UWF Grid Connection EIA Report (2019)

Volume C2: EIAR Main Report

Chapter 10: Soils

HYDRO ENVIRONMENTAL SERVICES

ECOPOWER

October 2019

Contents

Topic Soils

List of Figures

Figures and mapping referenced in this topic chapter can be found in **Volume C3 EIAR Figures.**

List of Appendices

Appendices referenced in this topic chapter can be found in **Volume C4 EIAR Appendices.**

Glossary of Terms

Term	Definition
Alluvium	Deposits of clays, silts, sands and gravels associated with river action.
Blanket Bog	Blanket bog is an area of peatland, forming where there is a climate of high rainfall and a low level of evapotranspiration, allowing decomposed organic material to accumulate over large expanses of undulating ground.
Boulder Clay	See glacial till.
Glacial Till	Glacial sediment that is deposited directly from glacial ice and therefore not sorted. Also can be called overburden or boulder clay.
Greywacke	A variety of argillaceous sandstone that is highly indurated and poorly sorted.
Fluvio-glacial Deposits	Sediments deposited by river or/and glacial action.
Limestone	A sedimentary rock composed primarily of calcium carbonate. Some 10% to 15% of all sedimentary rocks are limestones. Limestone is usually organic, but it may also be inorganic.
Mineral Subsoil	Subsoil derived from parent bedrock material such as sandstone and limestone
Metasediments	Material derived from pre-existing rock which has undergone metamorphism.
Mudstone	Argillaceous or clay-bearing sedimentary rock which is non-plastic and has a massive non-

Term	Definition
	foliated appearance.
Overburden	See glacial till.
Project Design Measure	Measures for environmental protection, incorporated into the design of the project.
Sandstone	A clastic rock composed of particles that range in diameter from 1/16 millimetre to 2 millimetres in diameter. Sandstones make up about 25% of all sedimentary rocks.
Schist	A strongly foliated metamorphic rock that develops from mudstone or shale and splits easily into flat, parallel slabs.
Shale	A rock formed from fine-grained clay-size sediment.
Siltstone	A typically layered and flaggy rock composed of two thirds silt-sized particles.
Sensitive Aspect	Any sensitive receptor in the local environment which could be impacted by the project.
Topsoil	The uppermost mineral or organic layer of soil
Volcanic	An igneous rock formed from lava that has flowed out onto the Earth's surface, characterised by rapid solidification.

List of Abbreviations

Abbreviation	Full Term
BPM	Ecopower Best Practice Measure developed by members of the EIAR Team
NHA	National Heritage Area as defined by the National Parks and Wildlife Services
PD	Ecopower Project Design Environmental Protection Measure developed by members of the EIAR Team
SAC	Special Areas of Conservation as defined by the National Parks and Wildlife Services
UGC	Underground Cables
UWF	Upperchurch Windfarm

Executive Summary of the Soils Chapter

Baseline Environment: Soils (i.e. superficial geology including subsoils) in the study area comprise mainly poorly draining mineral or peaty topsoil over glacial tills, sandstone tills with bedrock close to the surface along much of the 110kV UGC route along the Regional Road R503. Alluvium and fluvio-glacial sand and gravels are present along the larger watercourses such as the Newport River, Bilboa River and Clare River. The underlying bedrock in the study area comprises a mixture of sandstone, limestone and volcanic meta-sediments, with the latter being most predominant.

Survey Results for Sensitive Aspects in the Baseline Environment: Review of geological mapping of the Mountphilips Substation site and the 110kV UGC route was carried out and surveys of the site including trial pit investigations at the Mountphilips Substation site (5 No.) and the Consented UWF Substation site (1 No.), were carried out to assess soil / subsoil lithology, subsoil depth and ground conditions**.** Soils are generally shallow at the UWF Grid Connection locations with 'bedrock close to surface' mapped along much of the 110kV UGC route. There are also some 'blanket peat' soils mapped by EPA adjacent to the central part of the 110kV UGC on the R503 Regional Road, peat probes at these locations found that this regional road is predominately constructed on competent ground. Project design of the cables trench includes the use of geotextile material in any sections of trench where competent ground is not encountered, this will ensure that the 110kV UGC does not affect the structure of public roads or affect the stability of the soils below.

The UWF Grid Connection will be located on agricultural grassland at Mountphilips Substation and within road pavements for the 110kV UGC outside of the Mountphilips Site (c.84% of the development). The soils in the agricultural lands and underlying the public road pavements have been heavily altered by the existing landuse. The soils, subsoils and bedrock are largely not designated and have a low to medium geological importance.

In total, approximately 28,680m^3 of geological material will be permanently excavated and this will mainly arise from the ground works and new access road for Mountphilips Substation and the trenching/joint bays for the 110kV UGC; comprising topsoil (4,060m^3), subsoil (1,240m^3) and spoil from public road excavations (23,380m^3); 5,000m^3 of the excavated material will be permanently stored along the new access road to Mountphilips Substation and around the Mountphilips Substation Compound as linear berms around the substation and along both sides of the new access road. The remaining excavated soils (300m^3) will be reinstated within the works area at Coole/Mountphilips. All material excavated (23,380m^3) from trench and joint bay excavations along the 110kV UGC, outside the Mountphilips Substation site, will be removed to licenced waste facilities.

The cabling works are located within the boundary of the Lower River Shannon SAC at six locations along public road carriageways only, for a total length of 1025m of trenching. Within the SAC, 760m^3 of public road spoil, comprising 90m^3 of public road bitumen material; 60m^3 of public road base layer stone and 610m^3 of subsoil, will be excavated. No Joint Bays are located within the SAC boundary.

Summary of the Likely Impact on Local Soils, Subsoils & Bedrock: Soils and geology can be sensitive to processes such as excavation and relocation, erosion, compaction and contamination. Soil is biologically active and supports complex ecosystems which are sensitive to chemical and biological changes. The impact on Soils is evaluated as **Imperceptible** for compaction, erosion and contamination by oils or cement; and **Slight** for excavation and relocation, because the soil and geology at the Mountphilips Substation and along the 110kV UGC are abundant in the area and of low to medium importance; all works will be temporary and generally transient in nature; the excavations required for the 110kV UGC works will be spread out over a large geographical area and will be relatively shallow; Mountphilips Substation site will be backfilled,

and the soils surrounding new permanent hard-core areas will be fully reinstated and landscaped immediately after the works; environmental protection measures are designed into the project to prevent compaction, erosion and contamination of soils; no batching of wet cement will take place on-site and only precast concrete structures will be used at joint bays and at watercourse crossing locations as required. **Summary of the Likely Cumulative Impact on Local Soils, Subsoils & Bedrock**: Where the UWF Grid Connection interacts with Other Elements of the Whole UWF Project the cumulative compaction, erosion or contamination by fuels/oils will be **Imperceptible** due to limited interaction at the 110kV UGC with the Other Elements of the Whole UWF Project. **Slight** cumulative excavation/relocation impact due to the large volumes of excavations required for the whole project, with **Slight to Moderate** cumulative impacts in relation to contamination by cementious products which reflects the volumes of concrete which will be required for the Consented Upperchurch Windfarm turbine foundations. Concrete control measures will be implemented as part of the Consented Upperchurch Windfarm as per planning condition.

Summary of the Likely Impact on the Lower River Shannon SAC: Soils and geology are not a qualifying feature of the Lower River Shannon SAC and the construction of the 110kV UGC will not directly affect the qualifying interests of River Shannon SAC (which are largely water based aquatic habitats / species). There will be no excavation of the river bed or banks within the boundary of the SAC, and all UWF Grid Connection works within the boundary of the SAC will take place within road pavements and over existing bridge structures. The direct impact on Soils in the Lower River Shannon SAC is evaluated as **imperceptible** because the interaction of the development with the SAC is entirely within the paved public road surface and existing bridge structures, which will provide a protective cover to the underlying subsoils; use of wet cement within the SAC will be limited to the placement of very small volumes of cement mix, in the cables trench and environmental protection measures such as the lining of trenches within the SAC with impermeable material, are designed into the project to protect soils from contamination. There is **No Potential for cumulative effects with the Other Elements** of the Whole UWF Project because only the UWF Grid Connection (110kV UGC route) overlaps the boundary of the Lower River Shannon SAC.

Conclusion: The UWF Grid Connection will not cause significant adverse effects to Soils.

Topic **Soils**

10 Environmental Factor: Soils

10.1 Introduction to the Soils Chapter

10.1.1 What are Soils?

Soil is a biologically active, complex mixture of weathered minerals, organic matter, organisms, air and water. This mixture supports a range of critical functions such as supporting terrestrial ecosystems and biological diversity, agricultural food production, flood alleviation, water filtration and storage, and carbon capture.[1] This Soils chapter relates to the topsoil and subsoil (collectively referred to as overburden) along with the underlying bedrock.

10.1.2 Overview of Soils in the Local Environment

The UWF Grid Connection will be located on agricultural grassland at the Mountphilips Substation site and within public road pavements outside of the Mountphilips Station site. The eastern end of the 110kV UGC is located within a short section of private paved road and within the Consented Upperchurch Windfarm Substation. See Figure GC 10.1: Location of the UWF Grid Connection**.** Figures and mapping which are referenced in this topic chapter can be found in Volume C3 EIAR Figures**.**

Soils (*i.e.* superficial geology including subsoils) in the study area comprise mainly poorly draining mineral or peaty topsoil over glacial tills. Alluvium and fluvio-glacial sand and gravels are present along the larger watercourses such as the Newport River, Bilboa River and Clare River. The underlying bedrock in the study area comprises a mixture of sandstone, limestone and volcanic meta-sediments, with the latter being most predominant.

A small number of County Geological Heritage Sites occur in valleys and on the lower slopes of the Slievefelim and Silvermine Mountain upland areas, a small number of National Heritage Areas (NHAs and pNHAs) occur generally on upland blanket bogs, while the Lower River Shannon SAC occurs along river valleys in the area. Overall, the soils, subsoils and bedrock at the majority of the study area are largely not designated, can be considered to have a low to medium geological importance (refer to Table 10-3).

10.1.3 Sensitive Aspects of the Soils Environment included for further evaluation

Any sensitive receptor in the local environment which could be impacted by the project is a Sensitive Aspect. The following Sensitive Aspects **are included in this topic chapter** as they could be potentially impacted:

Sensitive Aspect No. 1	Local Soils, Subsoils and Bedrock	Section 10.2
Sensitive Aspect No. 2	Lower River Shannon SAC	Section 10.3

Each of the above listed Sensitive Aspects are evaluated individually in Sections 10.2 to 10.3 of this Chapter.

[1] www.epa.ie/irelandsenvironment/landandsoil/

To help readers navigate to individual sensitive aspect sections, the colour codes for each Sensitive Aspect used above are also used in the Sensitive Aspect sections Section 10.2 to 10.3. The colour-codes have been applied to section headings, tables and on side-tabs on the edge of the pages.

10.1.4 Sensitive Aspects excluded from further evaluation

The following Sensitive Aspects **are excluded from this topic chapter**:

Lower River Suir SAC	Evaluated as having no potential for impacts due to: The Lower River Suir SAC is located to the south of the elements of the Whole UWF Project - 5.8km from UWF Grid Connection, 5.5km from UWF Related Works, 6km from Upperchurch Windfarm and 8.5km from UWF Replacement Forestry No element of the Whole UWF Project Interacts directly with the River Suir as there are no works located within the SAC boundary and therefore no direct impacts on soil and geology within the SAC will take place. The potential for indirect effects from sediment laden runoff into the SAC are considered in Chapter 11 Water.
Bleanbeg Bog NHA	Evaluated as having no potential for impacts due to: Bleanbeg Bog NHA is an upland blanket bog which is located approximately 2.5km north of the UWF Grid Connection (110kV UGC), 12.2km west of the UWF Related Works and Upperchurch Windfarm and 13.2km west of the UWF Replacement Forestry. As no element of the Whole UWF Project is located within this NHA, direct effects on soils and geology within the NHA are scoped out from further evaluation, as no impacts will take place.
Mauherslieve Bog NHA	Evaluated as having no potential for impacts due to: Mauherslieve Bog NHA is an upland blanket bog which is located approximately 3km north of the UWF Grid Connection, 5km west of the UWF Related Works and Upperchurch Windfarm and 6.5km west of the UWF Replacement Forestry. As no element of the Whole UWF Project is located within this NHA, direct effects on soils and geology within the NHA are scoped out from further evaluation, as no impacts will take place.
Clare Glen Moraine	Effects evaluated as having no potential for impacts due to: Moraines are mapped in a valley c.2km to the south of the UWF Grid Connection (110kV UGC). All works for the UWF Grid Connection are contained within the carriageway of the public road, and therefore there is no potential for impacts. UWF Related Works, UWF Replacement Forestry, Upperchurch Windfarm and UWF Other Activities are located c.20km to the east and due to the intervening distance will not cause any effects to the moraine.
Rear Cross Moraine	Effects evaluated as having no potential for impacts due to: Moraines are mapped in a valley c.1.4km to the north of the UWF Grid Connection (110kV UGC) at Rear Cross. All works are contained within the carriageway of the public road, and therefore there is no potential for impacts. UWF Related Works, UWF Replacement Forestry, Upperchurch Windfarm and UWF Other Activities are located greater than 5km from these Moraines and due to the intervening distance will not cause any effects to the Rear Cross Moraines.
Owenbeg Moraine	Evaluated as having no potential for impacts due to: The construction works areas are located at a distance from and do not intercept the unaudited mapped boundary of the Owenbeg Moraine, which is mapped in the Owenbeg River valley to the south of the UWF Grid Connection, UWF Related Works, Upperchurch Windfarm, and UWF Replacement Forestry.

10.1.5 Overview of the Subject Development

The UWF Grid Connection is the subject development, being the subject of a current application to An Bord Pleanála.

The main parts of the UWF Grid Connection are identified in the table below.

Table 10-1: Subject Development – Element 1 of the Whole UWF Project

Project ID	The Subject Development	Composition of the Subject Development
Element 1	The Subject Development UWF Grid Connection (GC)	Mountphilips Substation Mountphilips – Upperchurch 110kV UGC (110kV UGC) Ancillary Works at Mountphilips Substation site

Note: The UWF Grid Connection is 'Element 1' of the Whole UWF Project.

A description of the location, size and design, life-cycle stages, use of natural resources, emissions and wastes, and the vulnerability to major accidents and natural disasters is provided in this EIA Report in Chapter 5: Description of the Development – UWF Grid Connection (Volume C2 EIAR Main Report).

This EIA Report is also available on www.upperchurchwindfarmgridconnection.ie.

10.1.5.1 Changes to the development from the 2018 Application

This is the 2nd Application for UWF Grid Connection (2019 Application). The previous application (2018 Application) was refused by An Bord Pleanála in December 2018. There are changes in this 2019 UWF Grid Connection Application from the 2018 Application. These comprise;

- In this 2019 Application, the route of the 110kV UGC from Mountphilips Substation Site entrance to the Consented UWF Substation site is wholly under the public road (except for 700m under a private paved road at the Consented UWF Substation end) and is 30.5km in length. By comparison, the 2018 Application 110kV UGC route was through agricultural and forestry tracks and lands with some public road crossings and 27.5km in length.
- Mountphilips Substation is at the same location, but the footprint of the Substation Compound is increased by 15% (from 8930m^2 to 10290m^2) and the footprint of the control building is increased from 205m^2 to 375m^2. ***Note***: Details of the changes/no changes to the Mountphilips Substation Site as a result of the increased dimensions are listed in Chapter 5: Description of the Development: Section 5.1.1.1.

