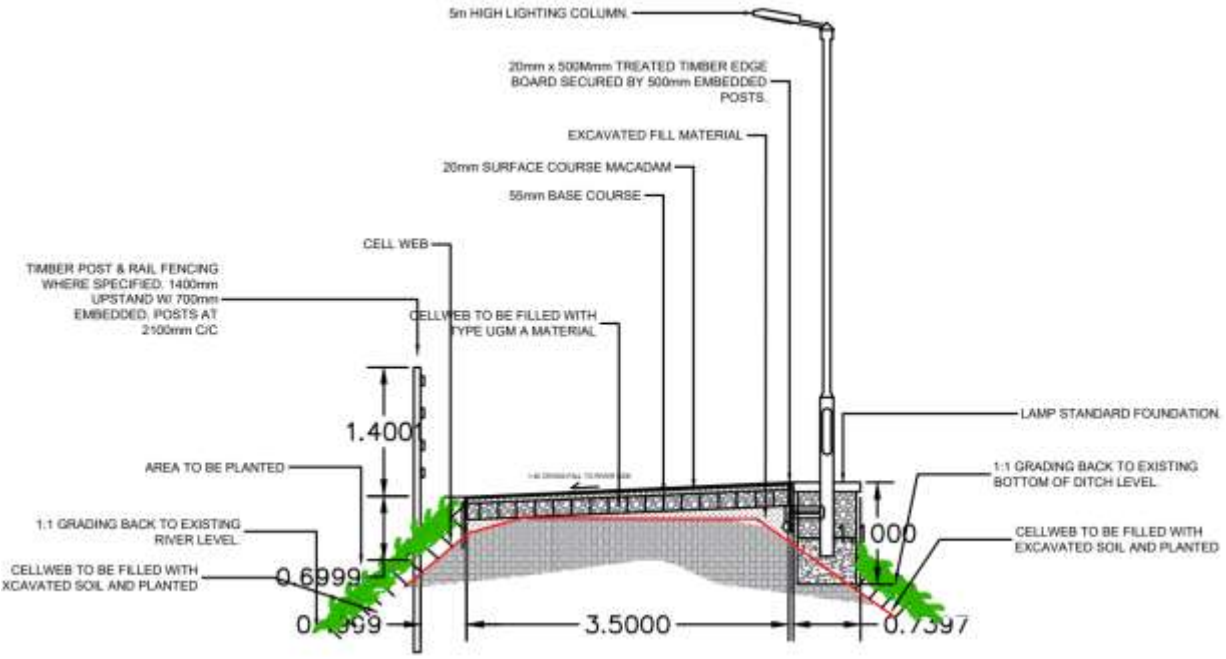
Contents

7 LAND USE, SOILS AND GEOLOGY

This chapter provides an assessment of the baseline for land use, soils and geology in the Study Area and investigates how the proposed Limerick City Greenway (UL to NTP) may impact on the existing soil and geological environment as well as land use during the construction and operational phases of the project.

As described in Chapter 4 – Description, the general construction of the greenway will be in accordance with the TII document on *Rural Cycleway Design* DN-GEO-03047 and will comprise as detailed in Drawing PD0007 and as follows;

- Excavated Fill Material;
- Treetex Geotextile;
- Cellweb (to be filled with Type UGM A Material);
- 55mm Base Course (Clause 804); and
- 20mm Surface Course Macadam.



In a number of sections along the proposed route, the greenway changes to Active Travel infrastructure with separate footpaths consisting of 150mm Clause 804 Sub-base and 150mm reinforced concrete and two-way cycle lanes comprising a 22mm Surface Course Macadam, 55mm Base Course and 150mm Clause 804 Sub Base.

Where negative effects are anticipated, mitigation measures and monitoring are proposed and residual effects of the proposed Scheme on land, soil and geology are assessed. The cumulative effects of the project and the cumulative effects in-combination with other plan and projects are also presented in this Chapter.

The Limerick City Greenway (UL to NTP) has an indefinite operational duration; therefore, it is not considered necessary to assess the impacts of decommissioning.

7.1 METHODOLOGY

This chapter was compiled in accordance with the following:

- The European Commission '*Guidance on the Preparation of the Environmental Impact Assessment Report*' (2017);
- The EPA '*Guidelines on the information to be contained in Environmental Impact Assessment* Reports' (2022);
- The EPA '*Advice Notes on Current Practice in the preparation of Environmental Impact Statements*' (*Draft* September 2015);
- The Institute of Geologists of Ireland (IGI) '*Geology in Environmental Impact Statement – A Guide*' (2002);
- Institute of Geologists of Ireland (IGI) 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (2013);
- The Department of Housing's '*Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment*' (August 2018); and
- National Road Authority (NRA) (Now Transport infrastructure Ireland (TII)) '*Guideline on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*' (2009).

A desktop study and review of published literature was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. Stakeholder consultation, meetings and detailed background surveys were conducted. Information collected was then used to inform this Chapter of the Environmental Impact Assessment Report (EIAR) with regard to land use, geology and soils within the Study Area. It was then possible to propose practicable mitigation measures to ensure that any potential impacts identified will not have a significant effect on the environment during the construction and operation of the Greenway.

7.1.1 Assessment of Significance of Geological Impact on the Receiving Environment

An impact rating has been developed for each of the phases of development of the greenway based on the Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.

In line with IGI guidance the receiving environment (Geological Features) is identified, then the importance of the geological features is rated (Table 7-1) followed by an estimation of the magnitude of the impact (Table 7-2). This determines the significance of the impact prior to application of mitigation measures as set out in Table 7-3.

Table 7.1 – Criteria Rating Site Importance of Geological Features

Magnitude	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a	• Geological feature on a regional or national scale (NHA). • Large existing quarry or pit.

Magnitude	Criteria	Typical Example
	national or regional scale. Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	• Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying the site is significant on a local scale	• Contaminated soil on site with previous heavy industrial usage • Large recent landfill site for mixed wastes • Geological feature of high value on a local scale (County Geological Site) • Well drained and/or high fertility soils • Moderately sized existing quarry or pit • Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying the site is moderate on a local scale	• Contaminated soil on site with previous light industrial usage • Small recent landfill site for mixed wastes • Moderately drained and/or moderate fertility soils • Small existing quarry or pit • Sub-economic extractable mineral resource
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying the site is small on a local scale	• Large historical and/or recent site for construction and demolition wastes • Small historical and/or recent landfill site for construction and demolition wastes • Poorly drained and/or low fertility soils • Uneconomic extractable mineral resource

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. The magnitude criteria for geological impacts are defined as set out in Tables 7-1 and 7-2.

Table 7.2 – Estimation of Magnitude of Impact on Geology Attribute

Magnitude	Criteria	Typical Example
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves • Irreversible loss of high proportion of local high fertility soils • Removal of entirety of geological heritage feature • Requirement to excavate / remediate entire waste site • Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves • Removal of part of geological heritage feature • Irreversible loss of moderate proportion of local high fertility soils • Requirement to excavate / remediate significant proportion of waste site • Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves • Removal of small part of geological heritage feature • Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils • Requirement to excavate / remediate small proportion of waste site • Requirement to excavate and replace small proportion of peat, organic soils

Magnitude	Criteria	Typical Example
		and/or soft mineral soils beneath alignment
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	• Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	• Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	• Major enhancement of geological heritage feature

The matrix in Table 7-3 determines the significance of the impacts based on the importance and magnitude of the impacts as determined by Table 7-2 and the determination of the significance of each impact for the proposed greenway is discussed in the following sections.

