

# MWP



## **BALLYCAR WIND FARM**

**Environmental Impact Assessment Report (EIAR)**

**Volume II: EIAR Chapters**

**Ballycar Green Energy Ltd.**

**Project No. 22156 | January 2024**

## Contents

1.	Introduction.....	1-1
1.1	The Applicant.....	1-1
1.2	The Project.....	1-1
1.3	Legislative Context of Strategic Infrastructure Development and Environmental Impact Assessment (EIA) 1-2	
1.3.1	Strategic Infrastructure Development.....	1-2
1.3.2	Environmental Impact Assessment .....	1-2
1.4	The Environmental Impact Assessment (EIA) Process.....	1-3
1.4.1	Screening .....	1-3
1.4.2	Consultation .....	1-3
1.5	EIA Study Area .....	1-8
1.6	Overview of EIAR Structure .....	1-11
1.6.1	Volume I – NON-TECHNICAL SUMMARY.....	1-11
1.6.2	Volume II – MAIN EIAR.....	1-11
1.6.3	Volume III – APPENDICES.....	1-12
1.6.4	Volume IV – PHOTOMONTAGES .....	1-12
1.7	Project Team.....	1-12
1.8	Technical Difficulties and Availability of Data.....	1-17
1.9	Note on Drawings and Graphics .....	1-17
1.10	Viewing and Purchasing the EIAR.....	1-17
	References .....	1-18
2.	Description of the Proposed Development .....	2-1
2.1	Introduction.....	2-1
2.2	Characteristics of the Proposed Development .....	2-1
2.2.1	Proposed Development .....	2-1
2.2.2	Development Location.....	2-4
2.2.3	Development Lands Ownership .....	2-7
2.3	Size, Design and Appearance of the Proposed Project .....	2-7
2.3.1	Wind Turbines .....	2-9
2.3.2	Wind Turbine Foundations .....	2-10
2.3.3	Hardstands and Lay Down Areas .....	2-10
2.3.4	Permanent Meteorological Mast .....	2-10
2.3.5	Underground cabling within the proposed development site.....	2-11
2.3.6	Internal Site Access Tracks .....	2-11
2.3.7	Site Access .....	2-12
2.3.8	Turbine Delivery .....	2-13
2.3.9	Traffic Management .....	2-15

2.3.10	Temporary construction compounds and welfare facilities .....	2-15
2.3.11	Borrow Pits and Material Deposition Areas .....	2-16
2.3.12	Surface Water Management .....	2-17
2.3.13	Conifer Tree Felling.....	2-18
2.3.14	Replant Lands .....	2-19
2.3.15	Grid Connection Options and Infrastructure .....	2-19
2.3.16	Connection Route and Connection Point.....	2-20
2.3.17	Electrical Substation .....	2-20
2.3.18	Underground Cabling within the Wind Farm Site.....	2-21
2.3.19	Turbine transformers .....	2-21
2.3.20	Communication links.....	2-21
2.3.21	Cumulation with other existing and/or approved Projects .....	2-21
2.4	Description of Construction.....	2-28
2.4.1	The construction phase land use requirement.....	2-28
2.4.2	Proposed Works .....	2-29
2.4.3	Construction Methods .....	2-29
2.4.4	Duration and Timing.....	2-30
2.4.5	Major temporary features .....	2-31
2.4.6	List of Plant .....	2-31
2.4.7	Construction Working Hours .....	2-32
2.4.8	Construction Personnel.....	2-32
2.4.9	Construction Environmental Management Plan (CEMP) .....	2-32
2.5	Description of Commissioning.....	2-33
2.6	Description of Operation .....	2-33
2.6.1	Land Use Requirement.....	2-33
2.6.2	Operating Hours and Operational Conditions .....	2-33
2.7	Decommissioning and Restoration Phase of the Proposed Development.....	2-34
2.7.1	Wind Farm .....	2-34
2.7.2	Grid Connection .....	2-35
2.8	The Use of Natural Resources .....	2-35
2.8.1	Aggregate.....	2-35
2.8.2	Water .....	2-36
2.9	The Production of Waste .....	2-36
2.9.1	Excavated soils, subsoil, and rock .....	2-36
2.9.2	Domestic Waste-Water Effluent .....	2-36
2.9.3	General Wastes .....	2-36
2.10	Emissions and Disturbances .....	2-37
2.11	Environmental Protection Measures.....	2-38

