option 2 and Option 3 whereby the northern end of Option 3 will diverge into Option 2. The connection between Option 2 and 3 will occur 250m north of the L2006. This option travels along green-field for a short period before it diverges back into the existing N52 for the remainder of its length. This is a short green-field option that travels across agricultural land – managed grasslands and tillage fields.

This route option would cause the severance of up to 52 hedgerows and habitat loss (albeit of low ecological value agricultural land). The removal of several hedgerows would be required to accommodate overbridges and local access link roads in addition to up to 3km of hedgerow removal either side of the existing N52. This option traverses four watercourses and intersects with four woodland areas. One of these wooded areas was found to contain a considerable number of installed bat boxes.

Bat roost potential was also identified elsewhere along the route option and included a number of mature oak and beech trees in hedge lines and as discrete features. This route option may cause potential disturbance to bat commuting and/or loss of roosts.

There is evidence of mammal activity along this route including that of badger where a number of active badger setts were noted 120m east of route Option 2 and 90m west of route Option 3. The link road between Option 2 and Option 3 would directly intersect these setts.

Four watercourses would be intersected by the route option, namely; the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Silver River. The Silver River would require bridge upgrades and would be subject to road widening to include a parallel link road and realignment of the L2003. The Brosna is an important site for salmonids and crayfish. All mentioned watercourses provide downstream connectivity (30km) to the Shannon Callows SAC and SPA, where Otter and several protected bird species are known to occur. Bird activity may also be disturbed throughout this route and the surrounding area such as breeding, wintering and wading birds.

This route is located <200m from Derrygolan Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). Esker landscapes are often high value for biodiversity, consisting of small patches of woodland or calcareous grassland which are floristically rich, e.g. grassland wildflowers including wild orchids.

4 OPTION SUMMARY

Table 4-1 provides a summary of the appraisal of each of the six route options for the N52 Tullamore to Kilbeggan Link Road Scheme in terms of biodiversity. Impacts are described as “Preferred”, “Good”, “Intermediate”, “Poor” or “Least Preferred” and assigned an impact score based on the basic Multi Criteria Analysis (MCA) seven point scaled outlined in the TII publication ‘Project Appraisal Guidelines for National Roads Unit 7.0 - Multi Criteria Analysis’ (PE-PAG-02031) (2016).

The Management Option is classed as “preferred” given the online nature of the route and the limited potential for adverse biodiversity impact. It is noted that this route will still have potential for adverse impact through the online widening of the cross section impacting on hedgerows and woodlands and hence a slight negative impact score is assigned. Option 1 is also classed as “preferred” given the online nature of the route and the limited potential for significant adverse biodiversity impact. The impact of Option 1 will be greater than the Management Option but remains significantly lower than each of the offline options.

Option 5 directly intersects a site designated for nature conservation; Derrygolan Esker proposed Natural Heritage Area (pNHA) (site code: 000896) and is classed as “Least Preferred” given this significant impact. All other options show a range of impacts to hedgerows, woodlands and water courses relative to the online nature of each of the routes.

Table 4-1: Biodiversity Quality Impact Score Matrix

Option	Potential for Impact	Impact Level	Impact Score	Preference
Management Option	<ul style="list-style-type: none"> This route is largely online. Removal of up to 5km of hedgerow either side the existing N52. Loss and fragmentation of small quantity of mature woodland/trees. Potential disturbance to bat commuting and/or loss of roost. Four river water bodies crossed - the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Tullamore Silver River. 	Minor or slightly negative	3	Preferred
Option 1 (Brown)	<ul style="list-style-type: none"> This route is largely online. Removal of up to 8km of hedgerow either side the existing N52. High Road woodland and the woodland north of Saint Colmcille Church Durrow would become fragmented. Potential disturbance to bat commuting and/or loss of roost. Four river water bodies crossed - the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Tullamore Silver River. 	Minor or slightly negative	3	Good
Option 2 (Purple)	<ul style="list-style-type: none"> Half of this route is along the existing N52. It is the shortest offline section. Severance of 43 hedgerows in addition to up to 4km of hedgerow removal either side of the existing N52. Potential disturbance to bat commuting and/or loss of roost. Four river water bodies crossed - the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Tullamore Silver River. Evidence of badger activity along the route. Located <500m from Derrygolan Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). 	Moderately negative	2	Intermediate
Option 3 (Orange)	<ul style="list-style-type: none"> Largely greenfield. Intersects four woodland areas and severs 55 hedgerows in addition to up to 1.5km of hedgerow removal either side of the existing N52. Potential disturbance to bat commuting and/or loss of roost. 	Moderately negative	2	Intermediate

Option	Potential for Impact	Impact Level	Impact Score	Preference
	<ul style="list-style-type: none"> Three river water bodies crossed - the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Tullamore Silver River. Evidence of badger activity along the route. Located <300m from Derrygolan Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). 			
Option 4 (Blue)	<ul style="list-style-type: none"> Largely greenfield. Intersects two woodland areas and would sever up to 59 hedgerows. Potential disturbance to bat commuting and/or loss of roost. Two watercourses would be intersected by this route option, namely; the Tullamore Silver River and the Tonaphort. Evidence of badger activity along the route. Avoids Derrygolan Esker pNHA (site code: 000896), it still intersects the wider esker landscape Clonmacnoise Esker in the north and Ballyduff esker to the south. 	Moderately negative	2	Poor
Option 5 (Green)	<ul style="list-style-type: none"> Severs up to 44 hedgerows and two watercourses to addition to up to 2.7km of hedgerow removal where this route is located along the existing N52. Route is also located <120m from four discrete wooded habitats. The route directly intersects the Derrygolan Esker proposed Natural Heritage Area (pNHA). Derrygolan Esker pNHA is described as containing a nationally important population of the rare green-winged orchid. 	Major or highly negative	1	Least Preferred
Option 2-3 (Purple-Orange)	<ul style="list-style-type: none"> This route is a mixture of both online and offline development (greater offline presence). Up to 2.7km of hedgerow removal where this route is located along the existing N52. Potential disturbance to bat commuting and/or loss of roost. Four river water bodies crossed - the River Brosna, the Tonaphort (a tributary of the Brosna), Durrow Abbey Stream and the Tullamore Silver River. Evidence of badger activity along the route. Located <500m from Derrygolan Esker pNHA (site code: 000896) and intersects the wider mosaic of esker landscape (Clonmacnoise Esker). 	Moderately negative	2	Intermediate