10.1.6 The Authors of the Soils Chapter

This report on the Environmental Factor Soils has been written by David Broderick (BSc, H. Dip Env Eng, MSc): Hydrogeologist; and Michael Gill (P. Geo., B.A., B.A.I., M.Sc., Dip. Geol, MIEI): Environmental Engineer and Hydrogeologist of Hydro-Environmental Services (HES). HES was established in 2005 as a hydrological, hydrogeological and environmental practice, specialising in soils and geology, and peatland and upland hydrology.

10.1.7 Sources of Baseline Information

The information sources outlined in Table 10-2 were reviewed during desktop studies and confirmed during fieldwork in order to gather information on the baseline environment. The recommendations in the guidelines listed in the table, have been considered during the preparation of this chapter.

Table 10-2: Sources of Baseline Information for Soils

Type	Source
Consultation	No Feedback received from consultees See Chapter 3: The Scoping Consultations, Chapter 3 Appendices for further details.
Industry Guidelines	• National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes; and, • Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements
Desktop	• Environmental Protection Agency database (www.epa.ie); • Geological Survey of Ireland Database (www.gsi.ie); • National Parks & Wildlife Services Public Map Viewer (www.npws.ie); • Review of Chapter 9: Land • Review of planning/ environmental information documents for the Other Elements of the Whole UWF Project as contained in Volume F of the planning application
Fieldwork	• Surveys and geological mapping of the Mountphilips Substation site and 110kV UGC; • Trial pit investigations at the Mountphilips Substation site and the Consented Windfarm Substation site to assess soil / subsoil lithology, subsoil depth and ground conditions (Appendix 10.1: Trail Pit Investigations) • Review of peat probing undertaken on lands adjacent to the R503 at Tooreenbrien Lower, Reardnogy Beg, Reardnogy More, Kilcommon, Loughbrack and Knocknabansha townlands - Appendix 15.5: Peat Probe Survey • A visual survey of the R503 Regional Road to assess potential road settlement

10.1.7.1 Certainty and Sufficiency of Information Provided

The criteria used for soils appraisals are derived from the National Roads Authority (2008) guidance document. A clear documentary trail is provided throughout this chapter and chapter appendices to the competency of data and methods used and the rationale for selection of same. The information used to compile this chapter is collated from site specific investigations, data and documents generated by public bodies and statutory agencies. The online baseline data was verified in the field.

Impacts on soils and geology are generally quantifiable to a high degree of certainty as impacts are typically direct and measurable (i.e. excavation volumes, storage volumes and working area footprints susceptible to compaction and erosion). All excavation volumes for the UWF Grid Connection have been clearly tabulated in this EIAR.

In respect of Soil no significant limitations or difficulties were encountered.

10.1.8 Methodology used to Describe the Baseline Environment and to Evaluate Impacts

10.1.8.1 NRA Soil Evaluation Criteria

The criteria used for this Soils appraisal are derived from the above listed NRA Guidelines. Whilst this is tailored to the soil appraisal, the significance judgements correspond very closely with the EPA significance criteria with the main point of note being that significance of impacts range from "Imperceptible to Profound". The criteria and approach for evaluation of soil are set out below.

Using the National Roads Authority (2008) guidance, an estimation of the importance of the soil and geological environment within the study area is quantified, using the criteria set out in Table 10-3 below. An estimation of the magnitude of the impact is assessed using criteria in Table 10-4 (NRA, 2008) and the rating of environmental impacts is then assessed using criteria in Table 10-5 (NRA, 2008).

Table 10-3: NRA Criteria for Determining the Importance of Soil and Geology

Importance	Criteria[1]	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 national or regional scale. • Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	• Geological feature rare on a regional or national scale (NHA/SAC). • Large existing quarry or pit. • 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 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 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 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. • Uneconomically extractable mineral resource.

High quality and a high degree of site contamination are put side by side in this table, because either could be a potentially constraining factor when developing a site. High quality will likely be more relevant to a Greenfield site, while the extent of contamination will likely be more relevant to a Brownfield site. The higher the quality/contamination means the higher the potential for constraints, the higher the importance

Table 10-4: NRA Estimation of Magnitude of Impact (NRA, 2008)

Magnitude of Impact	Criteria	Typical Examples
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 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

Table 10-5: NRA Rating of Environmental Impacts at EIAR Stage (NRA, 2008)

	Magnitude of Impact			
Importance of Tribute	**Negligible**	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
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

10.2 Sensitive Aspect No.1: Local Soils, Subsoils & Bedrock

This Section provides a description and evaluation of the Sensitive Aspect - Local Soils, Subsoils & Bedrock.

10.2.1 BASELINE CHARACTERISTICS of Local Soils, Subsoils & Bedrock

10.2.1.1 STUDY AREA for Local Soils, Subsoils & Bedrock

The study area for Local Soils, Subsoils & Bedrock in relation to the UWF Grid Connection is described in Table 10-6 and illustrated on Figure GC 10.2.1 UWF Grid Connection Study Area for Local Soils & Subsoils and Figure GC 10.2.2: UWF Grid Connection Study Area for Local Bedrock**.**

Table 10-6: UWF Grid Connection Study Area for Local Soils, Subsoils & Bedrock

Study Area for Local Soils, Subsoils & Bedrock	Justification for the Study Area Extents
Within the footprint of construction works and immediate adjacent lands that adjoin the works areas	Only direct effects on soils and geology are anticipated.

10.2.1.2 Baseline Context & Character of Local Soils, Subsoils & Bedrock in the UWF Grid Connection Study Area

To put the soil and geological environment into context, the current landuse in the study area is briefly described here.

The UWF Grid Connection will be located in the Slievefelim to Silvermine Mountain upland area. The UWF Grid Connection will be located predominately on public roads, with a smaller area on agricultural lands at Mountphilips Substation site, as outlined on Table 10-7.

The Mountphilips Substation will be constructed on a grassland site near Newport. The 110kV UGC will run in an easterly direction from the new Mountphilips Substation, and will cross under the southern hills of the Silvermine Mountains on the regional road R503 towards the Consented UWF Substation. The straight line distance between the Mountphilips Substation and the Consented UWF Substation is ~23km while the actual length of the 110kV UGC route is 30.5km.

10.2.1.2.1 Overview of Landuse

An overview of the current landuse at the UWF Grid Connection areas is shown in Table 10-7 below. Please refer to the Land Chapter (Chapter 9) for full details relating to landuse within the UWF Grid Connection study area. For information relating to historical landuse at the construction works areas, please refer to the Cultural Heritage Chapter (Chapter 16).

Table 10-7: Overview of Landuse within the UWF Grid Connection Study Area

Element	Total Landuse (Ha)	Agricultural	Public Roads	Forestry (private bitumen paved road)
UWF Grid Connection	29.6	16%	82%	2%

10.2.1.2.2 Summary of Soils and Bedrock within the Study Area

A summary of the Geological Survey of Ireland (GSI) mapped subsoil and bedrock geology within the study areas is shown in Table 10-8 below. The GSI mapping for subsoils and bedrock geology is illustrated on Figure GC 10.2.1 and on and Figure GC 10.2.2

Table 10-8: Summary of the GSI Mapped Geology within the UWF Grid Connection Study Area

UWF Grid Connection part	**Townlands**	**Length (km)** -Figure GC 10.2.2	**General Bedrock Unit Name** -Figure GC 10.2.2	**GSI Local Bedrock Formation Description**	**Main Subsoil Type** -Figure GC 10.2.1	**Main Soil Type**
Mountphilips End Masts & Mountphilips Substation	Mountphilips	0.1 km	Dinantian Lower Impure Limestone	Dark, muddy Limestone and Shale	Sandstone Tills	Poorly Draining Mineral soil
Mountphilips Substation & New Permanent Access Road	Mountphilips, Coole	0.7 km	Dinantian Sandstones, Shales and Limestone	Sandstone, Mudstone and thin Limestone	Sandstone Tills	Poorly Draining and Well Draining Mineral soil
110kV UGC	Freagh, Foildarrig, Oakhampton, Rockvale, Mackney (O'Brien), Mackney (Bourke), Ahane, Newross, Castlewaller, Carrowkeale, Tullow, Cooldrisla, Derryleigh, Kilnacappagh, Scraggeen, Derrygareen, Inchadrinagh, Knockancullenagh, Fanit	10.5 km	Devonian Old Red Sandstones	Pale red Sandstone, Grit and Claystone	Sandstone Tills Devonian, Bedrock at Surface and Cutover Peat	Poorly Draining Mineral soil and Peaty Soil
110kV UGC & Private Paved Road at the Consented UWF Substation	Lackamore, Tooreenbrien Upper, Tooreenbrien Lower, Reardnogy Beg, Reardnogy More, Shanballyedmond, Baurnadomeeny, Coonmore, Foildarragh, Kilcommon, Loughbrack, Knocknabansha, Knockmaroe, Knockcurraghbola Crownlands and Knockcurraghbola Commons	19.2 km	Silurian Meta-sediments and Volcanics	Greywacke, Siltstone and Grit	Sandstone Tills Devonian, Bedrock at Surface, Cutover Peat, Blanket Peat, Made Ground	Peaty Soil and Poorly Draining Mineral Soil

10.2.1.2.3 Results of Fieldwork Investigations

The detailed walkover surveys and site investigations at the Mountphilips Substation site, were undertaken in 2016 and 2017. The soils in the vicinity of the Consented UWF Substation were also investigated.

Peat probe surveys were undertaken in mapped Blanket Peat along the central sections of the 110kV UGC route on the R503.

The findings of the walkover surveys and site investigations are summarised in Table 10-9. The location of site investigations is identified on the Local Subsoil Maps on Figure GC 10.2.1.

Table 10-9: Summary of Local Geology and Ground Conditions in UWF Grid Connection Study Area

Location	Townlands	Landuse	Site Investigations -Figure GC 10.2.1	Summary of Local Geology and Ground Conditions
Mountphilips Substation (and End Masts)	Mountphilips, Coole	Grassland	5 no. Trial Pits	• Poorly draining mineral soil over sandstone tills • Alluvium adjacent to stream flowing between Compound site and End Masts • Trial Pits intercepted sandy SILT over gravelly sandy CLAY • Depth to bedrock >3m at End Mast location; • Depth to bedrock >1.4m at Substation location.
110kV UGC Section Section XX	Tooreenbrien Lower, Reardnogy Beg, Reardnogy More, Kilcommon, Loughbrack and Knocknabansha	Public Road R503	20 no. peat probes adjacent to the R503 road	• Mapped peat adjacent to the R503 • 15 no. probes identified only peaty topsoil over mineral soil • 5 no. locations encountered peat depths between 1 and 4m • The peat was typically upslope of road • The road itself underlain by competent soil and not peat
110kV UGC At the consented UWF Substation	Knockcurraghbola Commons	Grassland with some Forestry track	1 no. Trial Pits	• Poorly draining soil or well draining soil over Sandstone and Shale Tills in grassland and forestry areas • Gravelly SILT/CLAY or gravelly SILT was encountered in grassland and forestry areas • Bedrock not met

Further information on these surveys and investigations can be found in Appendix 10.1: Trail Pit Investigations and Appendix 15.5: Peat Probe Survey (Volume C4: EIAR Appendices). The results of peat probe surveys is also examined in Chapter 15: Material Assets (Roads).

10.2.1.3 Importance of Local Soils, Subsoils & Bedrock

Soil, subsoil and bedrock in the area are for the most part not designated (*i.e.* SAC) and the soil types are locally and regionally abundant and are not unique in any way. The soils in agricultural lands at the Mountphilips Substation site and the soils underlying the public road pavements and the private paved road pavements have been heavily altered by the existing landuse. The soils at the Consented UWF Substation will have been altered by the time works for the 110kV UGC take place within the compound. Therefore, based on the criteria set out in Table 10-3, the importance of the soils at the vast majority of the UWF Grid Connection study area is classed as having a **low to medium importance**.

The exception to this importance rating occurs along the UWF Grid Connection, where the 110kV UGC (within public road pavements and within bridge structures) briefly passes through the boundary of the Lower River Shannon SAC at 6 locations, the soils of the Lower River Shannon SAC are described separately in Section 10.3.1.2 of this chapter. The UWF Grid Connection is not located within, or in close proximity to,

any NHA, pNHA or other Geological Heritage Site (see also Section 10.1.4: Sensitive Aspects excluded from further evaluation, where the potential for impacts to national and geological heritage sites is evaluated).

10.2.1.4 Sensitivity of Local Soils, Subsoils & Bedrock

Soils and geology can be sensitive to processes such as erosion, compaction and drainage. The rate of these processes can be increased by certain landuse practices or landuse changes such as deforestation. Soil is also biologically active and it supports complex ecosystems which are sensitive to chemical and biological changes.

10.2.1.5 Trends in the Baseline Environment (the 'Do-Nothing' scenario)

The soils and subsoils in the study areas have all been altered to some extent by drainage or by other land improvement works or land use changes related to the existing land use (*i.e.* forestry and agriculture, and public roads). These landuse improvement practices are expected to continue, as agricultural land and forestry regularly needs continued ploughing, seeding, planting etc to improve soil and subsoil structure. This leaves land susceptible for periods to erosion and compaction. Forestry tracks and farm tracks are also regularly upgraded. The other main, on-going, land use improvement practice that will directly affect soil and subsoil is drainage works.

10.2.1.6 Receiving Environment (the Baseline + Trends)

Rates of natural processes (i.e. erosion and weathering) and changes made by landuse practices are typically relatively slow. Therefore it is assumed in this report that the baseline environment for soils as identified above will be the receiving environment at the time of construction.

10.2.2 CUMULATIVE INFORMATION - Cumulative Projects & Baseline Characteristics

10.2.2.1 Cumulative Evaluation Study Areas

10.2.2.1.1 UWF Grid Connection Cumulative Evaluation Study Area

The UWF Grid Connection was evaluated for cumulative effects with other projects and the study area is set out in the table below.

UWF Grid Connection Cumulative Evaluation Study Area for Local Soils, Subsoil & Bedrock	Justification for the Study Area Extents
Footprint of UWF Grid Connection construction works areas and immediate adjacent lands that adjoin the works areas	Only direct effects on soils and geology are anticipated

The study is illustrated on Figure CE 10.2.1: UWF Grid Connection Cumulative Evaluation Study Area for Local Soils & Subsoil and on Figure CE 10.2.2: UWF Grid Connection Cumulative Evaluation Study Area for Local Bedrock.

10.2.2.1.2 Whole Project Cumulative Evaluation Study Area

UWF Grid Connection is part of a whole project which comprises the following Other Elements; Element 2: UWF Related Works, Element 3: UWF Replacement Forestry, Element 4: Upperchurch Windfarm (UWF), and Element 5: UWF Other Activities. The Subject Development, UWF Grid Connection is Element 1. All five elements are collectively referred to as the Whole UWF Project in this EIA Report.