Table 7.3 Ratings of Significance of Impacts for Geology

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

7.1.2 Published Material

The baseline study of the existing geological and hydrogeological environment throughout the Study Area was prepared using the Geological Survey of Ireland's (GSI) online database, published literature and additional source material. A comprehensive list is included below:

- The GSI online database (www.gsi.ie);
- Limerick Development Plan 2022-2028 (www.limerick.ie);
- CORINE Database (www.epa.ie);
- Aerial Photography, 1:5000 and 6 Inch base mapping;
- General Soil Map of Ireland;
- Explanatory Bulletin to Soil Map of Ireland 1980;
- Irish National Soils Map, 1:250,000k, V1b (2014). Teagasc, Cranfield University (EPA, 2014); and
- OPW - Lower Shannon Hydro-Geomorphology Study 2020.

An initial site investigation was commissioned for the purposes of project design and to inform this EIAR and was completed in March 2022. A change to the proposed greenway route resulted in the requirement for additional site investigation works which is expected to be completed in Q3/Q4 2024 and concentrate in a greenfield site along the River Shannon west of the UL Boat Club, and in a greenfield site to the rear of existing fishing cottages.

The site investigation works comprised trial pits (TP), slit trenches (ST), archaeological test trenching (ATT), boreholes (BH) completed by a combination of shell & auger cable percussion drilling and rotary core drilling, cone penetration tests (CPT), standard penetration test (SPT), plate testing, *in-situ* testing, sampling and external laboratory testing along the route of the proposed Greenway. The recorded data was used to confirm and verify information obtained from the above sources.

7.1.3 Definitions

Land is introduced into the Environmental Impact Assessment Report as per the 2014 Directive as a prescribed factor addressing the issues of land take. Land use requirements have also been identified and assessed.

Environmental scientists generally understand the word '*soil*' to refer to the fertile, organic rich layer which occurs on the surface of the Earth and the underlying layers which interact with it in terms of nutrient, ion, water and heat exchange. Using this definition, the depth of the soil layer is typically 0.3m to 1.0m thick. Geologists and engineers, on the other hand, generally understand the word '*soil*' to refer to all unconsolidated (non-lithified) organic and inorganic deposits which occur above bedrock.

For the purpose of this EIAR, the term '*soil*' refers to the unconsolidated, organic rich material closest to the Earth's surface ('*topsoil*), while the term '*subsoil*' (Quaternary Geology) is used to refer to all other unconsolidated (non-lithified) materials which occur above bedrock.

The Study Area referred to in this Chapter relates to the area within which physical works are proposed to be constructed, accessed and maintained, as detailed in Chapter 1 Section 1.2 Study Area.

7.2 'DO-NOTHING' SCENARIO

If the proposed project were not to proceed, the land, soils and geology within the Study Area would be left as it is, and no changes would be made to the existing land- use practices.

Connectivity between NTP and the University of Limerick with Corbally and Limerick City Centre is essential to the future plans for the city as stated in '*Limerick 2030, An Economic and Spatial Plan for Limerick*'. In implementing the '*Do nothing*' alternative, the opportunity to allow for a direct, safe, and enjoyable walking and cycling link from campus to campus would be lost.

7.3 LAND

The assessment of land use generally considers land take or acquisition and changes in baseline land use. The CORINE (Co-ordinated Information on the Environment) data series was established by the European Community (EC) as a means of compiling geo-spatial environmental information in a standardised and comparable manner across the European continent. The land in the Study Area can be described as follows:

Agricultural areas: Some agricultural lands (*231 - Pastures*) lie on the north side of the River Shannon surrounding existing UL sports, leisure, accommodation and educational facilities and also to the east of the Mulkear. Agricultural practices on properties on the north side are moderately intensive in nature and the predominant farm enterprises are beef. Lands to the east of the of the study area where the River Shannon and Mulkear river merge are described as class *243 - Lands principally occupied by agriculture with significant areas of natural vegetation.*

Artificial surfaces: The main UL campus where the Greenway will traverse is classed *121 – Industrial or commercial units* and *142 – Spots and leisure facilities* which comprises areas of sport, leisure and educational facilities as well as industrial and commercial units. Some discontinuous urban fabric can also be found south and east within the study area.

Wetlands, Forests and Semi-Natural Areas: Pockets of class *411 - Inland marshes* exist to the southwest of the Study Area as a mostly non-forested area with dominantly herbaceous vegetation, subject to flooding by running water.

Table 7.4. Land use within the Study Area (CORINE Land cover)

Class Value	Description	Total Surface (ha)	Surface Occupied (%)
112	Discontinuous urban fabric	59.48	10.11
121	Industrial or commercial units	140.95	23.97
142	Sport and leisure facilities	39.26	6.68
231	Pastures	212.45	36.13
243	Land principally occupied by agriculture with significant areas of natural vegetation	68.98	11.73
411	Inland marshes	22.67	3.85
511	Watercourses	44.28	7.53

Most of the land use within the Study Area is dedicated to agriculture in the form of pastures other forms of agricultural use (47.86%) and artificial surfaces (40.76%). Pasture lands are mostly located north of the River Shannon, opposite from where the works will be undertaken. The preferred Greenway route runs along the River Shannon, classified as watercourse which occupies 7.64% of the total land use and finally inland marshes can be found at the western side of the Study Area (3.85%) occupying a much smaller surface area.