2.11.1	Surface Water Management System .....	2-39
2.11.2	Site Management Controls .....	2-39
2.12	Transboundary Effects .....	2-39
2.13	Risk of Major Accidents and Disasters .....	2-39
2.13.1	Construction Issues .....	2-39
2.13.2	Operational Issues .....	2-40
2.14	Impact of Climate Change .....	2-41
2.14.1	Severe Weather .....	2-41
2.14.2	Flooding .....	2-41
2.15	References .....	2-42
3.	Civil Engineering .....	3-1
3.1	Introduction .....	3-1
3.2	Local Access Routes .....	3-1
3.3	Site Entrances .....	3-2
3.4	Internal Wind Farm Site Tracks .....	3-4
3.4.1	Internal Wind Farm Access Track Construction Methods .....	3-5
3.5	Wind Turbines .....	3-12
3.5.1	Wind Turbine Locations .....	3-12
3.5.2	Turbine Crane Hardstands .....	3-12
3.5.3	Turbine Bases .....	3-14
3.6	Internal Site Cables .....	3-16
3.7	Grid Connection Route .....	3-17
3.7.1	Excavation and Duct Installation .....	3-17
3.7.2	Grid Construction- Watercourse Crossings .....	3-18
3.7.3	Grid Connection Construction- Land Drainage Ditches .....	3-19
3.7.4	Grid Connection Construction – Existing and Proposed Underground Services .....	3-19
3.7.5	Grid Connection Construction- Joint Bays and Communication Chambers .....	3-20
3.8	Substation Compound and Buildings .....	3-21
3.9	Permanent Meteorological Mast .....	3-23
3.10	Temporary Site Construction Compound .....	3-24
3.11	Borrow Pit .....	3-25
3.12	Spoil Management and Material Volumes .....	3-27
3.12.1	Excavated Spoil Storage .....	3-27
3.12.2	Temporary Storage of Excavated Material .....	3-28
3.12.3	Permanent Deposition Areas .....	3-28
3.13	Site Drainage .....	3-29
3.13.1	Design Principles .....	3-29
3.13.2	Flood Attenuation .....	3-30

3.13.3	Drainage / Stream Channel Crossings .....	3-31
3.13.4	Water Quality Management Systems.....	3-37
3.14	Decommissioning and Restoration.....	3-50
3.14.5	Wind Farm .....	3-50
3.14.6	Grid Connection .....	3-50
3.15	References .....	3-52
4.	Alternatives .....	4-1
4.1	Introduction.....	4-1
4.2	Site Selection Process .....	4-2
4.2.1	Phase 1 Initial Screening .....	4-2
4.2.2	Phase 2 Grid Constraints.....	4-3
4.2.3	Phase 3 Screening .....	4-3
4.2.4	Site Validation.....	4-4
4.3	Design Process.....	4-7
4.3.1	Identification of Environmental Sensitivities .....	4-7
4.3.2	Constraint Mapping and Buildable Area .....	4-11
4.3.3	Preliminary planning stage design.....	4-14
4.3.4	Detailed planning stage design.....	4-14
4.4	Alternatives Considered.....	4-14
4.4.1	Alternative Wind Farm Layout and Turbine Scale.....	4-15
4.4.2	Alternative Grid Connection Methodologies .....	4-20
4.4.3	Alternative Construction Methodology .....	4-25
4.5	Do Nothing Scenario .....	4-28
4.6	Conclusion .....	4-28
4.7	References .....	4-29
5.	Population and Human Health .....	5-1
5.1	Introduction.....	5-1
5.1.1	Competency of Assessor.....	5-1
5.1.2	Legislation and Guidelines .....	5-1
5.2	Methodology .....	5-2
5.2.1	Public Consultation .....	5-3
5.2.2	Study Area .....	5-3
5.2.3	Scope of Assessment.....	5-6
5.3	Baseline Environment .....	5-10
5.3.1	Site Location and Description .....	5-10
5.3.2	Settlement Patterns .....	5-11
5.3.3	Population Density .....	5-12
5.3.4	Population Trends.....	5-13

5.3.5	Public Health.....	5-14
5.3.6	Economic Activity .....	5-15
5.3.7	Land Uses.....	5-18
5.3.8	Tourism and Amenities .....	5-18
5.4	Assessment of Effects.....	5-19
5.4.1	Construction Phase .....	5-19
5.4.2	Operational Phase .....	5-23
5.4.3	Demolition or Decommissioning Phase .....	5-27
5.4.4	Do Nothing .....	5-27
5.4.5	Cumulative Effects.....	5-28
5.5	Mitigation and Monitoring Measures .....	5-29
5.5.1	Mitigation Measures .....	5-29
5.5.2	Monitoring Measures .....	5-29
5.5	Residual Effects.....	5-29
5.6	Conclusion .....	5-30
5.7	References .....	5-31
6.	Biodiversity .....	6-1
6.1	Introduction.....	6-1
6.1.1	Competency of Assessor.....	6-1
6.1.2	Legislation and Published Guidance.....	6-2
6.1.3	Scope of Assessment.....	6-3
6.1.4	Zone of Influence (ZOI) .....	6-3
6.2	Methodology .....	6-4
6.2.1	Desktop Study .....	6-4
6.2.2	Data Requests.....	6-6
6.2.3	Consultation .....	6-6
6.2.4	Field Surveys.....	6-7
6.2.5	Ecological Value .....	6-15
6.2.6	Scope of Assessment.....	6-16
6.3	Baseline Environment .....	6-17
6.3.1	Site Location and Description .....	6-17
6.3.2	Proposed development.....	6-18
6.3.3	Local Hydrology .....	6-19
6.3.4	Designated Sites .....	6-20
6.3.5	Habitats.....	6-30
6.3.6	Invasive Alien Plant Species (IAPS) .....	6-52
6.3.7	Rare and Protected Flora .....	6-54
6.3.8	Non-Volant Mammals .....	6-54