The Other Elements must be considered because UWF Grid Connection is part of a whole project. Therefore, the cumulative information and evaluations for the Other Elements of the Whole UWF Project are included in order to present the totality of the project.

A description of these Other Elements is included in this EIA Report at Appendices 5.3, 5.4, 5.5 and 5.6**,** in Volume C4 EIAR Appendices**.** Scoping of these Other Elements is presented in Section 10.2.2.2.1 below.

The Whole Project Cumulative Evaluation Study Area comprises of the UWF Grid Connection Study Area along with the study areas for Other Elements and Other Projects or Activities which are described in Table 10-10 and illustrated on Figure WP 10.2.1: Whole Project Study Area for Local Soils & Subsoils and Figure WP 10.2.2: Whole Project Study Area for Local Bedrock (Volume C3 EIAR Figures).

Table 10-10: Whole Project Cumulative Evaluation Study Area for Local Soils, Subsoils & Bedrock

Cumulative Project	**Cumulative Study Area Boundary**	**Justification for Study Area Extent**
Element 1: UWF Grid Connection	Boundary of works areas and activity locations	Only direct effects on soils and geology are anticipated.
Element 2: UWF Related Works		
Element 3: UWF Replacement Forestry		
Element 4: Upperchurch Windfarm (UWF)		
Element 5: UWF Other Activities		

10.2.2.2 Scoping for Other Projects or Activities & Potential for Impacts

The evaluation of cumulative impacts to Local Soils, Subsoils & Bedrock also considered Other Projects or Activities. A scoping exercise was carried out to determine which projects or activities, if any, have potential to cause cumulative effects to Local Soils, Subsoils & Bedrock with either the UWF Grid Connection or the Other Elements of the Whole UWF Project and therefore should be brought forward for evaluation in this topic chapter. A brief overview of the Other Projects or Activities and the scoping exercise by the topic authors is included in Appendix 2.1: Scoping of Other Projects or Activities for the Cumulative Evaluations (Sections A2.1.4.16).

The results of this scoping exercise are that: no other projects or activities will cause cumulative effects to Local Soils, Subsoils & Bedrock with UWF Grid Connection or with the Other Elements.

10.2.2.2.1 Potential for Other Elements or Other Projects to cause Impacts to Local Soils, Subsoils & Bedrock

An evaluation was carried out by the topic authors of the likelihood for the Other Elements of the Whole UWF Project and for the Other Projects or Activities to cause cumulative effects to the Sensitive Aspect Local Soils, Subsoils and Bedrock. The results of this evaluation is included in Table 10-11.

The location of, and study area boundary associated with, the Other Elements is illustrated on Figure WP 10.2.1: and Figure WP 10.2.2. The baseline character of the areas around these projects is described in Section 10.2.2.3.

Table 10-11: Results of the Evaluation of the Other Elements and Other Projects or Activities

Other Element of the Whole UWF Project	
Element 2: UWF Related Works	Included for the evaluation of cumulative effects
Element 3: UWF Replacement Forestry	Evaluated as excluded: Neutral effect/No potential for effects due to: • Neutral excavation/relocation effects or erosion effects to local soils or subsoils as there will be no requirement for mechanical excavations with the UWF Replacement Forestry being planted by hand using spades (Project Design Measure), any excavation of soil will be very localized and shallow. • No potential for compaction effects, as there will be no use of heavy machinery during the planting or maintenance activities, • No potential for impacts to bedrock, as there will be no requirement to excavate bedrock. • Neutral contamination effects, as there will be no refuelling of vehicles, no storage of fuels and no overnight parking permitted within the site (Project Design Measure), • No potential for contamination of soils by pesticides, fertilizers or cementitious materials, as pesticides or fertilizers will not be used (Project Design Measure) and there will be no requirement for cement based products for the UWF Replacement Forestry, • No effects on soils and geology are expected during the growing (operational) phase as there is no requirement for any excavations. • The UWF Replacement Forestry will be permanent woodland (project design) therefore no harvesting (changes to the project) will occur.
Element 4: Upperchurch Windfarm (UWF)	Included for the evaluation of cumulative effects
Element 5: UWF Other Activities	Evaluated as excluded: Neutral effect/No potential for effects due to: • Haul Route Activities: no potential for impacts as matting will be laid over any reinstated verges as necessary; these activities will not require any works, excavations or

	relocation of soils. • Overhead Line Activities: Neutral impact, these activities will involve cable wrapping and re-sagging of the overhead existing lines and there and will not involve mechanical excavation or relocation of soils, therefore effects on soils will be Neutral. • Upperchurch Hen Harrier Scheme: Neutral impact, this activity will comprise planting and fencing at hedgerows, watercourse boundaries and areas of scrub. These activities will generally take place on the periphery of fields and will not involve mechanical excavation or moving soils, therefore effects on soils will be Neutral. During the Operational Stage of UWF, farming practices under the Upperchurch Hen Harrier Scheme will, to a certain extent, cause lands to revert back to wet grassland which will have a neutral effect on soils over time, due to the extent of the Scheme area in the context of the extent of soils in the surrounding area. • Monitoring Activities: No potential for impacts, these activities will not require any works, excavations or relocation of soils.

10.2.2.3 Cumulative Information: Baseline Characteristics – Context & Character

10.2.2.3.1 Element 2: UWF Related Works & Element 4: Upperchurch Windfarm

The Consented Upperchurch Windfarm is located on land comprising mainly upland agricultural grassland and some forestry.

The UWF Related Works which will be located in the area of the Consented Upperchurch Windfarm are also located on land comprising mainly upland agricultural grassland and some forestry. Some of the related Haul Route Works are located along the verges of local existing public roads.

An overview of the current landuse at Upperchurch Windfarm and UWF Related Works is shown in Table 10-12 below.

Table 10-12: Overview of Landuse within the Cumulative Evaluation Study Area (Other Elements)

Element	Total Landuse (Ha)	Forestry	Agricultural	Public Roads
Upperchurch Windfarm	56.3	17%	83%	0%
UWF Related Works	20.9	34%	59%	7%

A summary of the Geological Survey of Ireland (GSI) mapped subsoil and bedrock geology within the Upperchurch Windfarm/UWF Related Works study areas is shown in Table 10-13 below. The GSI mapping for subsoils and bedrock geology is illustrated on Figure WP 10.2.1 and Figure WP 10.2.2.

Table 10-13: Summary of the GSI Mapped Geology within the UWF Related Works Study Area

UWF Related Works	General Bedrock Unit Name - Figure WP 10.2.2	GSI Local Bedrock Formation Description	Main Subsoil Type - Figure WP 10.2.1	Main Soil Type
All parts of the Upperchurch Windfarm and UWF Related Works	Silurian Meta-sediments and Volcanics	Greywacke, Siltstone and Grit	Bedrock at Surface, underlain by Sandstone and Shale Tills. Some Blanket Peat	Well Draining and Poorly Draining Mineral soil

Detailed site investigations, were undertaken in 2012 as part of the original Upperchurch Windfarm site investigation works. Walkover surveys of the UWF Related Works area were completed between January

2016 and September 2017. The locations of site investigations are identified on Figure WP 10.2.1. The findings of the walkover surveys and 2012 site investigations are summarised in Table 10-15.

Table 10-14: Summary of Local Geology and Ground Conditions on the Upperchurch Windfarm

Location	Landuse	Site Investigations	Summary of Local Geology and Ground Conditions
Upperchurch Windfarm	Grassland Forestry	20. Trial Pits 2 no. Peat Probes	• Poorly draining peaty soil and well draining soil over Sand-stone and Shale Tills • Most peat has been removed due to past agriculture im-provements • Thin peat remains in some forested areas (<1m) • Trial pits mainly encountered peaty topsoil on gravelly CLAY over weathered SILTSTONE bedrock • Depth to bedrock ranged from 1.2 to 2.9m with an average of 1.9m • Peat probes undertaken at consented turbine locations T05 and T14 recorded peats depth less than 1m

Consideration of the Passage of Time: There has been no changes to the soils, subsoils and bedrock of the Upperchurch Windfarm area, and the descriptions in the 2013 and 2014 documents remain relevant to the cumulative evaluations in this EIAR. Therefore it is considered that there has been no material changes in the baseline environment.

10.2.2.3.2 **Element 3: UWF Replacement Forestry**

Not applicable – Element evaluated as excluded. See Section 10.2.2.2.1.

10.2.2.3.3 **Element 5: UWF Other Activities**

Not applicable – Element evaluated as excluded. See Section 10.2.2.2.1.

10.2.2.3.4 **Other Projects or Activities**

Not applicable – No Other Projects or Activities were scoped in for evaluation of cumulative effects, see Section 10.2.2.2.

10.2.3 PROJECT DESIGN MEASURES for Local Soils, Subsoils & Bedrock

At the conception of the UWF Grid Connection, the design team evaluated the potential for significant impacts to the environment. Impacts will only take place where three components exist together; (1) the source of the impact (project), (2) the receptor of the impact (sensitive aspect) and (3) a pathway between the source and the sensitive aspect. The objective of mitigation measures is to avoid, prevent or reduce, one of the three components of an impact by choosing an alternative location, alternative design or an alternative process.

Potential or likely significant impacts were avoided, prevented or reduced by integrating mitigation measures into the fundamental design of the development – these are the Project Design Environmental Protection Measures, which are shortened to 'Project Design Measures' in this EIA Report.

The development as evaluated in the EIA Report incorporates the Project Design Measures.

The Project Design Measures outlined in Table 10-16 are relevant to the Environmental Factor, Soils, and in particular to the sensitive aspect **Local Soils, Subsoils & Bedrock**.

Table 10-15: UWF Grid Connection Project Design Measures relevant to Local Soils, Subsoils & Bedrock

PD ID	Project Design Environmental Protection Measure (PD)
PD05	At the Mountphilips Substation site, construction traffic will be restricted to the construction works area and tracking across adjacent ground will not be permitted. A speed limit of 25km/hr for all traffic/machinery will be implemented at the Mountphilips Substation site. Outside of Mountphilips Substation site, all construction will be restricted to the paved road surfaces or built surfaces along the 110kV UGC. A speed limit of 50km/hr for all delivery and construction traffic will be implemented on Local Roads ('L' roads).
PD17	At Mountphilips Substation, water for operational stage welfare facilities will be obtained from a Rain Water Harvesting system. Waste water will be collected in tanks and removed from site by an appropriately licensed operator, for treatment in a licensed water treatment plant. These two measures will avoid the need for a new well or mains water connection and will avoid the need to treat waste water on-site.
PD21	At Mountphilips Substation site, the permanent storage berms will be along the new access road and around the substation compound will be planted with local provenance native fruiting hedge species, with grasses and native flower species common to the surrounding vegetation sown along the sides of the berms. Local provenance native wildflower seed of flowering plants like clovers, vetches and knapweed will be included. Revegetation works will take place at the soonest practicable opportunity after emplacement.
PD34	Only precast concrete culverts or structures will be used at the watercourse crossing locations at Mountphilips Substation site and for any culvert replacements along the 110kV UGC. Only precast concrete chambers will be used at Joint Bay locations. No batching of wet cement will take place on-site.
PD42	There will be no refuelling of vehicles or plant permitted within 100m of a watercourse. Spill response apparatus including spill-kits and hydrocarbon absorbent packs will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment. The Environmental Emergency Response Procedure will be implemented immediately in the event of any spills. The Environmental Emergency Response Procedure is part of the UWF Grid Connection Environmental Management Plan.
PD43	The main fuel stocks for, and chemical wastes arising from, construction activities will be stored in a designated location, away from main traffic activity, within the temporary compound at the Mountphilips Substation site. All fuel will be stored in bunded, locked storage containers. The designated storage location will be greater than 100m from a watercourse. Spill response apparatus including spill-kits and hydrocarbon absorbent packs will be stored at the designated location in the temporary compound and all operators will be fully trained in the use of this equipment. The Environmental Emergency Response Procedure will be im-

	plemented immediately in the event of any spills. The Environmental Emergency Response Procedure is part of the UWF Grid Connection Environmental Management Plan.
PD44	Overnight parking of plant and machinery will only be permitted at the temporary compound at the Mountphilips Substation site and at a distance greater than 50m from watercourses.

Cumulative Information: Potential or likely significant impacts caused by the Other Elements of the Whole UWF Project were avoided, prevented or reduced by incorporating Project Design Measures into the design of the UWF Related Works and into the consented design of the Upperchurch Windfarm. These Project Design Measures are included in the description of these Elements, and can be found in this EIA Report in Appendices 5.3 and 5.5 in Volume C4: EIAR Appendices.

10.2.4 EVALUATION OF IMPACTS to Local Soils, Subsoils & Bedrock

In this Section, the likely direct and indirect effects of the UWF Grid Connection are identified and evaluated. Then the likely cumulative effects of the UWF Grid Connection together with the Other Elements of the Whole UWF Project and Other Projects or Activities are identified and evaluated.

A conceptual site model exercise was carried out to facilitate the identification of source-pathway-receptor links between the project (source) and the sensitive aspect (receptor) - Local Soils, Subsoils & Bedrock.

As a result of the exercise, some impacts were included and some were excluded.

Table 10-16: List of all Impacts included and excluded from the Impact Evaluation Table sections

Impacts Included (Evaluated in the Impact Evaluation Table sections)	***Impacts Excluded*** *(Justification at the end of the Impact Evaluation Table sections)*
Excavation and relocation of soil, subsoil and bedrock (Construction Stage)	*Ground instability (construction stage)*
Soil and subsoil compaction (Construction Stage)	*Operational stage effects*
Soil and subsoil erosion (Construction Stage)	*Decommissioning stage effects*
Contamination from Oils, Fuels & Chemicals (Construction Stage)	
Contamination from Cement Based Compounds (Construction Stage)	

The source-pathway-receptor links for included impacts are described in the **Impact Evaluation Tables,** which are presented **in the following sections 10.2.4.1 to 10.2.4.5.**

The source-pathway-receptor links and the rationale for excluded impacts are described in the section directly after the Impact Evaluation Table sections- Section 10.2.4.6.

10.2.4.1 Impact Evaluation Table: Excavation & Relocation of soils, subsoil, bedrock

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Groundworks, earthworks
Cumulative Impact Source: Groundworks, earthworks, extraction from borrow pits
Impact Pathway: Excavation, drilling, movement and mounding of overburden

Impact Description: The physical excavation and relocation of soil, subsoil and to a lesser extent bedrock from its natural location to a different location. All excavated and relocated soil will be contained within the boundary of construction works areas.

Impact Quality: Negative

Evaluation of the Subject Development Impact – Excavation & Relocation of soils, subsoil and bedrock

Element 1: UWF Grid Connection – direct/indirect impact

Impact Magnitude:

- In total, approximately 28,680 m^3 of geological material will be permanently excavated and this will mainly arise from the ground works and new access road for Mountphilips Substation (total 5,300m^3) and the trenching/joint bays for the 110kV UGC ; comprising topsoil (4,060m^3), subsoil (1,240m^3) and spoil from public road excavations (23,380m^3);
- 5,000m^3 of the excavated material will be permanently stored along the new access road to Mountphilips Substation and around the Mountphilips Substation compound as linear berms along both sides of the road, and the remainder (300m^3) will be reinstated within the works area at Coole/Mountphilips.
- The 23,380m^3 of spoil from the public road excavations will be removed to a licensed waste facility.
- It is considered that the impact magnitude will be Small Adverse (refer to Table 10-4) as the excavation volumes, which are relatively small, will be spread out over a large geographical area over the length of the UWF Grid Connection (i.e. 23km latitudinal distance).