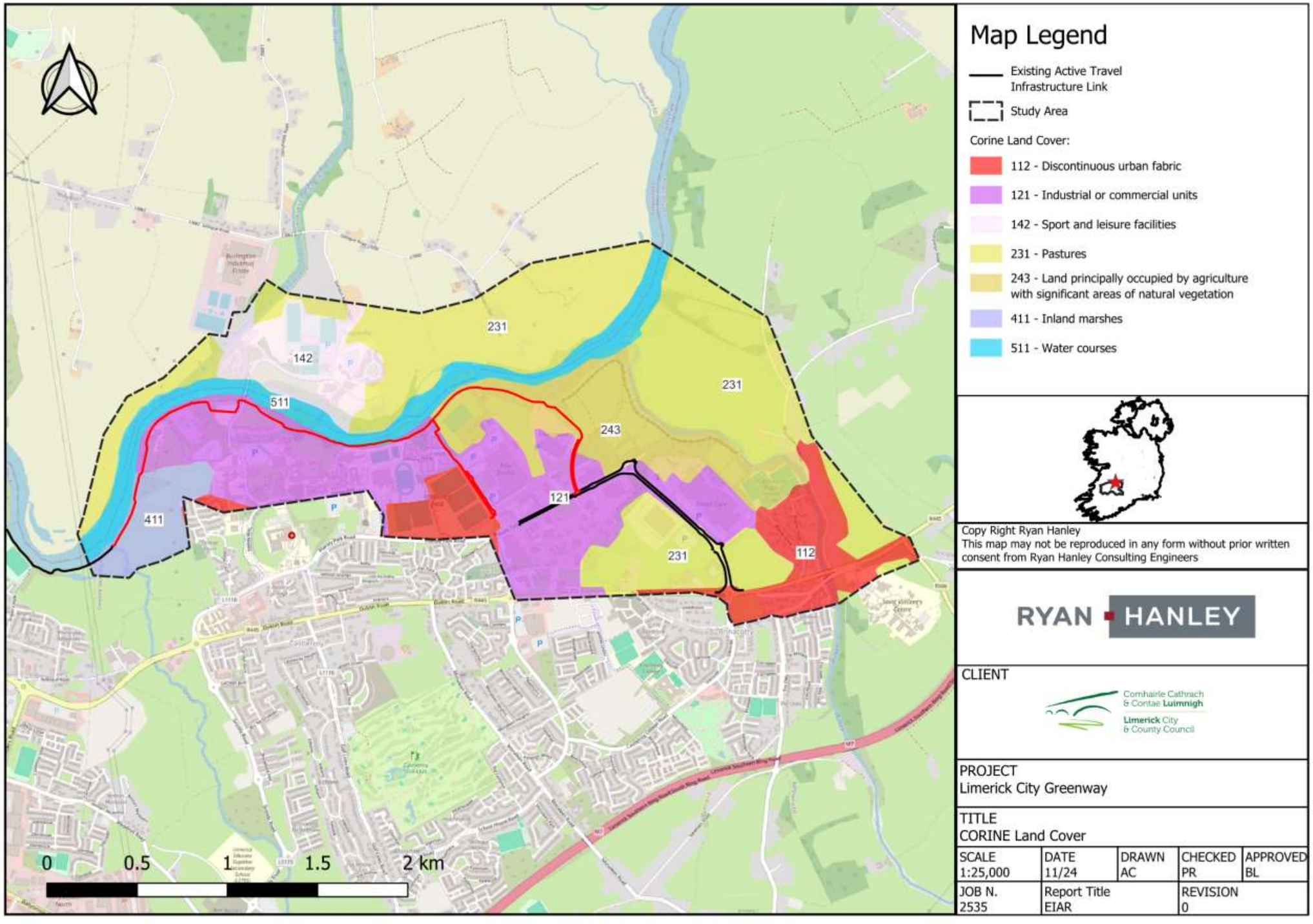


Figure 7. 1 CORINE Land Use cover in the Greenway Study Area

7.3.1 Impact on Agricultural Land

7.3.1.1 Impact on agriculture nationally

Permanent Not Significant Neutral Impact

The national agricultural land area is 4,509,256 ha including commonage and rough grazing, including 4,151,456 ha of grassland, 265,592 ha of cereals and 92,208 ha of other crops, fruit and horticulture (Central Statistics Office, 2020).

There are 135,037 farms in Ireland with an average farm size of 33.4 ha. The proposed Greenway is a 3.5-4.0m wide path which will run over a distance of approx. 4.5km primarily along an existing trail on the banks of the River Shannon which will not have a significant effect at a country wide level.

7.3.1.2 Impact on agriculture in County Limerick

Permanent Not Significant Neutral Impact

The surrounding area is primarily industrial, commercial and residential with some agricultural lands. The majority of agricultural lands in the study area lay to the north of the River Shannon. The proposed Greenway is a 3.5-4.0m wide path which will run primarily along an existing trail on the south bank of the River Shannon, and local roads will not have a significant effect on agriculture at a county level.

7.3.1.3 Impact on agriculture in the study area

Construction Phase

Potential Short-Term Slight Negative Impact

The proposed scheme will not impact on any active farm activities, farm buildings or farm facilities. Construction activities may have the potential to impact on agriculture due to noise and/or dust. In the absence of mitigation, the potential impact on agricultural land use in the Study Area ranges from slight to significant negative impact.

Operation Phase

Permanent Not Significant Neutral Impact

No impacts on agriculture are anticipated during the operation phase of the Greenway.

Mitigation Measures

Landowner consultation has been carried out during the development of the proposed Greenway as outlined in Chapter 3 – Sections 3.2.2.2 to 3.2.2.4. Consultation with landowners will continue throughout detailed design and construction of the Greenway. The following mitigation measures will be implemented in respect of land use in the Study Area to reduce any construction phase impacts:

- Existing accesses to all properties will, where practicable, be maintained during construction otherwise reasonable temporary access will be provided. The location of any temporary access will be at a suitable location and, where possible, with agreement of the landowner;
- Machinery and machinery movement will be minimised as much as possible to avoid unnecessary damage to lands such as tracking and/or soil compaction;
- Where any fences, walls, hedges, drains or land are during the course of construction or operation related maintenance work accidentally damaged they will be remedied immediately and repair

works carried out, where necessary. Any necessary permanent restoration of fences, walls, hedges, drains or land will be completed as soon as practicable after work has concluded; and

- Mitigation measures will be implemented in relation construction traffic, services, dust and noise as set out in Chapter 9 – Air Quality, Noise & Vibration and in Chapter 13 – Material Assets of the EIAR.

There will be no additional negative impacts on agriculture post construction during the operational phase of the Greenway.

Residual Impact

Temporary Not Significant to Imperceptible Impact & Temporary Not Significant Neutral Impact

Based on this assessment, the impact of the proposed Scheme on agricultural land is imperceptible on a national and county level. It is also anticipated that a temporary not significant to imperceptible impact on agricultural lands within the Study Area during construction and a temporary not significant neutral impact during the operation.

The overriding benefits to the area of a fully integrated Greenway will provide a safe transport route along the banks of the River Shannon, within the UL campus, University Road and Mc Laughlan Road and to Plassey Park Road in the National Technology Park, connecting to existing active travel infrastructure which extends to Annacotty Roundabout, whilst also enhancing the amenity value of the area.

7.3.2 Impact on Artificial Surfaces

Construction Phase

Potential Temporary Not Significant to Slight Negative Impact

A large section of the construction phase of the proposed Greenway is on an existing walking route, involves connection with existing active travel infrastructure or construction of a two-way cycle lane and footpath. Stripping of gravel, tar and/or topsoil will be required along the length of the proposed route and to prepare the ground for the Greenway to be laid in its place. Any works will constitute a potential temporary not significant to slight negative impact on artificial surfaces. The potential impact on existing pathways, access routes and road infrastructure are assessed further in Chapter 13, Material Assets. Works will be carried out and reinstated in sequence thereby reducing the temporary loss of and disruption to existing artificial surfaces at any one time.

Operational Phase

Permanent Not Significant Positive Impact

The existing pathway will not only be reinstated to its original condition following surface stripping of tar and/or soil, but will incorporate significant improvements in terms of health & safety, technical design and construction material resulting in a positive impact on artificial surfaces. Overall, the improvement to the existing routes and construction of new sections of Greenway will constitute a permanent not significant positive impact on artificial surfaces.

Mitigation Measures

The following mitigation measure will be implemented in order to minimise an impact to artificial surfaces during the construction phase of the Scheme and following reinstatement.

- General condition and structural surveys of all transport infrastructure (roads, bridges, culverts, etc) on all routes, including any haulage routes, that may be impacted as a result of the proposed

Greenway before works commence on site and after completion. Further detail is provided in Chapter 13 Material Assets.