6.3.9	Bats .....	6-57
6.3.10	Freshwater Aquatic Surveys.....	6-64
6.3.11	Reptiles & Amphibians .....	6-67
6.3.12	Terrestrial Macro-Invertebrates.....	6-68
6.3.13	Identification of Important Ecological Features (IEFs).....	6-70
6.3.14	Do-Nothing Scenario .....	6-77
6.4	Assessment of Impacts and Effects .....	6-77
6.4.1	Construction Phase .....	6-77
6.4.2	Operational Phase .....	6-97
6.4.3	Decommissioning Phase .....	6-105
6.4.4	Cumulative Effects.....	6-106
6.5	Mitigation and Monitoring Measures .....	6-110
6.5.1	Mitigation by Design (Avoidance).....	6-110
6.5.2	Mitigation by Management .....	6-111
6.6	Residual Effects.....	6-126
6.7	Enhancement .....	6-138
6.7.1	Creation of Ponds/Wetland Habitat .....	6-138
6.7.2	Creation of Invertebrate Refugia (Deadwood/Log-Piles) .....	6-138
6.7.3	Retention and Enhancement of Existing Boundary Habitats .....	6-138
6.7.4	Linear Wildflower Meadow Habitat .....	6-139
6.7.5	Bat-box Scheme (Additional artificial roost-sites).....	6-139
6.7.6	Monitoring.....	6-139
6.8	Conclusion .....	6-140
6.9	References .....	6-141
7.	Ornithology.....	7-1
7.1	Introduction.....	7-1
7.1.1	Outline Site Description .....	7-1
7.1.2	Outline Proposed Development Description .....	7-2
7.1.3	Purpose of the Chapter.....	7-3
7.1.4	Competency of the Assessor .....	7-3
7.1.5	Relevant Legislation and Published Guidance .....	7-5
7.1.6	Zone of Influence and the Study Area.....	7-6
7.2	Methodology .....	7-6
7.2.1	Desktop Study .....	7-6
7.2.2	Consultation .....	7-7
7.2.3	Field Surveys.....	7-7
7.2.4	Assessment Approach.....	7-14
7.3	Baseline Conditions.....	7-17

7.3.1	Desk review results .....	7-17
7.3.2	Field Survey Results.....	7-22
7.3.3	Evaluation of Status of Ornithological Receptors within Study Area .....	7-27
7.3.4	Summary of Conservation Value of Site for Birds .....	7-33
7.4	Assessment of Potential Effects.....	7-34
7.4.1	The ‘Do-Nothing’ Impact .....	7-34
7.4.2	Impact on birds .....	7-34
7.4.3	Decommissioning Phase Impacts .....	7-46
7.4.4	Cumulative Impacts.....	7-46
7.5	Mitigation Measures .....	7-48
7.5.1	Construction Phase .....	7-48
7.5.2	Operation Phase .....	7-50
7.5.3	Decommissioning Phase .....	7-51
7.5.4	Mitigation for waterbirds associated with River Shannon and SPA .....	7-51
7.6	Pre-Construction and Construction Phase Monitoring .....	7-52
7.6.1	Pre-construction bird survey .....	7-52
7.7	Post Construction Monitoring .....	7-53
7.7.1	Post Construction Bird Monitoring.....	7-53
7.8	Residual Effects of the Development .....	7-54
7.9	Conclusions.....	7-56
	References.....	7-58
8.	Water .....	8-1
8.1	Introduction.....	8-1
8.1.1	Competency of Assessor.....	8-1
8.1.2	Scope of Assessment.....	8-1
8.1.3	Methodology .....	8-2
8.1.4	Assessment Criteria.....	8-3
8.1.5	Statement on Limitations and Difficulties Encountered.....	8-10
8.2	Existing Receiving Environment.....	8-10
8.2.1	Site and Project Context .....	8-10
8.2.2	Surface Hydrology .....	8-11
8.3	Likely Significant Effects .....	8-25
8.3.1	Do-Nothing Scenario .....	8-25
8.3.2	Construction Phase .....	8-25
8.3.3	Operational Phase .....	8-29
8.3.4	Decommissioning Phase .....	8-29
8.3.5	Risk of Major Accidents and Disasters .....	8-30
8.3.6	Cumulative Effects.....	8-30