Significance of the Impact: Slight

Rationale for Impact Evaluation:

- As per Table 10-4, Small Adverse magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- The excavations required for the 110kV UGC works will be spread out over a large geographical area - 23km latitudinal distance, therefore are not concentrated in any one area, thereby distributing the overall effect on soils and geology over a wide geographical area);
- The relatively shallow nature of the excavation works required for the 110kV UGC, Mountphilips Substation, new access roads and site entrance;
- All permanent excavated areas at Mountphilips Substation site will be backfilled, and the soils surrounding new permanent hard-core areas will be fully reinstated and landscaped with local provenance native fruiting hedge species, with grasses and native flower species at the soonest practicable opportunity after emplacement by virtue of the project design;
- All excavations along the 110kV UGC will be will be backfilled immediately after the works by virtue of the design (i.e. backfilling and reinstatement of the 110kV UGC cable trench);
- All effects will be direct and relatively localised;
- The soil and geology at the Mountphilips Substation and along the 110kV UGC are abundant and are not unique in any way;
- With the exception of the short sections of the 110kV UGC route within the Lower River Shannon SAC (which is assessed separately below), the soil and geology is of low to medium importance; and,

- All works will be temporary and generally transient in nature.

Element 1: UWF Grid Connection – cumulative impact

Cumulative Impact Magnitude:
The potential for cumulative impacts is limited to the eastern end of the 110kV UGC route in 1 No. forestry landholding in Knockcurraghbola Commons. Cumulative impacts relate to the combined excavation and relocation of soils in this landholding, where 140m^3 of bitumen layer and 400m^3 sub-soil will be excavated from the private paved road for the 110kV UGC trench, and 960m^3 of soils for the Internal Windfarm Cabling (UWF Related Works) and windfarm access roads and turbine hardstand (Upperchurch Windfarm) in the forestry landholding (off the paved road).

It is considered that the cumulative impact magnitude will be Negligible in the Forestry landholding due to the location of the 110kV UGC in a paved road, with no land-use change, and excavations relating to soils which have already been excavated and heavily modified during the laying of the roadway.

Significance of the Cumulative Impact: Imperceptible

Rationale for Cumulative Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- location of the 110kV UGC within an existing paved road within the zone of cumulative impacts;
- The transient and temporary nature of the construction works.

Cumulative Information: Individual Evaluations of Other Elements of the Whole UWF Project

Element 2: UWF Related Works

Impact Magnitude:
In total, approximately 11,830m^3 of natural material will be excavated and this will mainly arise from the Internal Windfarm Cabling trenching, Haul Route Works, Realigned Windfarm Roads and Telecom Relay Pole. This will include topsoil (4,750m^3), subsoil (6,670m^3 to a much lesser extent bedrock (360m^3) and spoil (50m^3); and, ~930m^3 of overburden will be permanently stored within the windfarm and the remainder (10,850 m^3) will be reinstated within the works area. The impact magnitude will be Moderate Adverse (refer to Table 10-4) as the excavation volumes which are relatively small, will be spread out over the area of the Upperchurch Windfarm

Significance of the Impact: Slight to Moderate

Rationale for Impact Evaluation:

- As per Table 10-4, Moderate Adverse magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- The relatively small excavation volumes required for the Internal Windfarm Cabling trench by it being virtue of a narrow, relatively shallow excavation;
- Approximately 62% (11.1 of the total 17.9km) of the Internal Windfarm Cabling will be within the Consented UWF Roads thereby reducing overall excavations volume requirements;
- The small area of lands subject to works, in the context of the abundance of the soil types in the surrounding area;
- The relatively shallow nature of the excavation works required for UWF Related Works;
- All works will be temporary and transient in nature;
- All excavations will be fully reinstated and landscaped immediately after the works by virtue of the design (i.e. backfilling and reinstatement of the Internal Windfarm Cabling trenching);
- Following the completion of construction works in an area, lands will be reinstated to at least their former (or better) condition and returned to the landowner for use as before;
- The soil and geology at the UWF Related Works area is abundant and not unique in any way; and,

- The soil and geology is only of low to medium importance and is not designated (i.e. SAC, NHA or pNHA).

Element 3: UWF Replacement Forestry – *N/A, evaluated as excluded, see Section 10.2.2.2.1.*

Element 4: Upperchurch Windfarm

Impact Magnitude:

- As per the 2013 EIS, construction of the Upperchurch Windfarm will result in the removal of 108,000m3 of overburden. This will comprise soil (25,500m3), subsoil (79,600m3) and peat (2,900m3);
- There will be a total of 6 no. borrow pits within the site extracting bedrock with the total rock volume estimated at 43,000m3 (EIAR, 2017);
- Up to 56,000m^3 of overburden will be reinstated and used for landscaping;
- Up to 52,000m^3 of overburden will be permanently stored in bunds along Consented UWF Roads and at Consented UWF Turbine hardstanding areas and around the met mast areas; and,
- As per the ABP Inspectors Report (2014, Section 2.0 Reference Documents – Volume F10), the footprint of the Upperchurch Windfarm comprises 11ha within a total landholding area of c.1,050 hectares. Therefore, the footprint of the development accounts for only 1% of the total Upperchurch Windfarm landholding.

It was assessed in the 2013 EIS that the effects on soils and geology will not be significant in light of the consented mitigation measures. This is equivalent to 'Not Significant' in respect of terminology used herein.

Significance of the Impact: Not Significant

Rationale for Impact Evaluation:

- the small scale (~1%) of lands subject works, in the context of the size of total windfarm landholding.
- the volume of overburden / bedrock to be excavated is minimal in the context of the natural resources present within the windfarm landholding; and,
- Following the completion of construction works in an area, lands outside the hard-core footprint of the Upperchurch Windfarm will be reinstated to their former condition and returned to the landowner for use as before.

Element 5: UWF Other Activities – *N/A, evaluated as excluded, see Section 10.2.2.2.1.*

Evaluation of Other Cumulative Impacts – Excavation & Relocation of soils, subsoil and bedrock

Whole UWF Project Effect- Excavation & Relocation of soils, subsoil and bedrock

Cumulative Impact Magnitude:

The Whole UWF Project effect relates to the combined excavations and relocation of soils for the UWF Grid Connection and the UWF Related Works and the Upperchurch Windfarm elements. Combined excavation volumes will involve the excavation and relocation (from its natural location) of up to 148,510m^3 of overburden (topsoil, peat and subsoil) and the excavation of 360m^3 of bedrock within a combined landholding area of approximately 1,290 hectares across at latitudinal distance of ~25km.

It is considered that the overall impact magnitude will be Moderate Adverse (refer to Table 10-4) as the excavation volumes, which are moderate proportions, will be spread out over a large geographical area along the UWF Grid Connection and within the UWF Related Works/Upperchurch Windfarm site.

Significance of the Cumulative Impact: Slight to Moderate

Rationale for Cumulative Impact Evaluation:

- As per Table 10-4, Moderate Adverse magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- Due to the direct nature effects of excavation works on soils and geology (i.e. impacts will be limited to the construction works area) and the fact that each of the project development elements will largely have their own construction works area (with the exception of a short overlap of the 110kV UGC and the UWF Related Works/Upperchurch Windfarm and described below), increased excavations at any one element of the de-

velopment will not be greater as a result of the works at another element of the development;

- Only approximately 0.7km of the 110kV UGC route exists within the UWF Related Works/Upperchurch Windfarm landholding on its approach to the Consented UWF Substation and therefore the effect of increased excavation volumes on soils and geology within the UWF Related Works/Upperchurch Windfarm site is negligible;
- With respect to the UWF Related Works. Approximately 62% of the UWF Related Works Internal Windfarm Cabling will be within the Consented UWF Roads thereby reducing overall excavations volumes;,
- The transient and temporary nature of the construction works; and
- In the context of the abundance of soils in the surrounding area.

Note: No cumulative information for Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Local Soils, Subsoils or Bedrock with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.2.2.2).

10.2.4.2 Impact Evaluation Table: Compaction of Soil and Subsoil

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Construction traffic movement, temporary infrastructure and temporary storage of overburden
Cumulative Impact Source: Construction traffic movement, temporary infrastructure and temporary storage of overburden
Impact Pathway: Physical Compression

Impact Description: The compaction of the soil and subsoil layers beneath compounds, access roads, and storage berms, due to the additional weight of this infrastructure along with any traffic, and the additional weight of soils in temporary and permanent overburden storage berms.

Impact Quality: Negative

Evaluation of the Subject Development Impact – Compaction of Soil and Subsoil

Element 1: UWF Grid Connection – direct/indirect impact

Impact Magnitude:
The potential for compaction mainly relates to the Mountphilips Substation site, as no compaction is likely to occur as a result of 110kV UGC construction works along the public road network, private paved road or at the future compound location of the Consented UWF Substation.

Within the construction works area boundary at the Mountphilips Substation site, soil and subsoil compaction is likely to occur under the new Mountphilips Substation compound area, (under the new permanent access road, under the End Mast locations, under the temporary access road to the End Masts, and under permanent storage berms. Some compaction of soils (overburden) in the permanent storage berms will also occur due to mounding.

Given the fact that the vast majority of the 110kV UGC route is along existing public roads where no compaction is likely to occur, with compaction impacts limited to the Mountphilips Substation site where the extent of compaction will be small and limited to two landholdings, it is considered that the magnitude will be Negligible (refer to Table 10-4).

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- The majority of the UWF Grid Connection is along the carriageway of public roads (for the 110kV UGC) where no further soil compaction is likely;
- Works, machinery and traffic at the Mountphilips Substation site will be restricted to the construction works area and particularly to the new permanent and temporary access roads and compound locations, and tracking across adjacent ground will not be permitted (project design measure).

Element 1: UWF Grid Connection – cumulative impact

Cumulative Impact Magnitude: No cumulative impacts are likely to occur, as the UWF Grid Connection project will not cause compaction impacts in the Upperchurch Windfarm/UWF Related Works area due to the location of UWF Grid Connection works within the public road, private paved road and future consented UWF Substation compound location in this area.

Significance of the Cumulative Impact: No Cumulative Impact

Rationale for Cumulative Impact Evaluation:

- Due to its location on paved roads and in hardcore compound areas, the UWF Grid Connection project will not cause compaction effects in the Upperchurch Windfarm/UWF Related Works area, and therefore there is no potential for cumulative effects.

Cumulative Information for Other Elements of the Whole UWF Project

Element 2: UWF Related Works

Impact Magnitude:
There is expected to be some soil and subsoil compaction due to construction traffic along the Internal Windfarm Cabling working corridor. Soil and subsoil compaction can also be expected locally under the Telecom Relay Pole, the new Realigned Windfarm Roads and at Haul Route Works locations.
Given the small size of construction works areas within the overall landholding (<1%), it is considered that the magnitude will be Negligible (refer to Table 10-4).

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- Approximately 62% of the Internal Windfarm Cabling will be within the Consented UWF Roads thereby reducing the need to track off-road;
- Where permanent access roads are not being installed, temporary roads will be used along the working corridor and these roads will offer some protection from compaction to the underlying soil/subsoils by distribution of weight;
- The temporary access road footprint will account for <1% of the UWF Related Works landholding area;
- Construction work in the area of the Realigned Windfarm Roads (3 no. locations) and the Telecom Relay Pole will be localised to the permanent windfarm footprint area and construction traffic will use the Consented UWF Roads to access these works locations;
- The Haul Route Works will largely require construction vehicles working off public roads. The potential for compaction will largely be limited construction of access roads on private lands which only accounts for less <1% of the UWF Related Works landholding area; and,
- Any compaction that would be caused by the temporary footprint is reversible by reinstatement involving chisel ploughing and leveling.

Element 3: UWF Replacement Forestry – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Element 4: Upperchurch Windfarm

Impact Magnitude: Soil and subsoil compaction was assessed in the 2013 Upperchurch Windfarm EIS with respect to construction activity. As per the 2013 EIS: short to medium term effects are expected to occur within the development footprint It was assessed in the 2013 EIS that the effects on soils and geology will not be significant in light of the consented mitigation measures. This is equivalent to 'Not Significant' in respect of terminology used herein.

Significance of the Impact: Not Significant

Rationale for Impact Evaluation:

- Most of the traffic movement within the site during the construction phase will be over new or existing access roads;
- Vehicular movement will be restricted to the footprint of the consented development, particularly with respect the new constructed access roads; and,
- The small scale of lands subject works, in the context of the size of total Upperchurch Windfarm landholding.

Element 5: UWF Other Activities – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Evaluation of Other Cumulative Impacts – Compaction of Soil and Subsoil
Whole UWF Project Effect
Cumulative Impact Magnitude: The potential for soil and subsoil compaction will be limited to the construction works area (57.9ha) associated with the combined UWF Grid Connection (at the Mountphilips Substation site), and UWF Related Works and Upperchurch Windfarm, with construction works areas occurring on 5% of the total landholding area. The overall potential for additional compaction of the soil and subsoil is reduced by the direct nature of compaction effects on soils and geology (i.e. impacts will be limited to the footprint of the construction works areas); the overlap of approximately 62% of the Internal Windfarm Cabling for UWF Related Works will be within the Consented UWF Roads Given the small size of the construction works areas within the overall size of landholdings (5%), it is considered that the magnitude of the whole project effect will be Negligible (refer to Table 10-4).
Significance of the Cumulative Impact: Imperceptible
Rationale for Cumulative Impact Evaluation: • As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area; • The majority of the UWF Grid Connection is along the carriageway of public roads where no further soil compaction is likely; • Permanent access roads within the Upperchurch Windfarm will remain in place permanently for the benefit of the landowner and therefore any loss of soil productivity due to compaction will likely have an overriding positive effect in terms of improved land accessibility during wet weather events; and, • The small scale (5%) of lands subject to works, on average for all landholdings.

Note: No cumulative information for Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Local Soils, Subsoils or Bedrock with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.2.2.2).

10.2.4.3 Impact Evaluation Table: Erosion of Soil and Subsoil

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Groundworks and storage of overburden
Cumulative Impact Source: Groundworks and storage of overburden
Impact Pathway: Excavations, tracking of construction traffic and wind and rain action

Impact Description: Erosion of soil and subsoil as a result of construction traffic and also as a result of natural process such as rain and wind action on exposed soil and subsoil.

Impact Quality: Negative

Evaluation of the Subject Development Impact – Erosion of Soil and Subsoil

Element 1: UWF Grid Connection – direct/indirect impact

Impact Magnitude:
The potential for erosion of soils is limited to the new permanent berms at the Mountphilips Substation site. Erosion from the new berms will be reduced through the immediate seeding of the berms, which will minimise the length of time soils are exposed on the berms. There is likely to be some limited erosion of exposed soils and subsoils due to the storage of overburden at the Mountphilips Substation site. Tracking of construction traffic along off-road sections of the works areas has also the potential to cause erosion.