- Haulage roads will be developed to access the Greenway, where necessary, for the purpose of construction and will be removed, incorporated into new Greenway and/or reinstated post construction. The haulage roads are of particular importance to provide access to locations along the route where works structural items such as bridges are proposed.
- Cleaning regime for machinery to be implemented in order to minimise mud/dust or other contaminants on public roads.

Residual Impact

Construction Phase

Temporary Imperceptible Negative Impact

Based on this assessment, the implementation of the measures listed above will mitigate against impacts to artificial surfaces during the construction phase of the Scheme. The residual impact will be a temporary imperceptible negative impact during the construction phase.

Operation Phase

Permanent Significant Positive Impact

Any artificial surfaces removed during works will be reinstated to their original condition in accordance with TII Publication Requirements for Rural Cycleway Design (Offline & Greenway) (TII, Aug, 2022) and any roads impacted by the Scheme will be reinstated in accordance with the TII Publication Requirements for the Reinstatement of Openings in National Roads (TII, Apr 2017) – for National Roads. In addition, an improved and integrated Greenway designed to current standards & design practices will result in a permanent significant positive impact on artificial surfaces within the Study Area.

7.4 GEOLOGY

7.4.1 Ground Investigations

Detailed site investigation (SI) was carried out by Priority Geotechnical Ltd. between 16th March and 30th March 2022 along the proposed route as reported in University of Limerick to National Technology Park Cycle Path Project, Site Investigation, Factual Report.

A change to the proposed greenway route resulted in the requirement for additional site investigation works which is expected to be completed in Q3/Q4 2024 and concentrate in a greenfield site along the River Shannon west of the UL Boat Club, and in a greenfield site to the rear of existing fishing cottages.

With regard to Cultural Heritage, where previously undisturbed areas will be impacted by proposed construction works; advance archaeological testing trenches and archaeological monitoring, as detailed in Chapter 12 – Cultural Heritage will be undertaken to ensure that previously unrecorded archaeological deposits are identified and that appropriate mitigation is employed during construction phase.

The site investigation objectives were to determine the subsurface conditions, the extents of soft ground, made ground and likely depths to rock and rock strength. The GI investigation consisted of Cable Percussion Boreholes (BH), Trial Pits (TP) and Cone Penetration Tests (CPT).

7.4.2 Bedrock Geology

The '*Geological Survey of Ireland Online Database*' indicates that the proposed Scheme extends across two bedrock units assigned to the Dinantian Period.

- Dinantian Visean Limestone Formation (Undifferentiated);
- Dinantian Rathkeale Formation; Dark muddy limestone & shaly mudstone;

The Visean Limestones (undifferentiated) are situated on the western side of the study area and the Rathkeale Formation which is comprised of dark muddy limestone & shaly mudstone on the eastern side of the study area. The Lough Gur Foundation, which is present in the study area but not along the proposed greenway route, is described as dark grey to black cherty overlies the Waulsortian Limestones, as illustrated in Figure 7.1.

The depth to bedrock was found to vary across the site, from 1.4m below ground level (BGL) towards the middle of the scheme area to 9.0m BGL in the west.

7.4.3 Geological Heritage

Geological heritage encompasses the earth science component of nature conservation including both bedrock and unconsolidated (soil) deposits close to the surface and processes (past and present) that shaped the land surface. The identification of geological heritage is achieved by finding sites or areas that best demonstrate particular types of geology, processes or phenomena that rank as noteworthy. A site selection process has been completed by the Geological Survey of Ireland (GSI), through the Irish Geological Heritage (IGH) Programme and '*The Geological Heritage of County Limerick – An Audit of County Sites in County Limerick*' was published in 2021.

The IGH programme is a partnership between GSI and the National Parks and Wildlife Service (NPWS) and aims to identify, document the wealth of geological heritage, and protect and conserve it against threats through local authority planning and promote its value with landowners and the public. The primary national site designation for geological heritage (and nature conservation in general) is the Natural Heritage Area (NHA) designation. Designation of national sites is the responsibility of the National Parks and Wildlife Service (NPWS), working in partnership with the IGH programme. The second-tier designation is that of County Geological Sites (CGS). CGSs as adopted under the National Heritage Plan are included in County Development Plans and in the Geographical Information Systems (GIS) of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system.

The Limerick Development Plan (2022-2028) states that it is an objective of the Council to "seek the conservation and protection of features of geological interest within Limerick, particularly those that would have been recognised in the past as Areas of Scientific Interest or by the Geological Survey of Ireland as being of particular value".

The GSI records show that there are no County Geological Sites in the vicinity of the proposed Scheme or the surrounding area. The nearest recorded geological site is Ballycar South, Co. Clare (IGH 02) which is located approximately 7.0km north-west of the proposed Greenway.

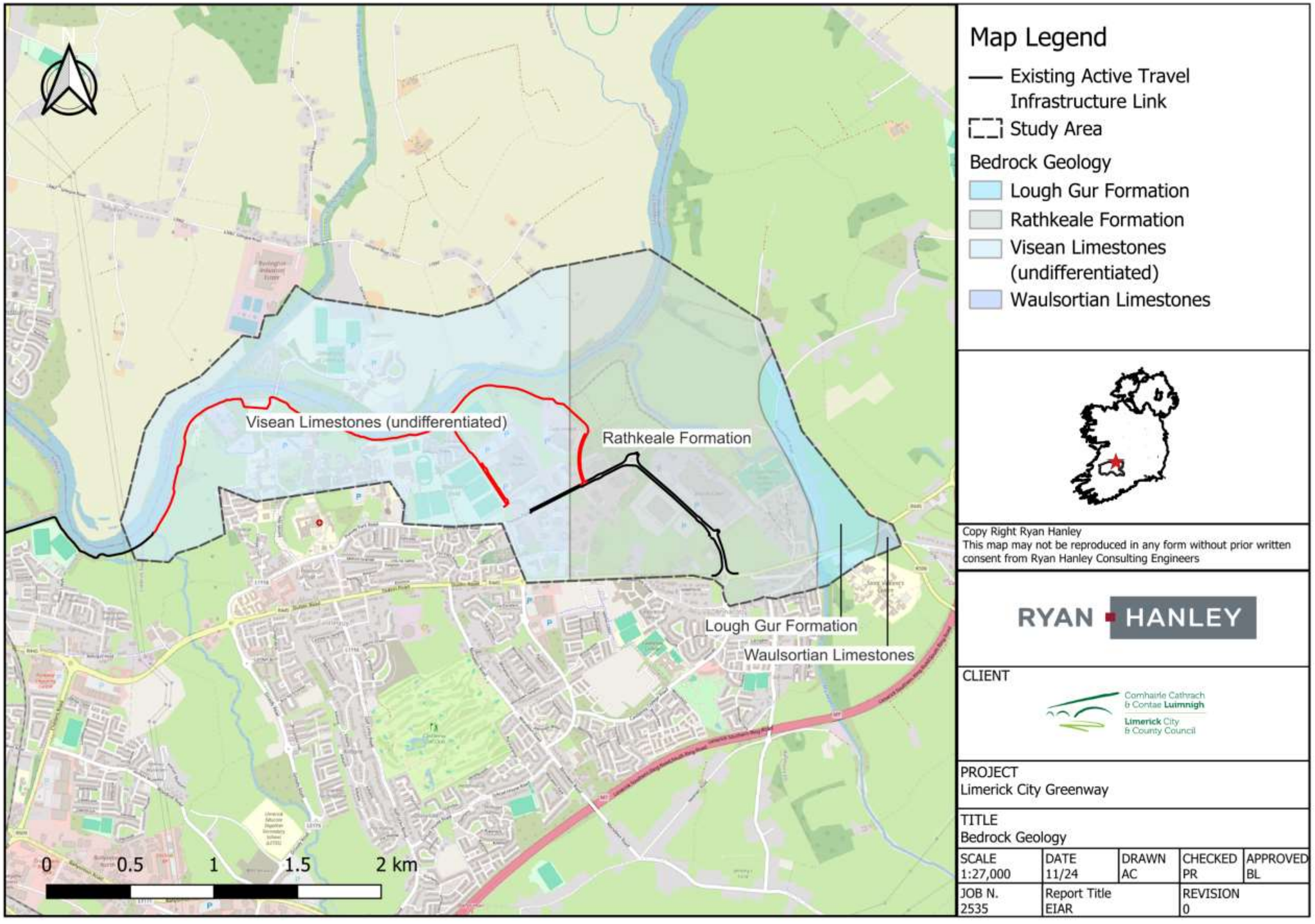


Figure 7.1. Bedrock Geology within the Greenway Study Area

7.4.4 Economic Geology

The term '*economic geology*' refers to commercial activities involving soil and bedrock. The activities involved principally comprise aggregate extraction (sand and gravel pits and quarries) and mining. A number of sources were examined for information on such commercial activities within the Study Area, including:

- GSI Active Quarry Directory 2014 www.gsi.ie;
- Aerial Photographs (2020); and
- ENVision Mines Site, the EPA's online Historic Mines Inventory.

The sources consulted above indicate that there are no active quarries within the Study Area. The nearest active quarries are presented in Table 7.5. As the abovementioned quarries are outside the Study Area, it is not envisaged the proposed Greenway will have any impact on these facilities.

Table 7.5 Quarries outside the Study Area

Location	Status	Operators
Gooig Pit, Castleconnell ~7.0km outside Study Area	Active	Roadstone Ltd.
Dereen Sand & Gravel Pit, Portcrusha. ~7.5km outside Study Area	Active	Dereen Concrete Ltd.

7.4.5 Geohazards

Upon consultation with the National Landslide Database for Ireland (Landslides Working Group), it was found that there are no known geohazards within the study area or within 10km of the study area.

7.4.6 Quaternary Geology (Subsoil)

The Quaternary Period extended from the beginning of the Ice Age to the present day and is the final one of geological time scale. Almost all surface deposits were deposited during the Quaternary Period either directly by glacier ice or by glacial meltwater. As the ice flowed over the underlying rock surface, pieces of protruding and loose rock became attached to its base. As these were carried along they both abraded the underlying rock and were ground down themselves. The rock that was picked up by the ice and partly ground down was later deposited either directly from the base or margin of the ice, or by meltwater flowing from the ice. In the former case it became Till and in the latter case it was separated out and deposited as gravel, sand, silt or clay. The composition of these sediments reflects the type of rock or substrate over which the ice flowed.

Subsoils deposited since the end of the last glaciation are typically referred to as '*recent deposits*'. The most widespread recent deposits in Ireland is peat, which occurs both as upland blanket peat and lowland raised bog.

The Geological Survey of Ireland Online Database and information obtained from the site investigations indicate that the Study Area comprises the following subsoils:

- Made ground;
- Marine/Estuarine Sediments;
- Alluvial Minerals; and
- Tills.

7.4.6.1 Made Ground

Madeground is defined as material, including soil, which has been deposited on land and/or altered by anthropogenic (human) activity. Madeground was encountered during the site investigation and ranged in thickness from 0.1 to 2.3 m. The site investigation indicates that localised pockets of made ground are to be found along the route of the proposed Greenway. The pockets of madeground as well as containing some traces of timber and bricks are composed of both reworked glacial and recent subsoils.

The key risk associated with madeground is its uncertain age and potential to harbour contamination. However, no evidence of historical activities which could potentially have contributed to soil contamination were identified along the route or in the vicinity of the proposed Scheme.

7.4.6.2 Marine/Estuarine Sediments

Deposits of silts and clays of marine/estuarine origin is recorded within the Study Area. The subsoil mapping as presented on the EPA geoportal Database shows these deposits are found along the banks of the River Shannon. These deposits are characterised by very fine-grained subsoils and are evident where high sediment cliffs are formed. Drilling logs recorded a fine to course sandy gravelly clay which was overlain by a layer of madeground. It is unlikely that the installation of the proposed Greenway which will be shallow (<0.5m BGL) will have any significant impact on Marine/Estuarine Silts and Clays.

7.4.6.3 Alluvium

Alluvium is a young sediment that was recently eroded and carried off the hill side by a surface watercourses. The sediment is ground into finer and finer grains each time it moves downstream, a process that can take thousands of years.

Alluvium soils are typically found at or in the vicinity of a surface watercourse. The EPA geoportal Database indicates that Alluvium mineral subsoils are predominantly situated in the eastern areas of the study area. As outlined in Lower Shannon Hydro-Geomorphology Study mixed sediment from the Mulkear River tributary enters the River Shannon and this material is deposited on the left bank as a submerged bar and riverside feature like Plassey beach. With shallow excavations (<0.5m BGL) expected close to this deposit in the eastern part of the study area, it is unlikely that the proposed Scheme will impact on Alluvium.

7.4.6.4 Tills

Glacial till is a generic term which applies to glacially derived and/or transported soil which is deposited beneath or on the margins of a glacier or ice sheet. The Teagasc subsoil map, as presented on the Geological Survey of Ireland Online Database, indicates that glacial till is the predominant subsoil occurring in the Study Area and is principally derived from limestones and gravels.

Areas of exposed till material are evident along the river Shannon and Mulkear where in some areas they form elevated cliffs. As the ground investigation for the proposed development was focused on areas where bridge and platform infrastructure are to be concentrated, there was no intensive ground investigation carried out within the area recorded as Glacial Till. As such there are no borehole records to confirm or deny

the Teagasc Subsoil mapping as shown on the GSI Online Database. However, given the shallow excavations expected, It is unlikely that the proposed scheme will impact on this Glacial Till.

7.4.7 Potential Impacts on Geology

Construction Phase

The key effect associated with the construction phase of the Greenway is the excavation, handling, storage, processing and transport of any earthwork materials. The estimated volume of excavation anticipated during the construction phase is presented on Table 7.6.

Table 7.6 Volumes of Excavated Material

Origin of Excavation	Total Volume of Excavated Material	Volume of Excavated Material to be Transported Off Site
Excavation of ground along proposed route on Southern banks of River Shannon for the Greenway	6,181 m^3	0 m^3

There are a number of potentially negative environmental impacts associated with the handling of excavated materials. These impacts can arise directly as a result of on-site excavation and construction activities or indirectly, due to placement of excess unsuitable materials at off-site locations.

In general, the potential impacts on soils and geology associated with the greenway construction include, excavation and compaction of soils, use of stone and aggregate for construction of greenway pavement, use and storage of fuels presenting a contamination risk and erosion of soils exposed during earthwork.