Erosion from other construction works areas is limited by the carrying out of works within excavated areas which will be overlaid with aggregate and hardcore (e.g. the new permanent access road, new substation compound and hardstanding area at the new End Masts). The potential for erosion is also reduced through the avoidance of excavations for the temporary road to the End Masts (this road will be constructed by placing geotextile on the grass surface with an overlay of aggregate).

Erosion of exposed subsoils in open trenches at works locations along the 110kV UGC along the public road and along the private paved road may also occur during wet periods. Due to the underground nature of the 110kV UGC trench, the exposed soils are not likely to be affected by wind erosion. All excavated material from the 110kV UGC trenches and joint bay excavations outside the Mountphilips Substation site will be removed immediately to a licensed facility, and therefore there is no potential for erosion of overburden from this excavated material.

Given the large geographical spread of the UWF Grid Connection, the fact that the majority of excavations (82%) relate to the excavated material from 110kV UGC trenches and joint bays within the paved public/private road surfaces, with the remainder relating to the relatively small storage volumes at the Mountphilips Substation site, which are also spread out over the works area, it is considered that the magnitude will be Negligible (refer to Table 10-4).

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- The majority of the proposed UWF Grid Connection 110kV UGC is along the carriageway of public roads (or along the paved surface of the private paved road) which provide a hard surface for construction traffic;
- The exposed in-situ subsoil along the 110kV UGC route will be contained within a trench and therefore the potential for erosion and transport by water and wind action is low;
- The 110kV UGC trench will be filled and reinstated very soon after excavation;
- The potential erosion of permanent overburden storages at Mountphilips Substation site will be eventually

limited by reseeding and vegetation growth;

- On agricultural grassland, a new permanent/temporary access roads will be used to access the Mountphilips Substation / End Masts and these roads will offer protection to the underlying soil/subsoils from erosion.

Element 1: UWF Grid Connection – cumulative impact

Cumulative Impact Magnitude: the potential for cumulative soil erosion effects is limited to the works area for UWF Grid Connection, where other Elements also occur – i.e. in the townlands of Knockmaroe, Knockcurraghbola Crownlands and Knockcurraghbola townlands.

It is considered that UWF Grid Connection will not contribute to erosion effects in these townlands, as the trenching and joint bay works for UWF Grid Connection are within paved public and private road pavements. Therefore any cumulative impacts with UWF Related Works or Upperchurch Windfarm works which occur on adjacent road verges or on adjacent lands will be negligible. Where the 110kV UGC overlaps the footprint of the Consented UWF Substation, the consented substation compound will have already been excavated and overlaid with hard-core by the time of trenching works for the 110kV UGC, and therefore will not contribute to erosion effects with the 110kV UGC trenching works in the compound area.

The 110kV UGC also overlaps with the UWF Related Works along the local roads L2264-50 and L6188-0 at Haul Route Works H8 – H12. However the 110kV UGC is in the public road along this section, and any additional erosion effects will be negligible.

Overall the magnitude of cumulative impact of UWF Grid Connection with Upperchurch Windfarm and UWF Related Works area will be negligible.

Significance of the Cumulative Impact: Imperceptible

Rationale for Cumulative Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area

Cumulative Information: Individual Evaluations of Other Elements of the Whole UWF Project

Element 2: UWF Related Works

Impact Magnitude:
There is likely to be some erosion of exposed soils and subsoils at the UWF Related Works areas where excavations take place and also during the permanent storage of overburden. Tracking of construction traffic along off-road sections of the works areas has also the potential to cause erosion.

Given the small area of the construction works areas within the overall landholding (<2%), it is considered that the magnitude will be Negligible (refer to Table 10-4).

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- The exposed in-situ soil along the Internal Windfarm Cabling will be largely contained within a trench and therefore the potential for erosion from water and wind is low;
- The internal cabling trench will be backfilled and reinstated very soon after excavation;
- The surface area of the permanent overburden storage berms is negligible compared to the total landholding area;
- The potential erosion of permanent overburden storages will be eventually limited by reseeding and vegetation growth;
- Approximately 62% of the Internal Windfarm Cabling will be within the Consented UWF Roads thereby re-

ducing the need to track off-road;

- Where no Consented UWF Roads are present, temporary access roads will be used to access the Internal Windfarm Cabling areas and these roads will offer protection to the underlying natural soil/subsoils from erosion;
- Construction work in the area of the Realigned Windfarm Roads (3 no. locations) and the Telecom Relay Pole will be localised to the construction works area and construction traffic will use consented roads to access these new locations; and,
- The Haul Route Works will largely require construction vehicles working off public roads. In addition, any natural soils and subsoils exposed under the footprint of the road widening will be surfaced with hard-core, thereby reducing the potential for erosion.

Element 3: UWF Replacement Forestry – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Element 4: Upperchurch Windfarm

Impact Magnitude:
There is likely to be some erosion of exposed soils and subsoils at the Upperchurch Windfarm construction works areas where excavations take place and also during the permanent storage of overburden.

It was assessed in the 2013 EIS that the effects on soils and geology will not be significant in light of the small area of lands subject to works and the consented mitigation measures. This is equivalent to 'Not Significant' in respect of terminology used herein.

Significance of the Impact: Not Significant

Rationale for Impact Evaluation:

- Most of the traffic movement within the site during the construction phase will be over new access roads;
- Vehicular movement will be restricted to the boundary of the construction works areas, particularly with respect the new constructed access roads; and
- The small scale (1%) of lands subject to works, in the context of the total size of the Upperchurch Windfarm landholding.

Element 5: UWF Other Activities – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Evaluation of Other Cumulative Impacts – Erosion of Soil and Subsoil

Whole UWF Project Effect

Cumulative Impact Magnitude:
The potential for soil and subsoil erosion will be limited to the construction works areas (57.9ha) associated with the combined UWF Grid Connection, UWF Related Works and Upperchurch Windfarm construction works area which accounts for 5% of the total landholding area of 1,266ha.

Due to the direct nature effects of erosion on soils and geology (i.e. impacts will be limited to the footprint of the construction works area) and the fact that each of the project development elements will largely have their own construction works area (with the exception of the overlap of the UWF Related Works and the Upperchurch Windfarm, described below), increased erosion at any one element of the development will not be greater as a result of the works for another element of the development.

The potential for erosion effects due to UWF Grid Connection mainly relates to the Mountphilips Substation site. Cumulatively, only approximately 740m of the 110kV UGC route exists within landholdings associated with the Other Elements - UWF Related Works and Upperchurch Windfarm landholdings, where the 110kV UGC is located within the existing private paved road and the future compound for the consented UWF Substation, and due to the location of the 110kV UGC, the effect of increased erosion on soils and geology within this landholding is negligible; The 110kV UGC also overlaps with the UWF Related Works along the local roads L2264-50 and L6188-0 at Haul Route Works H8 – H12. However the 110kV UGC is in the public road along this section, and any additional erosion effects will be negligible.

With respect of the UWF Related Works (within the Upperchurch Windfarm site). Approximately 62% of the Internal Windfarm Cabling will be within the Consented UWF Roads thereby reducing the overall potential for erosion due to construction traffic; Given the small size of the construction works area, it is considered that the magnitude will be Negligible (refer to Table 10-4).
Significance of the Cumulative Impact: Imperceptible
Rationale for Cumulative Impact Evaluation: • As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area; and, • The small scale (5%) of lands subject to works, on average for all landholdings.

Note: No cumulative information for Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Local Soils, Subsoils or Bedrock with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.2.2.2).

10.2.4.4 Impact Evaluation Table: Contamination by Oils, Fuels & Chemicals

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Oils, Fuels and Chemicals
Cumulative Impact Source: Oils, Fuels and Chemicals
Impact Pathway: Soil, subsoil and bedrock pore space

Impact Description: The plant and equipment that will be used during the construction phase will be run on fuels and oils. This creates the potential for spillage and leakage of hydrocarbons from plant during refuelling or storage of oils and fuels. The effect on soil, subsoil and bedrock will be a direct, local effect.

Impact Quality: Negative

Evaluation of the Subject Development Impact – Contamination by Oils, Fuels & Chemicals

Element 1: UWF Grid Connection - direct/indirect impact

Impact Magnitude:
Plant and equipment will be used at all works areas for UWF Grid Connection, however the potential for contamination effects is limited to the construction works areas in agricultural lands at the Mountphilips Substation site, because all material (made up of asphalt/bitumen road surfacing material, hardcore and natural subsoil), from 110kV UGC outside of the Mountphilips Substation site will be treated as spoil and removed to a licensed waste facility.

At the Mountphilips Substation site, construction works will take place on 4.7ha of lands. Any contamination effects will be minor - only relatively small volumes of fuels or oils will be on-site at any one time and therefore there is no significant spills, and any spillages, should they occur, will be limited to small accidental spillage (i.e. small spillage volumes) during storage of oils, fuels and chemicals and during refuelling of construction or excavation plant with petroleum hydrocarbons.

Given the large geographical spread of the works area, the fact that the majority of UWF Grid Connection works will be along asphalt/bitumen covered public roads and the small volumes of fuel that will be present on-site and any one time, it is considered that the magnitude will be Negligible (refer to Table 10-4).

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- The main fuel stocks for, and chemical wastes arising from, construction activities will be stored in a designated location, away from main traffic activity, within the temporary compound at the Mountphilips Substation site. All fuel will be stored in bunded, locked storage containers. The designated storage location will be greater than 100m from a watercourse (Project Design Measure);
- Overnight parking of plant and machinery will only be permitted at the temporary construction compound in Mountphilips and at a distance greater than 50m from watercourses and this reduces the risk posed by leaks (Project Design Measure); and,
- Any effects that do occur will be very localised to the soils and subsoils at the source / works activity area.

Element 1: UWF Grid Connection – cumulative impact

Cumulative Impact Magnitude: the potential for cumulative contamination effects is limited to the works area for UWF Grid Connection, where other Elements also occur – i.e. in the townlands of Knockmaroe, Knockcurraghbola Crownlands and Knockcurraghbola townlands.

It is considered that UWF Grid Connection will not contribute to contamination effects in these townlands, as the trenching and joint bay works for UWF Grid Connection are within paved public and private road pavements, and all materials excavated from the 110kV UGC trenches and joint bays in the UWF Grid Connection Cumulative Evaluation Study Area will be removed to a licensed waste facility. Therefore there will be no material present which can cause cumulative contamination effects with any contamination associated with the Other Elements. It is evaluated that the magnitude of cumulative impacts will be Negligible (refer to Table 10-4).

Significance of the Cumulative Impact: Imperceptible

Rationale for Cumulative Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;

Cumulative Information: Individual Evaluations of Other Elements of the Whole UWF Project

Element 2: UWF Related Works

Impact Magnitude:
Plant and equipment will be used at all the UWF Related Works areas and therefore contamination effects could in theory occur at any of the construction works areas, which are 20.9ha in total. However, any effects will be minor - only relatively small volumes of fuels or oils will be on-site at any one time and therefore there is no significant spills, and any spillages, should they occur, will be limited to small accidental spillage (i.e. small spillage volumes) during storage of oils, fuels and chemicals and during refueling of construction or excavation plant with petroleum hydrocarbons. Given the small size of the construction works area within the overall landholding (<1%) and the small volume of fuels that will be present on-site at any one time, it is considered that the magnitude will be Negligible (refer to Table 10-4).

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- All fuels required for construction activities will be stored in a designated location within the windfarm site, away from main traffic activity, within the Site Compound No. 1. All fuel will be stored in bunded, locked storage containers (Project Design Measure);
- Overnight parking of plant and machinery will only be permitted at designated sites where there is a hardcore surface in place and this reduces the risk posed by leaks (Project Design Measure);
- All chemical wastes will be stored in secure, bunded and covered storage containers, in a designated secure part of the Site Compound No. 1, and will be removed from site and transported to either Enva Ireland Limited approved licensed facilities (Project Design Measure);
- Any effects that do occur will be localised to the soils and possibly shallow subsoils at the source / works activity area.

Element 3: UWF Replacement Forestry – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Element 4: Upperchurch Windfarm

Impact Magnitude: The effects on soils and geology from hydrocarbon leaks are assessed in the Upperchurch Windfarm EIS. The EIS states that potential effects can occur to 'earth materials at and downhill from the development site'. Contamination effects could in theory occur at any of the construction works areas, which are 56.3ha in total. It was assessed in the 2013 EIS that the residual effects on soils and geology will not be significant in light of the small area of lands subject to works and the consented mitigation measures. This is equivalent to 'Not Significant' in respect of terminology used herein.

Significance of the Impact: Not significant

Rationale for Impact Evaluation:

- Condition No. 15 of the Grant of Permission requires the implementation of a Construction Environmental Management Plan, and Ecological Management Plan and an Environmental Management Plan. Furthermore, Condition No.15 specifies that: (a) all oils and fuels shall be stored in an area bunded to 110% of the total volume of stored oils and fuels; and (b) re-fuelling or machine servicing shall take place only within designated impermeable bunded areas, which shall be drained through an oil interceptor; and,
- The Environmental Management Plan (EMP) includes a Fuel Management Plan, which provides for the regular checking of vehicles, equipment, plant and material storage areas; and best practice measures for storing and handling of fuels/oils and procedures to deal with emergency incidents and spills

Element 5: UWF Other Activities – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Evaluation of Other Cumulative Impacts – Contamination by Oils, Fuels & Chemicals

Whole UWF Project Effect

Cumulative Impact Magnitude:
Plant and equipment will be used at all works areas and therefore soil, subsoil and bedrock along construction works areas associated with UWF Grid Connection, UWF Related Works, Upperchurch Windfarm could potentially be affected by contamination effects (with the exception of the 110kV UGC route outside the Mountphilips Substation site where all excavated material will be treated as spoil and removed to a licensed waste facility). However, any effects to soils are only likely to be minor and localised within the construction works areas.

Due to the direct nature effects of spills and leaks on soils and geology (i.e. impacts will largely be limited to the footprint of the works area) and the fact that each of the project development elements will largely have their own construction works area, increased soil or subsoil contamination at any one element of the development is not expected to be increased contamination as a result of the works at another element of the development;
It is considered that the overall magnitude will be Negligible (refer to Table 10-4).

Significance of the Whole Project Effect: Imperceptible

Rationale for Cumulative Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- Location of the UWF Grid Connection 110kV UGC predominately along public road which are asphalt/bitumen surfaced;
- Minor accidental spillage (i.e. small spillage volumes) during storage and refuelling of construction / excavation plant with petroleum hydrocarbons is only likely to occur (worst case);
- Only relatively small volumes of fuels / oils will be on-site at any one time and therefore no significant effects are expected;
- The large geographical spread of the Whole UWF Project means that large accumulation of spills / leaks at any one location is not possible; and,
- Implementation of the Environmental Management Plan for the Upperchurch Windfarm.

Note: No cumulative information for Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Local Soils, Subsoils or Bedrock with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.2.2.2).