It is also considered that the importation of granular fill and other products in the form of concrete or other construction related products will have a permanent moderate/slight impact on the source quarries.

Site investigations were undertaken to inform detailed design of the project, the impact of which is predicted to be imperceptible based on the scale of the proposed site investigation works and as such has not been assessed below.

7.4.7.1 Loss of Bedrock

Potential Permanent Slight Negative Impact

As detailed in Section 7.4.1, the Study Area is underlain by the Dinantian Visean Limestone Formation (Undifferentiated) and Dinantian Rathkeale Formation; Dark muddy limestone & shaly mudstone. A small section to the east of the Study Area is on Waulsortian Limestones. A section of the Lough Gur Foundation which is described as dark grey to black cherty overlies the Waulsortian Limestones. As highlighted in Section 7.4.2, the depth to bedrock based on geotechnical data collected was found to vary across the site, from 1.4m below ground level (BGL) towards the middle of the scheme area to 9.0m BGL in the west

Based on geotechnical data collected, on maximum proposed excavation depths for the greenway sections of approximately 0.5m BGL for the greenway sections and an average depth of 1.0m for manhole chambers as described in Chapter 4 - Description, it is considered unlikely that any significant quantities of bedrock will be encountered.

It is expected that no bedrock or indeed any significant quantities will be encountered during the proposed works, however as the type of bedrocks (if encountered) are abundant throughout the Study Area any portion to be removed will be imperceptible in comparison to the volumes retained and as such will not have a significant impact on the bedrock of the Study Area.

Mitigation Measures

One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of bedrock excavation during the greenway construction.

Where it is necessary to remove bedrock in green fields to facilitate construction of the proposed greenway, the material removed will be transported to the closest storage compound suitably and reused where possible.

Where it is necessary to remove existing concrete to facilitate construction of the proposed greenway, the concrete shall be transported to the closest temporary construction compound and reused where possible.

Residual Impact

Permanent Imperceptible Negative Impact

With the mitigation in place, any loss of bedrock as a result of the installation of the Greenway will be minimal, this impact will constitute a permanent imperceptible negative impact.

Operation Phase

Minor amounts of granular material may be required to maintain the greenway during operation which will result in an

7.4.7.2 Loss of Geological Heritage

Potential Neutral Impact

There are no geological heritage sites in the vicinity of the proposed works of sufficient geological or geomorphological importance on a national or county scale to merit consideration for designation as a Natural Heritage Area (NHA). In addition, there are no County Geological Sites (CGSs) in the vicinity of the Study Area.

It is considered that the potential impact will be neutral.

7.4.7.3 Loss of Quaternary Geology

Potential Permanent Slight Negative Impact

As described in Section 7.4.6, the Study Area is underlain by madeground, marine/estuarine sediments, alluvial minerals and till derived from limestone rocks.

The impact of the removal of excavated material from the proposed work area will be minimal as these subsoils are in abundance throughout the Study Area, and the county as a whole.

The majority of the proposed route of the Greenway is underlain by madeground or ground which has been manipulated and reworked by human activity. There is a risk however that contaminated material may be encountered during the construction phase. No evidence of historic activities which could potentially have contributed to soil contamination was identified in the immediate vicinity of the proposed Greenway during the desk study or geotechnical investigation. Although the key risk with madeground is its uncertain origin,

on the basis of available evidence and taking into consideration the anticipated volume of made ground to be excavated, the potential impact is regarded as being slight negative.

Mitigation Measures

It is expected that excavated soil will be reused as fill where possible during the construction of the proposed Greenway. Excavated subsoils will be mounded on the river side of the path and reseeded.

Residual Impact

Permanent Imperceptible Negative Impact

With the mitigation in place, the loss of quaternary geology will be minimised. This impact will constitute a residual permanent imperceptible negative impact.

Operation Phase

No impacts on quaternary geology are anticipated during the operation phase of the Greenway.

7.5 SOILS

Soil is the top layer of the earth's crust. It is formed by mineral particles, organic matter, water, air and living organisms. It is an extremely complex, variable and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief and the actions of living organisms over time.

Soil can take thousands of years to evolve and is essentially a non-renewable resource. Soil performs many vital functions. It supports food and other biomass production (for example forestry and biofuels) by providing anchorage for vegetation and storing water and nutrients long enough for plant to absorb them. Soil also stores, filters and transforms other substances including carbon and nitrogen. It has a role supporting habitats and serves as a platform for human activity, landscape and archaeology.

7.5.1 Soil Formation

There are three principal soil formation processes that take place in Ireland, leaching, gleisation and calcification.

Through the *leaching* process, soluble constituents are carried down through the soil profile, the soil becomes progressively more acidic until relatively insoluble constitutes such as iron, aluminium and humus are washed deeper into the soil. Organic matter may accumulate on the surface and an iron pan may be formed at a lower level in the soil. At this point the leaching process may be referred to as podzolisation.

Gleisation is the soil-forming process resulting from the water-logging, possibly due to high water tables, or the impermeable nature of the soil itself. The movement of water through the soil is highly restricted and as a result leaching is very limited. Due to anaerobic conditions many soil constituents are converted by chemical processes into reduced forms. The soil usually takes a grey or blue colour as a result of the reoxidation processes.

Calcification is a process resulting in the redistribution of calcium carbonate in the soil profile without complete removal of it. Regions where rainfall is typically 750mm or less are affected by this process. Since the rainfall is low, the percolation of water through the profile is not sufficient to completely remove the calcium carbonate that existed in the parent material or that was produced by reaction between carbonic acid and the calcium hydrolysed from silicate minerals. Accumulation of carbonates at some point in the profile is typical of calcification. Calcium also tends to keep fine clay in a granular condition resulting in very little downward clay movement.

Due to the climate in Ireland, Leaching and Gleisation are the two most common soil formation processes.

7.5.2 Soil Associations

The General Soil Map of Ireland classifies the lands within in which the Study Area as '*Alluvial region*' and '*Lowland*'.

The alluvial region includes the extensive river and estuarine flats associated mainly with the River Shannon. In the vicinity of Limerick City, the Shannon alluvium extends a mile of so on either side of the river. The lowland region mainly occupies central and eastern Limerick. The lowland region, in general coincides with the Carboniferous limestone formations. The topography of the region is gently undulating to easy rolling with most slopes less than 8°.

These lands generally have a slope ranging between 2 and 6° and generally occur at elevations below 150 m. The Study Area comprises principally Brown Podzolics (60%). Associated soil classifications are defined as Acid Brown Earths (20%) and Gleys (20%). These soils are mainly derived from Mica schist glacial till. Madeground from the surface was recorded in a number of locations as part of the site investigation contract.

Brown Podzolic soils were formed under the influence of the podzolisation process, whereby soils are subject to leaching and are depleted of nutrients and become acid. The profile of Brown Podzolics generally consists of a surface A1 horizon in which organic and mineral matter are mixed which overlays a reddish-brown B horizon in with iron, aluminium and sometimes humus have accumulated. The physical characteristic of Brown Podzolic soils makes them suitable for cultivated cropping and pasture production. The low nutrient content of the soil can be remedied with the addition of lime and fertiliser.

Acid Brown Earths are relatively mature, well drained, mineral soil with a relatively uniform profile. These soils have not been extensively leached with the result that there are no obvious signs of removal and deposition of iron oxides, humus or clays. In many cases a certain degree of leaching has taken place resulting in the translocation of soluble constituents, notably calcium and magnesium. The majority of Brown Earths result from lime deficient parent minerals and are therefore acidic in nature. The desirable structure and drainage characteristics results in these soils being the most extensively cultivated soils, making up for a relatively low nutrient status by responding well to manurial amendments.

Gleys are soils in which the effects of poor drainage dominate and which have developed under the influence of waterlogging, characterised by the Gleisation process described above. Most gleys have poor physical conditions which make them unsuitable for cultivation or for intensive grassland farming. Their productive capacity is also affected by restricted growth in spring and autumn.

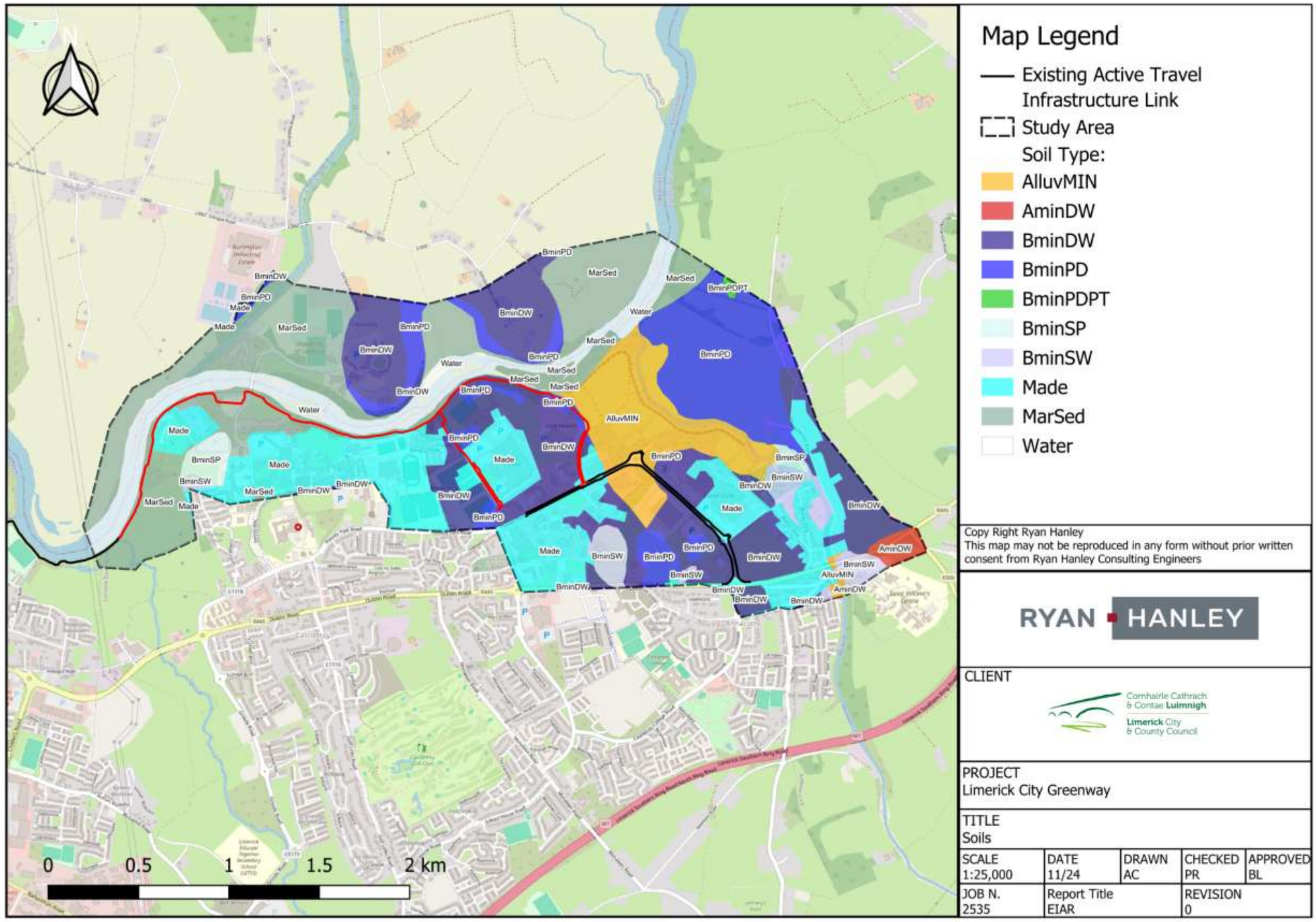


Figure 7.2. Soils within the Study Area of the proposed Greenway

7.5.3 Potential Impacts on Soil

7.5.3.1 Loss of Soil

Construction Phase

Permanent Slight to Moderate Negative Impact

As the proposed Greenway traverses areas of land outside of artificial surfaces such as areas of amenity grassland and scrub areas prior to connecting onto McLoughlin Road in the National Technology Park (NTP) and also taking into account the soil profiles encountered during the site investigation it is likely that the project will have some impact on the soil in the area.

Any loss of soil, or other potential impacts will be during the construction phase and likely to be associated with excavation, handling, storage, processing and transport of earthworks materials related to the Greenway. Where soils are disturbed, excavated and/or temporarily stored for re-use during construction and subsequent reinstatement of topsoil, they are prone to erosion by wind and/or surface water run-off. *In-situ* soils may also be compacted by construction machinery, reducing their ability to store water, which in turn may lead to an increase in run-off and possible soil erosion.

Soils underlying the proposed footprint of works are abundant on a local and regional scale, the soils are also considered to be composed of both reworked shallow topsoil. The volume of soils exposed during the construction phase will also be relatively small. The volume requiring excavation will be offset by its reuse during construction works. This constitutes a potential permanent slight to moderate negative impact.

Mitigation Measures

Any excavated topsoil will be temporarily stored in site compounds and used to for reinstatement purposes as and where required. The amount stored at any time will be minimised by completing the areas of the Greenway in a timely and efficient manner and on a sectional basis with each section being completed before proceeding to the next as set out in Chapter 4, Sections 4.19 and 4.2. Storage compounds will be defined and fenced off with silt fencing and a surface water management system in place to prevent run off and minimise the volume of suspended solids transported by surface water run-off and discharged into local watercourses. Excavated soil will be reused where possible in the sub-base material or for use in graded banking material.

The following measures will form part of the surface water management system; preventing sediment erosion and ingress into the watercourse (as detailed in Chapter 6 Biodiversity and Chapter 8 Water) and will be implemented during the construction phase:

Where bank stabilisation works are to take place, excessive ingress of sediment into the watercourse should be prevented where possible. Sediment barriers such as sediment netting/ fences or silt traps should be used to temporarily trap sediment and prevent sediment transport into watercourse, at all interfaces of the works area with a waterbody in advance of construction works on the banks of the watercourse;

- Works undertaken on the banks should be fully consolidated to prevent scour and run off of silt, Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and may also the sowing of grass seed on bare soil.
- Particular care to prevent run-off of sediment or pollutants into the river should be taken at the Compound Site 1, Compound Site 2 and Compound Site 3, where their proximity to the River as having the potential for the highest surface runoff.