10.2.4.5 Impact Evaluation Table: Contamination by Cement Based Compounds

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Cement Based compounds
Cumulative Impact Source: Cement Based compounds
Impact Pathway: Soil, subsoil and bedrock pore space

Impact Description: Contamination of Soil, Subsoil and Bedrock due to direct contact with cement based construction compounds used for construction. Concrete and other cement-based products are highly alkaline and corrosive and can have impacts specifically on the soil and subsoils in terms of toxicity to its flora and fauna. The effects will largely localised to the soil in direct contact area with cementitious material.

Impact Quality: Negative

Evaluation of the Subject Development Impact – Contamination by Cement Based Compounds

Element 1: UWF Grid Connection – direct/indirect impact

Impact Magnitude:
The main use of cement based compounds will be in the 110kV UGC cable trench and during the construction of foundations at the Mountphilips Substation and End Masts. The underlying subsoils at these locations may come in direct contact with the subsoils. All effects will be directly localised to the footprint of the Mountphilips Substation and End Masts and cable trenches for the 110kV UGC (i.e. soil and subsoil in direct contact with the foundations).

The magnitude of impact is reduced by: the location of the 110kV UGC (outside of the Mountphilips Substation site) within public road pavements where the majority of the trench walls will comprise asphalt/bitumen/hardcore rather than natural soil/subsoil; no batching of wet cement will take place on-site therefore large volumes of cement will not be present on-site at any one time; and only precast concrete structures will be used at joint bays and at watercourse crossing locations (as required).

Only a temporary (and reversible) increase in the pH of the soil, subsoil and bedrock in direct contact with the cement is likely to occur. The effects, which will be localised to the cable trench and Mountphilips substation / End Mast foundations will only persist until the cement mix has hardened and the high alkalinity leachate flushed out / diluted by rainfall. Indirect effects on groundwater quality and surface water quality from cement based compounds are assessed in the Water Chapter (Chapter 11). Given the large geographical spread of the UWF Grid Connection works areas and the relatively small volumes of cement involved, the impact magnitude is expected to be Negligible.

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- No batching of wet cement will take place on-site therefore large volumes of cement will not be present on-site at any one time;
- Only precast concrete structures will be used at joint bays and at watercourse crossing locations as required;
- Only a temporary (and reversible) increase in the pH of the soil, subsoil and bedrock in direct contact with the cement is likely to occur.

Element 1: UWF Grid Connection – cumulative impact

Impact Magnitude: The potential for cumulative impacts relates to the eastern end of the 110kV UGC where it is located within the Consented UWF Substation compound in Knockcurraghbola Commons. Concrete for UWF

Related Works at the Telecoms Relay Pole, and concrete for Consented UWF Turbines are not located close to the 110kV UGC and therefore will not cause cumulative effects. Any cumulative effects within the Consented UWF Substation compound will be negligible as the compound will already have been excavated and overlaid with aggregate before the 110kV UGC trench is excavated within the compound, therefore concrete for the 110kV UGC in the Consented UWF Substation compound will be in contact with aggregate rather than soil/subsoil.

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with the Medium to Low Importance of soils and geology within the study area.

Cumulative Information: Individual Evaluations of Other Elements of the Whole UWF Project

Element 2: UWF Related Works

Impact Magnitude:
Cement will only be used at the Telecom Relay Pole foundation and at the 9 No. Internal Windfarm Cabling public road crossings (c.3 – 5m each). Due to the small scale of the works, the impact magnitude is expected to be Negligible.

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- Small scale of works (e.g. 5m^2 compound), volumes of cement to be used will be negligible.

Element 3: UWF Replacement Forestry – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Element 4: Upperchurch Windfarm

Impact Magnitude:
The primary use of cement at the windfarm will be construction of the Consented UWF Turbine foundations and in the foundations of the control building structure at the Consented UWF Substation. The volumes of cement that will be imported on-site will be considerable, but given that the Consented Upperchurch Windfarm is spread out over several landholding areas, the impact magnitude is considered to be Small Adverse (refer to Table 10-4).

Significance of the Impact: Slight

Rationale for Impact Evaluation:

- As per Table 10-4, Small Adverse magnitude combined with the Medium to Low Importance of soils and geology within the study area;
- No batching of wet cement will take place on-site and therefore large volumes will not be present on-site at any one time;
- The pouring of turbine bases (22 no.) will be done over 3 - 4 months and therefore large volumes of wet cement will not be on-site at any one time;
- A precast concrete structure, in the form of a clear span bridge, will be used at the watercourse crossing on the Upperchurch Windfarm site
- Only a temporary (and reversible) increase in the pH of the soil, subsoil and bedrock in direct contact with the cement or indirectly via seepage water is likely to occur.
- The effects, which will be localized, will only last until the cement mix has hardened and the high alkalinity leachate flushed out / diluted by rainfall;
- The implementation of Cement Control Procedures under the Environmental Management Plan for the Upperchurch Windfarm (See 2013 RFI).

Element 5: UWF Other Activities – *N/A, evaluated as excluded, see Section 10.2.2.2.1*

Evaluation of Other Cumulative Impacts – Contamination by Cement Based Compounds
Whole UWF Project Effect
Magnitude: Cement based compounds will be used for the UWF Grid Connection at Mountphilips Substation, End Masts and along the 110kV UGC. Cement based compounds will also be used at Upperchurch Windfarm turbine foundations and substation, and to a much lesser extent at UWF Related Works Telecoms Relay Pole. Any soil, subsoil and bedrock at these locations are a potential receptor. Due to the direct nature effects of cement based compounds on effects on soils and geology (i.e. impacts will largely be limited to the construction works area) and the fact that the 110kV UGC for UWF Grid Connection is within road pavements (outside of the proposed Mountphilips Substation site); and that each of the Elements of the Whole UWF Project will largely have their own construction works areas, increased cement exposure to soils and subsoils at any one Element of the Whole UWF Project is not expected to be increased as a result of the works at another Element of the Whole UWF Project. Only a temporary (and reversible) increase in the pH of the soil, subsoil and bedrock in direct contact with the cement or indirectly via seepage water is likely to occur. The overall impact magnitude of the whole project is considered to be **Small Adverse**.
Significance of the Whole Project Effect: Slight
Rationale for Impact Evaluation: • As per Table 10-4, Small Adverse magnitude combined with the Medium to Low Importance of soils and geology within the study area; and, • Only a temporary (and reversible) increase in the pH of the soil, subsoil and bedrock in direct contact with the cement or indirectly via seepage water is likely to occur. • Temporary duration and reversibility of the effect

Note: No cumulative information for Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Local Soils, Subsoils or Bedrock with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.2.2.2).

10.2.4.6 Description and Rationale for Excluded (scoped out) Impacts

The source-pathway-receptor links and the rationale for impacts excluded from the Impact Evaluation Table sections are described in the table below.

Table 10-17: Description and Rationale for Excluded Impacts to Local Soils, Subsoils & Bedrock

Source(s) of Impacts	Project Element	Pathway	Impacts (Consequences)	Rationale for Excluding
Construction Stage				
Excavations	1	Soil	Ground instability	Rationale for Excluding: No Likely Impacts: In relation to UWF Grid Connection 110kV UGC works through mapped peat along the central part of the route, site investigations (see Appendix 15.4) showing the stable nature of roads within the construction works areas being predominantly of 'excavate and fill' construction and their location on firm ground and not peat. At the sections of road along the 110kV UGC on the R503 where it occurs through mapped peat areas will use a floating road cable trench detail and 2.6m reinstatement of the road surface following works, this will improve the strength of the road in these locations. In all other locations, the public road is located on competent ground. All other parts of the UWF Grid Connection and the Other Elements of the Whole UWF Project are located on competent ground with no potential for ground instability.
Operational Stage Effects				
Neutral effect: Major excavations or groundworks are not expected to occur during the operation of Upperchurch Windfarm or UWF Related Works. In relation to UWF Grid Connection, excavations or groundworks will not occur as part of normal operation, and any excavations required along the 110kV UGC as part of major maintenance or repair work is likely to relate to the pulling of new cables at joint bay locations – all works will occur in aggregate/already altered ground, no soils or subsoils will be directly impacted. In addition, all ground that was previously exposed during excavation works, along with permanent overburden storage berms will have vegetated over and therefore there will be no potential for erosion. Any impacts on soils and geology that do occur during the operational phase will be Neutral				
Decommissioning Stage Effects				
UWF Grid Connection: No potential for impacts - the UWF Grid Connection will remain part of the National Grid on a permanent basis and is not expected to be decommissioned. UWF Related Works: No potential for impacts - The cables will be pulled from the Internal Windfarm Cabling ducts at the Consented UWF Turbines or at the Consented UWF Substation; the ducting, Realigned Windfarm Roads and Haul Route Works will remain in-situ; therefore no decommissioning works to soils or lands are required. The Telecom Relay Pole will be removed, and its compound area reinstated and returned to agricultural. Neutral impacts to soils and geology will occur due to the very small footprint of the compound ($25m^2$). Upperchurch Windfarm; Neutral impact –It is likely that the Consented UWF Substation will remain in-situ for use by ESBN and that the Consented UWF Roads will also remain in-situ for use by the landowner. Decommissioning works will be limited to the Consented UWF Turbines, Turbine Hardstanding areas, Meteorological Masts and associated drainage systems, where the turbines and will be removed and the remaining hardstanding areas and associated drainage will be reinstated using the soils in the adjacent storage permanent overburden storage berms, this soil will be reseeded and will re-vegetate quickly, Neutral effects to soils are expected due to the small extent of the hardstands in the context of the large extent of soils in the surrounding area.				

10.2.5 Mitigation Measures for Impacts to Local Soils, Subsoils & Bedrock

Mitigation measures were incorporated into the project design including the Project Design Measures No additional mitigation measures are required as the topic authors conclude that **significant impacts are not likely to occur to Local Soils, Subsoils & Bedrock**.

10.2.6 Evaluation of Residual Impacts to Local Soils, Subsoils & Bedrock

Residual Impacts are the final or intended effects that will occur after mitigation measures have been put into place. No additional mitigation measures are required and thus the Residual Impact is the same as the Impact set out in Impact Evaluation Table sections for Local Soils, Subsoils & Bedrock above (Section 10.2.4) – i.e. **no significant adverse impacts**.

10.2.7 Application of Best Practice and the EMP for Local Soils, Subsoils & Bedrock

The UWF Grid Connection Environmental Management Plan also includes Best Practice Measures (BPM), which although not part of the Project Design for the UWF Grid Connection, will be employed to afford further protection to the Environment.

The following Best Practice Measures have been developed, for the protection of **Local Soils, Subsoils & Bedrock,** by the authors of this topic chapter, using industry best practice:

GC-BPM-05	Protection of Surface Water and Groundwater Quality during use of Cement Based Compounds
GC-BPM-06	Protection of Surface Water and Groundwater Quality During Storage and Handling of Fuels, Oils and Chemicals
GC-BPM-07	Surface Water Quality Protection Measures During Storage of Overburden at the Mountphilips Substation Site

These Best Practice Measures form part of the UWF Grid Connection Environmental Management Plan, which is appended to the EIA Report as Volume D.

10.2.8 Summary of Impacts to Local Soils, Subsoils & Bedrock

A summary of the Impact Evaluation Tables is presented in Table 10-19.

Table 10-18: Summary of the impacts to Local Soils, Subsoils & Bedrock

Impact to Local Soils, Subsoils & Bedrock:	**Excavation & Relocation of soils, subsoil and bedrock**	**Soil & Subsoil Compaction**	**Soil & Subsoil Erosion**	**Contamination from Oil, Fuels & Chemicals**	**Contamination from Cement Based Compounds**
Evaluation Impact Table	*Section 10.2.4.1*	*Section 10.2.4.2*	*Section 10.2.4.3*	*Section 10.2.4.4*	*Section 10.2.4.5*
Project Life-Cycle Stage	Construction Stage	Construction Stage	Construction Stage	Construction Stage	Construction Stage
UWF Grid Connection *Direct/indirect Impact*	**Slight**	**Imperceptible**	**Imperceptible**	**Imperceptible**	**Imperceptible**
UWF Grid Connection *Cumulative Impact*	**Imperceptible**	**No Cumulative Impact**	**Imperceptible**	**Imperceptible**	**Imperceptible**
Element 2: UWF Related Works	Slight to moderate	Imperceptible	Imperceptible	Imperceptible	Imperceptible
Element 3: UWF Replacement Forestry	No Potential for Impact - Evaluated as Excluded, see Section 10.2.2.2.1				
Element 4: Upperchurch Windfarm	Not Significant	Not Significant	Not Significant	Not Significant	Slight
Element 5: UWF Other Activities	No Potential for Impact - Evaluated as Excluded, see Section 10.2.2.2.1				
Cumulative Impact:					
Whole UWF Project Effect	**Slight to Moderate**	**Imperceptible**	**Imperceptible**	**Imperceptible**	**Slight**

The greyed out boxes in the above summary table relate to the cumulative information for the Other Elements of the Whole UWF Project, which are included to show the totality of the project.

Note: No cumulative information for Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Local Soils, Subsoils or Bedrock with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.2.2.2).

Local Soils, Subsoil & Bedrock

Sensitive Aspect

Topic **Soils**

10.3 Sensitive Aspect No.2: Lower River Shannon SAC

This Section provides a description and evaluation of the Sensitive Aspect - Lower River Shannon SAC.

10.3.1 BASELINE CHARACTERISTICS of Lower River Shannon SAC

10.3.1.1 STUDY AREA for Soils - Lower River Shannon SAC

The study area for Lower River Shannon SAC in relation to the UWF Grid Connection is described in Table 10-20 and illustrated on Figure GC 10.3: UWF Grid Connection Study Area for Lower River Shannon SAC (Volume C3 EIAR Figures).

Table 10-19: UWF Grid Connection Study Area for the Lower River Shannon SAC

Study Area for Lower River Shannon SAC	Justification for the Study Area Extents
The extent of the construction works area boundary associated with the UWF Grid Connection where it occurs within the Lower River Shannon SAC	Only direct effects on soils and geology are anticipated.

10.3.1.2 Baseline Context of the Lower River Shannon SAC within the UWF Grid Connection Study Area

Soils and geology are not a qualifying feature of the Lower River Shannon SAC. However, soils and geology are important from an overall habitat perspective. Its inclusion in the assessment also facilitates the evaluation of indirect effects to the SAC in Chapter 11: Water and Chapter 8: Biodiversity.

The Lower River Shannon SAC encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head.

Overlap with the SAC Boundary

The overlap of UWF Grid Connection works is limited to the 110kV UGC, where the 110kV UGC works are located within the boundary of the Lower River Shannon SAC at six locations along public road carriageways, as listed below and identified on Figure GC 10.3;

- 190m along a section of the local public road L6013-0 to the north of Newport;
- 230m along a section of local public roads L2156-0 and L2157-0 on either side of, and over, Rockvale Bridge. Rockvale Bridge crosses the Newport River, to the north of Newport town, at Watercourse Crossing W7;
- 100m, 80m and 390m sections along the Regional Limerick to Thurles Road R503 to the east of Rear Cross; and
- 35m along a section of the Regional Road R503 at Anglesey Bridge, near Kilcommon. Anglesey Bridge crosses over the Bilboa River, to the south of Kilcommon village, at Watercourse Crossing W53.

The qualifying interests of River Shannon SAC are largely aquatic and estuarine related. The interaction of the route of the 110kV UGC with the SAC is entirely within the paved public road surface and existing bridge structures, where the roads are topped with asphalt/bitumen, underlain with hardcore. Some mineral subsoil (sandstone tills) will be excavated from the bottom of the trenches in the public roads. All of the excavated material will be removed immediately to a licenced waste facility. Where the 110kV UGC is located within the SAC boundary at the Newport River and Bilboa River crossing (W7 and W53), the 110kV UGC will cross the watercourse within the bridge structure, and no excavations of soils is will occur.

It is considered that the construction of the 110kV UGC will not directly affect the qualifying interests of River Shannon SAC.

10.3.1.3 Importance of Lower River Shannon SAC

The Lower River Shannon is a designated SAC and contains many Annexed I habitats, including the most extensive area of estuarine habitat in Ireland. Based on the NRA (2008) criteria as shown in Table 10-3 (Section 10.1.8.1), the SAC is of Very High Importance. However, as stated above, the 110kV UGC will not directly affect the qualifying interests of River Shannon SAC.

10.3.1.4 Sensitivity of Lower River Shannon SAC

The primary sensitivities in respect of the UWF Grid Connection will be surface water quality and its water dependant ecosystems and not soils and geology (indirect effects on surface water quality within the SAC from excavations are assessed in Chapter 11 Water). However, soils and geology are important from an overall habitat perspective and therefore effects have been evaluated.

10.3.1.5 Trends in the Baseline Environment (the 'Do-Nothing' scenario)

The location of the 110kV UGC within the River Shannon SAC is along sections of the public roads L6013-0, L2156-0, L2157-0 and R503, which have already been altered for public road use. This use is expected to continue, and no further alteration of soils under public roads is expected to occur.

10.3.1.6 Receiving Environment (the Baseline + Trends)

No landuse changes are expected to occur that would alter the character of the soils and geology within the River Shannon SAC, where it overlaps the UWF Grid Connection Study Area. Therefore it is assumed in this report that the baseline environment identified above will be the receiving environment at the time of construction.

10.3.2 CUMULATIVE INFORMATION - Cumulative Projects & Baseline Characteristics

10.3.2.1 Cumulative Evaluation Study Areas

10.3.2.1.1 UWF Grid Connection Cumulative Evaluation Study Area

The UWF Grid Connection was evaluated for cumulative effects with other projects and the study area is set out in the table below.

UWF Grid Connection Cumulative Evaluation Study Area for Lower River Shannon SAC	Justification for the Study Area Extents
The extent of the construction works area boundary associated with the UWF Grid Connection where it occurs within the Lower River Shannon SAC	Only direct effects on soils and geology are anticipated.

The study is illustrated on Figure CE 10.3: UWF Grid Connection Cumulative Evaluation Study Area for Lower River Shannon SAC

10.3.2.1.2 Whole Project Cumulative Evaluation Study Area

UWF Grid Connection is part of a whole project which comprises the following Other Elements; Element 2: UWF Related Works, Element 3: UWF Replacement Forestry, Element 4: Upperchurch Windfarm (UWF), and Element 5: UWF Other Activities. The Subject Development, UWF Grid Connection is Element 1. All five elements are collectively referred to as the Whole UWF Project in this EIA Report.

The Other Elements must be considered because UWF Grid Connection is part of a whole project. Therefore, the cumulative information and evaluations for the Other Elements of the Whole UWF Project are included in order to present the totality of the project.

A description of these Other Elements is included in this EIA Report at Appendices 5.3, 5.4, 5.5 and 5.6**,** in Volume C4 EIAR Appendices**.** Scoping of these Other Elements is presented in Section 10.3.2.2.1 below.

The Whole Project Cumulative Study Area for the evaluation of cumulative effects is described in Table 10-21, and illustrated on Figure WP 10.3: Whole Project Study Area for Lower River Shannon SAC (Volume C3 EIAR Figures).

Table 10-20: Whole Project Cumulative Evaluation Study Area for the Lower River Shannon SAC

Cumulative Project	Cumulative Study Area Boundary	Justification for Study Area Extent
Element 1: UWF Grid Connection	Boundary of construction works areas, planting lands or activity locations where they interact/overlap with the boundary of the Lower River Shannon SAC	Only direct effects on soils and geology are anticipated.
Element 2: UWF Related Works		
Element 3: UWF Replacement Forestry		
Element 4: Upperchurch Windfarm (UWF)		
Element 5: UWF Other Activities		

10.3.2.2 Scoping for Other Projects or Activities & Potential for Impacts

The evaluation of cumulative impacts to Lower River Shannon SAC also considered Other Projects or Activities. A scoping exercise was carried out to determine which projects or activities, if any, have potential to cause cumulative effects to Lower River Shannon SAC with any of the Other Elements of the Whole UWF Project and therefore should be brought forward for evaluation in this topic chapter. A brief overview of the Other Projects or Activities and the scoping exercise by the topic authors is included in Appendix 2.1: Scoping of Other Projects or Activities for the Cumulative Evaluations (Sections A2.1.4.18).

The results of this scoping exercise are that: it is evaluated that no Other Projects or Activities are likely to cause cumulative effects with either the UWF Grid Connection or the Other Elements of the Whole UWF Project, and therefore no Other Projects or Activities are scoped in for evaluation of cumulative effects to Lower River Shannon SAC.

10.3.2.2.1 Potential for Other Elements or Other Projects to cause Impacts to Lower River Shannon SAC

An evaluation was carried out by the topic authors of the likelihood for the Other Elements of the Whole UWF Project to cause cumulative effects to the Sensitive Aspect Lower River Shannon SAC. The results of this evaluation are included in Table 10-22.

The location of, and study area boundary associated with, the Other Elements which are included for cumulative evaluation is illustrated on Figure WP 10.3. The baseline character of the areas around these projects is described in Section 10.2.2.3.

Table 10-21: Results of the Evaluation of the Other Elements of the Whole UWF Project

Other Element of the Whole UWF Project	
Element 2: UWF Related Works	Evaluated as excluded: No potential for effects due to: • all UWF Related Works construction works areas occur at least 1.5km outside the boundary of the Lower River Shannon SAC
Element 3: UWF Replacement Forestry	Evaluated as excluded: No potential for effects due to: • the entirety of the UWF Replacement Forestry lands occur outside both the boundary of the Lower River Shannon SAC and the River Shannon regional catchment area.
Element 4: Upperchurch Windfarm (UWF)	Evaluated as excluded: No potential for effects due to: • all Upperchurch Windfarm construction works areas occur at least 3km out-side the boundary of the Lower River Shannon SAC.
Element 5: UWF Other Activities	Evaluated as excluded: No potential for effects due to: • the UWF Other Activities will not occur within the boundary of the Lower River Shannon SAC.

10.3.2.3 Cumulative Information: Baseline Characteristics – Context & Character

10.3.2.3.1 Element 2: UWF Related Works

Not applicable – Element evaluated as excluded. See Section 10.3.2.2.1

10.3.2.3.2 Element 3: UWF Replacement Forestry

Not applicable –Element evaluated as excluded. See Section 10.3.2.2.1.

10.3.2.3.3 **Element 4: Upperchurch Windfarm**

Not applicable – Element evaluated as excluded. See Section 10.3.2.2.1

10.3.2.3.4 **Element 5: UWF Other Activities**

Not applicable – Element evaluated as excluded. See Section 10.3.2.2.1.

10.3.2.3.5 **Other Projects or Activities**

Not applicable – No Other Projects or Activities were scoped in for evaluation of cumulative effects, see Section 10.3.2.2.

10.3.3 PROJECT DESIGN MEASURES for Lower River Shannon SAC

At the conception of the UWF Grid Connection, the design team evaluated the potential for significant impacts to the environment. Impacts will only take place where three components exist together; (1) the source of the impact (project), (2) the receptor of the impact (sensitive aspect) and (3) a pathway between the source and the sensitive aspect. The objective of mitigation measures is to avoid, prevent or reduce, one of the three components of an impact by choosing an alternative location, alternative design or an alternative process.

Potential or likely significant impacts were avoided, prevented or reduced by integrating mitigation measures into the fundamental design of the development – these are the Project Design Environmental Protection Measures, which are shortened to 'Project Design Measures' in this EIA Report.

The development as evaluated in the EIA Report incorporates the Project Design Measures.

The Project Design Measures outlined in Table 10-23 are relevant to the Environmental Factor Soils, and were specifically developed for the sensitive aspect **Lower River Shannon SAC**. The Project Design Measures listed above at Table 10-16 for Local Soils, Subsoils & Bedrock are also relevant to the Lower River Shannon SAC.

Table 10-22: UWF Grid Connection Project Design Measures relevant to Lower River Shannon SAC

PD ID	Project Design Environmental Protection Measure (PD)
PD36	The sections of 110kV UGC trenches that overlap the Lower River Shannon SAC will be lined with an impermeable geotextile material to prevent potential migration of cement from the trench base or sides into the SAC.
PD37	In addition to PD22, there will be no storage of overburden within the Lower River Shannon SAC.
PD38	110kV UGC works outside of Mountphilips Substation site will be carried out entirely on paved roads and where the 110kV UGC crosses watercourses, the works will be carried out over the existing bridges and over/under existing culverts. No in-streams works are proposed at any watercourse crossing points (including the Newport River and Bilboa River crossings) within the boundary of the Lower River Shannon SAC and therefore there will be no placement of cement or other materials within the river channels or on the river banks within the SAC.
PD39	In addition to PD42, there will be no refuelling of vehicles or plant, no storage of fuels and no overnight parking permitted within 100m of the boundary of the Lower River Shannon SAC.
PD40	In addition to PD29, all 110kV UGC works within the boundary of the Lower River Shannon SAC will only be completed during dry weather in the dryer months of the year – i.e. February to September included.

10.3.4 EVALUATION OF IMPACTS to Lower River Shannon SAC

In this Section, the likely direct and indirect effects of the UWF Grid Connection are identified and evaluated. Then the likely cumulative effects of the UWF Grid Connection together with the Other Elements of the Whole UWF Project and Other Projects or Activities are identified and evaluated.

A conceptual site model exercise was carried out to facilitate the identification of source-pathway-receptor links between the project (source) and the sensitive aspect (receptor) - Lower River Shannon SAC.

As a result of the exercise, some impacts were included and some were excluded.

Table 10-23: List of all Impacts included and excluded from the Impact Evaluation Table sections

Impacts Included (Evaluated in the Impact Evaluation Table sections)	***Impacts Excluded*** *(Justification at the end of the Impact Evaluation Table sections)*
Excavation & Relocation of Soil, Subsoil and Bedrock (construction stage)	*Soil Erosion and/or Compaction (construction stage)*
Contamination from Oils, Fuels & Chemicals (construction stage)	*Operational Stage Effects*
Contamination from Cement Based Compounds (construction stage)	*Decommissioning Stage Effects*

The source-pathway-receptor links for included impacts are described in **the Impact Evaluation Tables,** which are **presented in the following sections 10.3.4.1 to 10.3.4.3.**

The source-pathway-receptor links and the rationale for excluded impacts are described in the section directly after the Impact Evaluation Tables, in Section 10.3.4.4.

10.3.4.1 Impact Evaluation Table: Excavation & Relocation of Soil, Subsoil and Bedrock

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Groundworks, relocation and storage of overburden
Cumulative Impact Source: n/a
Impact Pathway: Excavation, movement and mounding of overburden

Impact Description: The physical excavation and relocation of soil and subsoil and to a lesser extent bedrock from its natural location to a different location. The removal of soils from an SAC can have a direct effect on local habitats.

Impact Quality: Negative

Evaluation of the Subject Development – Excavation & Relocation of Soil, Subsoil and Bedrock

Element 1: UWF Grid Connection – direct/indirect impact

Impact Magnitude:
The UWF Grid Connection works are located within the boundary of the Lower River Shannon SAC at six locations, 760m³ of public road spoil, comprising 90m³ of public road Bitumen material; 60m³ of public road base layer stone and 610m³ of subsoil, will be excavated over a total distance of 1025m, as follows;

- 140m³ of spoil along a 190m section of the local public road L6013-0 to the north of Newport;
- 170m³ of spoil along a 230m section of local public roads L2156-0 and L2157-0 on either side of, and over, Rockvale Bridge. Rockvale Bridge crosses the Newport River, to the north of Newport town, at Watercourse Crossing W7;
- 80m³, 60m³ and 290m³ of spoil along a 100m, 80m and 390m sections, respectively, along the Regional Limerick to Thurles Road R503 to the east of Rear Cross; and
- 20m³ of spoil along a 35m section of the Regional Road R503 at Anglesey Bridge, near Kilcommon. Anglesey Bridge crosses over the Bilboa River, to the south of Kilcommon village, at Watercourse Crossing W53.

As all excavations will be within the road pavement, there is no potential for effects to the soils within the SAC at these points. As there will be no effects on the qualifying features of the SAC, which are largely aquatic habitats and species, the impact magnitude is considered to be Negligible.

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with Very High Importance of the SAC;
- There will be no excavation of the river bed or banks or any off-road locations within the boundary of the SAC;
- There will be no direct effects on the qualifying feature of the SAC which are largely aquatic habitats / species;
- The effects will be limited to excavations within public road pavements;
- All works will be temporary and transient in nature;
- There will be no removal of mineral subsoil within the SAC;
- there will be no storage of overburden within the Lower River Shannon SAC (project design)
- All 110kV UGC works within the boundary of the Lower River Shannon SAC will only be completed during dry weather in the dryer months of the year – i.e. February to September included (project design)

Element 1: UWF Grid Connection – cumulative impact
Cumulative Magnitude: There is no potential for cumulative effects of the UWF Grid Connection with the Other Elements of the Whole UWF Project as only the UWF Grid Connection (110kV UGC route) is located within the boundary of the Lower River Shannon SAC.
Significance of the Whole Project Effect: No Cumulative Impact
Rationale for Impact Evaluation: • None of the Other Elements are located within the boundary of the Lower River Shannon SAC.
Cumulative Information: Individual Evaluations of Other Elements of the Whole UWF Project
Element 2: UWF Related Works *– N/A, evaluated as excluded, see Section 10.3.2.2.1*
Element 3: UWF Replacement Forestry *– N/A, evaluated as excluded, see Section 10.3.2.2.1*
Element 4: Upperchurch Windfarm *– N/A, evaluated as excluded, see Section 10.3.2.2.1*
Element 5: UWF Other Activities *– N/A, evaluated as excluded, see Section 10.3.2.2.1*
Evaluation of Other Cumulative Impacts – Excavation & Relocation of Soil, Subsoil and Bedrock
Whole UWF Project Effect
Magnitude: No potential for cumulative effects of the UWF Grid Connection with the Other Elements of the Whole UWF Project - only the UWF Grid Connection (110kV UGC route) overlaps the boundary of the Lower River Shannon SAC. The whole project effect is in the order of UWF Grid Connection – i.e. Imperceptible.
Significance of the Whole Project Effect: No Cumulative Impact
Rationale for Impact Evaluation: • The UWF Grid Connection (110kV UGC route) is the only element which overlaps the boundary of the Lower River Shannon SAC.