- Guidelines for minimising impacts on water quality and fisheries in relation to Construction shall be implemented including, but not limited to, CIRIA C532 *"Control of water pollution from construction sites - Guidance for consultants and contractors"*, Inland Fisheries Ireland (IFI) guidelines and Transport Infrastructure Ireland (TII) guidelines

Residual Impact – Permanent Slight Negative Impact

Taking into account that any excavated topsoil and subsoil will be used in the reinstatement of works areas and as a subbase landscaping material in conjunction with the mitigation measures as outlined above, the residual impact of the proposed scheme on the soil in the area is a permanent slight negative impact.

Operation Phase

No impacts on soils are anticipated during the operation phase of the scheme.

7.5.3.2 Contaminated Land

Construction Phase

Short Term Moderate Negative Impact

With the presence of an extensive road network within the study area and along the route of the proposed greenway there is a risk of historic fuel leakages and other localised road related contamination in the upper soils which must be considered an unknown risk during construction.

Potential effects may arise from the improper management, storage and handling of fuels and lubricants for equipment and machinery and of non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed Greenway. There is always a risk of localised contamination of soils resulting from an accident, spill or leak.

A site investigation was carried out in March 2022. The soil profiles from the SI, indicates the presence of made ground along the route of the proposed Greenway, composted of both reworked glacial and recent subsoils. Made ground is also likely to be encountered in works areas associated with the path and road crossing as well as junction realignment. It is also possible that hazardous materials may be encountered during excavation works at these locations during the construction phase of the Greenway.

In addition, two invasive species were identified within the Study Area during surveys carried out between 2020 and 2024; Giant Hogweed (*H. mategzzianum*) and Himalayan balsam (*I. glandulifera*). Invasive species infestation was found to be extensive throughout the length of the proposed Greenway within the Study Area the locations of which are shown in Chapter 6, Figure 6.6.

Failure to implement appropriate management of soil contaminated with Giant Hogweed or Himalayan balsam during the construction phase of the Scheme could result in the spread and regrowth of the species in other areas.

Operational Phase

Temporary not significant negative impact

The maintenance activities and responsibilities associated with the Greenway are outlined in Chapter 4, Section 4.22. Maintenance activities are predicted to have a potential temporary impact in terms of the improper use of fuels used in equipment and machinery for repair work, maintenance of vegetation and grass cutting. Due to the localised and small-scale nature of these works, the potential impact is anticipated to be a temporary not significant negative impact during the operation phase of the Scheme.

Mitigation Measures

In order to reduce the risk of soil contamination as a result of accidents, spills, leaks or flooding the following measures will be implemented:

Fuels, chemicals, liquids, and solid wastes will be stored on impermeable surfaces. Fuels stored on site will also be kept to a minimum. Machinery refuelling shall be undertaken using a jeep mounted bowser to minimise storage of fuel on site. Small quantities of chemicals and petrol required for tools shall be stored with drip trays in a vented fuel store in the temporary works compound.

Plant refuelling shall be undertaken on hard standing at designated areas, and not within 10 metres of any watercourse, in accordance with best practice guidelines. No refuelling will be permitted in or near soil or rock cuttings. Only designated trained operatives will be authorised to refuel machinery on-site.

Machinery and equipment shall be inspected regularly for any leaks.

Storage of fuel and oil will be regularly inspected for leaks or signs of damage.

A lock system will be fitted on all taps, nozzles or valves associated with refuelling equipment.

All hydrocarbons and other potential contaminants will be stored within suitably constructed bunds in accordance with best practice guidelines. The bunds will be sized to hold 110% of the volume of the stored contaminants in order to contain a spill should it occur. The base and walls of the bund shall be impermeable to water and oil.

Spill kits will be provided at refuelling areas and at high risk/sensitive areas.

Large volumes of excavated material will not be allowed to accumulate within the temporary working areas. Any stockpiling of soils will be confined to compound areas and runoff will be prevented by the use of a silt fence or bund.

There will be no storage of materials, machinery or soil in areas that are susceptible to flooding or along the proposed greenway route. Storage of materials will happen in temporary construction compounds in Flood Zone C areas only. Materials to be used in constructing the greenway will be brought to site and used immediately.

Any contaminated soil if encountered will be stored separately from non-hazardous waste in bunded areas before being collected by an authorised waste contractor and transported to an approved waste facility for treatment and safe disposal.

An emergency response plan to deal with accidental spillages is contained within the Construction Environmental Management Plan. This will include providing toolbox talks regarding the appropriate use of spill kits and best practice for the management of accidental spills.

All Giant Hogweed and Himalayan balsam within and surrounding the site of the proposed works will be subject to the Invasive Species Management Plan.

Residual Impact –Short Term Slight Negative Impact

The implementation of the above measures will mitigate the risk of contamination as a result of fuels, chemicals and invasive species associated with construction phase of the project. The residual impact is considered to be a Short Term Slight Negative Impact.

7.6 Assessment of Cumulative and In-combination Impacts

7.6.1 Cumulative Impact Assessment

All elements of the proposed development were assessed in order to identify any cumulative effects.

The movement and removal of soils, overburden and rock during the construction phase of the proposed development has the potential to give rise to impact on water quality and aquatic ecology as addressed in Chapter 6 - Biodiversity and Chapter 8 - Water, respectively. The EIAR chapters and the Construction Environmental Management Plan provide robust information on how to avoid such effects.

The movement and removal of soils, overburden and/or rock during the construction phase has the potential to give rise to noise and dust impacts. However, these effects and the measures that are in place to avoid any cumulative or interactive effects are fully described in Chapter 9 – Air Quality, Noice and Vibration of the EIAR.

Based on the assessment of all elements of the proposed Scheme, no significant cumulative effects are anticipated.

It is considered that the proposed Limerick City Greenway (UL to NTP), the linear scale of the works and the implementation of effective mitigation and best practice will ensure that the Greenway, when considered on its own, will minimise as much as possible significant effects on land, soils and geology. Overall, the benefits of installation of a complete Greenway linking up with Active Travel routes will have a positive effect on the area.

7.6.2 In-Combination Impact Assessment

A search in relation to plans and projects that may have the potential to result in a cumulative in-combination effects on the environment was carried out as part of the EIAR. The proposed Greenway project has been considered, in combination with plans and the projects set out in Chapter 3, Section 3.5 of the EIAR. In addition, the following data sources were assessed:

- Limerick Development Plan 2022-2028;
- An Bord Pleanála Website (Planning Searches);
- Myplan.ie; and
- Web search for major infrastructure projects in Annacotty, Castletroy and surrounding areas.

The above sources were consulted to identify developments which could cause cumulative in-combination impacts with the proposed project. No significant housing developments are planned for within the study area which would have a potential effect. There is a grant of planning for a golf academy west of the UL Boat Club and this will expire in 2026 so there should be no overlap with the proposed Greenway. There is a grant of planning for a playing pitch project east of Kilmurray Student village, but the proposed greenway will not interfere with the proposals.

Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the plans and projects set out in Chapter 3, section 3.5, was found to have no potential for significant in-combination cumulative effects on land, soils and geology.

7.7 REFERENCES

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