Note: No cumulative evaluation of Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Lower River Shannon SAC with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.3.2.2).

10.3.4.2 Impact Evaluation Table: Contamination from Oils, Fuels & Chemicals

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Oils, Fuels and Chemicals
Cumulative Impact Source: n/a
Impact Pathway: Soil, subsoil and bedrock pore space

Impact Description: The plant and equipment that will be used during the construction phase will be run on fuels and oils. This creates the potential for spillage and leakage of hydrocarbons from machinery or plant during the operation of the machinery or during refuelling. Any spillages onto soil will contaminate the soil with toxic chemical and may cause secondary effects to water quality and biodiversity. Indirect effects on water quality and biodiversity are discussed in Chapter 11 and Chapter 8 respectively.
There will be no refuelling of vehicles or plant, no storage of fuels and no overnight parking permitted within 100m of the boundary of the Lower River Shannon SAC (project design).

Impact Quality: Negative

Evaluation of the Subject Development Impact– Contamination from Oils, Fuels & Chemicals

Element 1: UWF Grid Connection

Impact Magnitude:
The UWF Grid Connection 110kV UGC works overlap the Lower River Shannon SAC at 6 no. locations, with a total length of 1025m of trenching for the 110kV UGC within the SAC. No Joint Bays are located within the SAC boundary. Works within the SAC will take place over a total of 13 no. days as follows;

- 2 days of works along a 190m section of the local public road L6013-0 to the north of Newport;
- 6 days of works along a 230m section of local public roads L2156-0 and L2157-0on either side of, and over, Rockvale Bridge. Rockvale Bridge crosses the Newport River, to the north of Newport town, at Watercourse Crossing W7;
- 1 day, 1 day, 4 days of works along a 100m, 80m and 390m sections, respectively, of the Regional Limerick to Thurles Road R503 to the east of Rear Cross; and
- 4 days of works along a 35m section of the Regional Road R503 at Anglesey Bridge, near Kilcommon. Anglesey Bridge crosses over the Bilboa River, to the south of Kilcommon village, at Watercourse Crossing W53.

As all excavations will be within the road pavement, there is low potential for contamination effects to the soils within the SAC at these points. Given the small scale and short duration of the works within the SAC, the location of excavations within the road pavement, the small volume of fuels/oils that will be present and unlikelihood of large spills/leaks, the impact magnitude is considered to be Negligible

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with Very High Importance of the SAC; and,
- Soils and geology is not a qualifying feature of the SAC. The qualifying interests are largely aquatic, habitats and species;
- The works area in the area of the SAC is overlain by asphalt/bitumen which will provide a protective cover to the underlying subsoils;
- Minor accidental spillage (i.e. small spillage volumes) from leaks or dripping from machinery engines/hydraulics is only likely to occur (worst case);
- There will be no refuelling of vehicles or plant, no storage of fuels and no overnight parking permitted within 100m of the boundary of the Lower River Shannon SAC (project design). (Project Design Measure); and,
- Any effects that do occur will be very localised to the soils and subsoils at the works activity area.

Element 1: UWF Grid Connection – cumulative impact
Cumulative Magnitude: There is no potential for cumulative effects of the UWF Grid Connection with the Other Elements of the Whole UWF Project as only the UWF Grid Connection (110kV UGC route) is located within the Lower River Shannon SAC.
Significance of the Whole Project Effect: No Cumulative Impact
Rationale for Impact Evaluation: • None of the Other Elements are located within the boundary of the Lower River Shannon SAC.
Cumulative Information: Individual Evaluations of Other Elements of the Whole UWF Project
Element 2: UWF Related Works – *N/A, evaluated as excluded, see Section 10.3.2.2.1*
Element 3: UWF Replacement Forestry – *N/A, evaluated as excluded, see Section 10.3.2.2.1*
Element 4: Upperchurch Windfarm – *N/A, evaluated as excluded, see Section 10.3.2.2.1*
Element 5: UWF Other Activities – *N/A, evaluated as excluded, see Section 10.3.2.2.1*
Evaluation of the Cumulative Impact – Contamination from Oils, Fuels & Chemicals
Whole UWF Project Effect
Magnitude: No potential for cumulative effects of the UWF Grid Connection with the Other Elements of the Whole UWF Project - only the UWF Grid Connection (110kV UGC route) overlaps the boundary of the Lower River Shannon SAC. The whole project effect is in the order of UWF Grid Connection – i.e. Imperceptible.
Significance of the Cumulative Impact: No Cumulative Impact
Rationale for Impact Evaluation: • The UWF Grid Connection is the only element which overlaps the boundary of the Lower River Shannon SAC.

Note: No cumulative evaluation of Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Lower River Shannon SAC with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.3.2.2).

10.3.4.3 Impact Evaluation Table: Contamination from Cement Based Compounds

Impact Description	
Project Life Cycle Stage:	Construction stage

Impact Source: Cement based compounds such as concrete
Cumulative Impact Source: n/a
Impact Pathway: Soil, subsoil and bedrock pore space

Impact Description: Contamination of soil, subsoil and bedrock due to direct contact with cement based construction compounds used for construction. Concrete and other cement-based products are highly alkaline and corrosive and can have impacts directly on the soil and subsoils in terms of toxicity to its flora and fauna. The effects will largely be localised to the soil or subsoil in direct contact with the cementations material.
The sections of 110kV UGC trenches that overlap the Lower River Shannon SAC will be lined with an impermeable geotextile material to prevent potential migration of cement from the trench base or sides into the SAC (project design).

Impact Quality: Negative

Evaluation of the Subject Development Impact – Contamination from Cement Based Compounds

Element 1: UWF Grid Connection

Impact Magnitude:
The UWF Grid Connection 110kV UGC trenching works are located within the boundary of the Lower River Shannon SAC at six locations, where a total of 360m³ of concrete will be laid in the cable trench, as follows;

- 70m³ of concrete along a 190m section of the local public road L6013-0 to the north of Newport;
- 80m³ of concrete along a 230m section of local public roads L2156-0 and L2157-0 on either side of, and over, Rockvale Bridge. Rockvale Bridge crosses the Newport River, to the north of Newport town, at Watercourse Crossing W7;
- 40m³, 30m³ and 130m³ of concrete along a 100m, 80m and 390m sections, respectively, of the Regional Limerick to Thurles Road R503 to the east of Rear Cross; and
- 10m³ of concrete along a 35m section of the Regional Road R503 at Anglesey Bridge, near Kilcommon. Anglesey Bridge crosses over the Bilboa River, to the south of Kilcommon village, at Watercourse Crossing W53.

The use of cement within the SAC will be limited to the placement of concrete in the cable trenches in the public road which will comprise mainly asphalt/bitumen and hardcore. The cement will likely have some direct contact with the mineral subsoil beneath the existing public roadway. The cement will be covered and backfilled with aggregate and road surfacing materials.

Given the small scale nature of the works within the SAC, the location of trenches and the placement of cement in the public road pavement; and the small volume of cements involved at these 6 locations, the impact magnitude is considered to be Negligible.

Significance of the Impact: Imperceptible

Rationale for Impact Evaluation:

- As per Table 10-4, Negligible magnitude combined with Very High Importance of the SAC;
- The volume of cement to be used within the SAC will be minimal (c.360m³) due to the relatively short length of works within or in close proximity to the boundary;
- Contact with the cement will be limited to mainly asphalt/hardcore underneath the existing public roadways;
- Only a temporary (and reversible) increase in the pH of the soil, subsoil and bedrock in direct contact with the cement is likely to occur. The effects, which will be localised to the cable trench will only persist until after the cement mix has hardened and the residual high alkalinity leachate flushed out / diluted by rainfall.

Element 1: UWF Grid Connection – cumulative impact
Cumulative Magnitude: There is no potential for cumulative effects of the UWF Grid Connection with the Other Elements of the Whole UWF Project as only the UWF Grid Connection (110kV UGC route) is located within the boundary of the Lower River Shannon SAC.
Significance of the Whole Project Effect: No Cumulative Impact
Rationale for Impact Evaluation: • None of the Other Elements are located within the boundary of the Lower River Shannon SAC.
Cumulative Information: Individual Evaluations of Other Elements of the Whole UWF Project
Element 2: UWF Related Works – N/A, evaluated as excluded, see Section *10.3.2.2.1*
Element 3: UWF Replacement Forestry – N/A, evaluated as excluded, see Section *10.3.2.2.1*
Element 4: Upperchurch Windfarm – N/A, evaluated as excluded, see Section *10.3.2.2.1*
Element 5: UWF Other Activities – N/A, evaluated as excluded, see Section *10.3.2.2.1*
Evaluation of the Cumulative Impact – Contamination from Cement Based Compounds
Whole UWF Project Effect
Magnitude: No potential for cumulative effects of the UWF Grid Connection with the Other Elements of the Whole UWF Project - only the UWF Grid Connection (110kV UGC route) overlaps the boundary of the Lower River Shannon SAC. The whole project effect is in the order of UWF Grid Connection – i.e. Imperceptible.
Significance of the Cumulative Impact: No Cumulative Impact
Rationale for Impact Evaluation: • The UWF Grid Connection (110kV UGC route) is the only element which overlaps the boundary of the Lower River Shannon SAC.

Note: No cumulative evaluation of Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Lower River Shannon SAC with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.3.2.2).

10.3.4.4 Description and Rationale for Excluded (scoped out) Impacts

The source-pathway-receptor links and the rationale for impacts excluded from the Impact Evaluation Table sections are described in the table below.

Table 10-24: Description and Rationale for Excluded Impacts to Lower River Shannon SAC

Key: 1: UWF Grid Connection; 2: UWF Related Works; 3: UWF Replacement Forestry; 4: Upperchurch Windfarm; 5: UWF Other Activities

Source(s) of Impacts	Project Element	Pathway	Impacts (Consequences)	Rationale for Excluding
Construction Stage				
Excavations, construction machinery and traffic, storage of Overburden	1	Movement and mounding	Soil Compaction	Rationale for Excluding: No potential for impacts/Neutral Impacts: Project design has ensured that construction traffic and construction works will be confined to the public roadway, with constructions relating to trenching for the 110kV UGC, with no sources of effects such as no temporary or new permanent access roads within the SAC; no temporary or permanent storage of overburden within the SAC. Trenching works within the SAC boundary will be brief in duration. There will be no potential for soil compaction as the road is overlain by asphalt/bitumen surfaced public roadway, Soils within the SAC boundary at the 6 no. locations are limited to spoil under the public road pavements, circa. 580m³. The location of construction works within the existing road will avoid effects to subsoils by construction traffic – any effects will be Neutral. There are no soil based qualifying features of the SAC - the qualifying features are largely aquatic habitats / species, therefore there is no potential for direct effects to the qualifying features of the SAC– any effects will be Neutral.
Operational Stage Effects				
UWF Grid Connection: There will be no requirement for any excavation work or groundworks within the SAC boundary during the operational phase. All Joint Bays are located outside the boundary of the SAC.				
Decommissioning Stage Effects				
UWF Grid Connection: No potential for impacts: The UWF Grid Connection will remain part of the National Grid on a permanent basis and is not expected to be decommissioned. The Other Elements of the Whole UWF Project are located outside the boundary of the Lower River Shannon SAC.				

10.3.5 Mitigation Measures for Impacts to the Lower River Shannon SAC

Mitigation measures were incorporated into the project design including the Project Design Measures. No additional mitigation measures are required as the topic authors conclude that **significant impacts are not likely to occur** to occur to Lower River Shannon.

10.3.6 Evaluation of Residual Impacts to the Lower River Shannon SAC

Residual Impacts are the final or intended effects that will occur after mitigation measures have been put into place. No additional mitigation measures are required and thus the Residual Impact is the same as the Impact set out in Impact Evaluation Table sections for the Lower River Shannon SAC above (Section 10.3.4) – i.e. **Imperceptible**.

10.3.7 Application of Best Practice and the EMP for the Lower River Shannon SAC

The UWF Grid Connection Environmental Management Plan also includes Best Practice Measures (BPM), which although not part of the Project Design for the UWF Grid Connection, will be employed to afford further protection to the Environment.

The following Best Practice Measures have been developed, for the protection of **Lower River Shannon SAC,** by the authors of this topic chapter, using industry best practice:

GC-BPM-05	Protection of Surface Water and Groundwater Quality during use of Cement Based Compounds
GC-BPM-06	Protection of Surface Water and Groundwater Quality During Storage and Handling of Fuels, Oils and Chemicals

As these Best Practice Measures primarily relate to Water protection, they are included at the end of the Water topic chapter (Chapter 11). These Best Practice Measures form part of the UWF Grid Connection Environmental Management Plan, which is appended to the EIA Report as Volume D.

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10.3.8 Summary of Impacts to the Lower River Shannon SAC

A summary of the Impact Evaluation Tables is presented in Table 10-26.

Table 10-25: Summary of the impacts to the Lower River Shannon SAC

Impact to Lower River Shannon SAC:	**Excavation & Relocation of Soil, Subsoil and Bedrock**	**Contamination from Oils, Fuels & Chemicals**	**Contamination from Cement Based Compounds**
Evaluation Impact Table	*Section 10.3.4.1*	*Section 10.3.4.2*	*Section 10.3.4.3*
Project Life-Cycle Stage	Construction	Construction	Construction
UWF Grid Connection *Direct/indirect Impact*	**Imperceptible**	**Imperceptible**	**Imperceptible**
UWF Grid Connection *Cumulative Impact*	**No Cumulative Impact**	**No Cumulative Impact**	**No Cumulative Impact**
Element 2: UWF Related Works	No Potential for Impact - Evaluated as Excluded, see Section 10.3.2.2.1		
Element 3: UWF Replacement Forestry	No Potential for Impact - Evaluated as Excluded, see Section 10.3.2.2.1		
Element 4: Upperchurch Windfarm	No Potential for Impact - Evaluated as Excluded, see Section 10.3.2.2.1		
Element 5: UWF Other Activities	No Potential for Impact - Evaluated as Excluded, see Section 10.3.2.2.1		
Cumulative Impact:			
Whole UWF Project Effects	No Cumulative Impact	No Cumulative Impact	No Cumulative Impact

The greyed out boxes in the above summary table relate to the cumulative information for the Other Elements of the Whole UWF Project, which are included to show the totality of the project.

Note: No cumulative information for Other Projects or Activities is included in the table above, because no Other Projects or Activities were evaluated as having potential to cause cumulative effects to Lower River Shannon SAC with either the UWF Grid Connection or the Other Elements of the Whole UWF Project (see Section 10.3.2.2).

10.4 Reference List

Geological Survey of Ireland (2004) Bedrock Geology 1:100,000 scale map series, Sheet 18 (Geology of Tipperary).

Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements.

National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

National Parks and Wildlife Services (2004): Bleanbeg Bog NHA Site Synopsis Report (002450).

National Parks and Wildlife Services (2013): Lower River Shannon SAC Site Synopsis Report (002165).

National Parks and Wildlife Services (2013): Lower River Suir SAC Site Synopsis Report (002137).

Tipperary County Council (December 2017 Edition): North Tipperary County Development Plan 2010 – 2016 (As Varied).