8.4	Mitigation .....	8-31
8.4.1	Proposed Drainage Management.....	8-32
8.3.2	Construction Phase .....	8-34
8.4.7	Operational Phase .....	8-39
8.4.8	Decommissioning Phase .....	8-39
8.5	Residual Effects.....	8-40
8.6	Compliance with the Water Framework Directive .....	8-44
8.7	Conclusion .....	8-45
8.8	References .....	8-46
9.	Land and Soils.....	9-1
9.1	Introduction.....	9-1
9.1.1	Competency of Assessor.....	9-1
9.1.2	Legislation .....	9-1
9.2	Methodology .....	9-2
9.2.1	Desktop Study .....	9-2
9.2.2	Site Walkover and Field Survey.....	9-3
9.2.3	Study Area .....	9-3
9.2.4	Scope of Assessment.....	9-4
9.2.5	Statement on Limitations and Difficulties Encountered.....	9-6
9.3	Baseline Environment .....	9-6
9.3.1	Site Location and Description .....	9-6
9.3.2	Existing Land Use.....	9-7
9.3.3	Topography .....	9-8
9.3.4	Regional Geology.....	9-9
9.3.5	Local Geology .....	9-10
9.3.6	Soil and Subsoil.....	9-13
9.3.7	Geological Heritage .....	9-15
9.3.8	Economic Geology.....	9-17
9.3.9	Existing Slope Stability.....	9-19
9.3.10	Extraction and Deposition Areas .....	9-20
9.4	Assessment of Effects.....	9-21
9.4.1	Construction Phase .....	9-21
9.4.2	Operational Phase .....	9-27
9.4.2.4	Grid Connection Route and Substation.....	9-28
9.4.3	Decommissioning Phase .....	9-28
9.4.4	Do-Nothing .....	9-29
9.4.5	Cumulative Effects.....	9-29
9.5	Mitigation and Monitoring Measures .....	9-30

9.5.1	Construction Phase .....	9-30
9.5.2	Operation Phase .....	9-35
9.5.3	Mitigation Measures for Cumulative Effects .....	9-36
9.5.4	Decommissioning Phase .....	9-36
9.6	Risk of Major Accidents and Disasters .....	9-37
9.6.1	Peat Stability .....	9-37
9.7	Residual Effects.....	9-38
9.8	Conclusions.....	9-40
9.9	References .....	9-41
10.	Noise and Vibration .....	10-1
10.1	Introduction .....	10-1
10.1.1	Noise and Vibration Emissions from a Wind Farm Development.....	10-1
10.1.2	Fundamentals of Noise .....	10-2
10.2	Methodology .....	10-3
10.2.1	Operational Wind Farm Noise Policy and Guidance.....	10-3
10.2.2	Construction and Decommissioning Phases Impact Assessment – Best Practice and Guidance 10-4	
10.2.3	Criteria for Evaluating the Operational Phase Impact from Wind Turbines .....	10-4
10.2.4	Criteria for Evaluating Construction and Decommissioning Noise Effects .....	10-5
10.2.5	Criteria for Evaluating Construction and Operational Vibration Effects .....	10-6
10.2.6	Scope of the Assessment .....	10-6
10.2.7	Statement on Limitations and Difficulties Encountered.....	10-6
10.3	Existing Environment.....	10-7
10.3.1	Noise Sensitive Receptors.....	10-7
10.3.2	Background Noise Monitoring.....	10-9
10.3.3	Noise Monitoring Equipment .....	10-13
10.3.4	Meteorological Data.....	10-13
10.3.5	Wind Shear .....	10-13
10.3.6	Filtering and Analysis of Data .....	10-14
10.3.7	Prevailing Background Noise Level.....	10-15
10.4	Likely Significant Effects .....	10-21
10.4.1	Construction Phase – Assessment of Noise Effects.....	10-21
10.4.2	Construction Phase Vibrations .....	10-27
10.4.3	Operational Phase Noise– Assessment of Effects.....	10-27
10.5	Mitigation .....	10-36
10.5.1	Construction Phase Noise .....	10-36
10.5.2	Construction Phase Vibration .....	10-37
10.5.3	Construction Phase Blast Management.....	10-38
10.5.4	Operational Phase Noise.....	10-38

10.5.5	Decommissioning Phase Noise.....	10-39
10.5.6	Decommissioning Phase Vibration.....	10-39
10.6	Residual Effects.....	10-39
10.6.7	Construction and Decommissioning Phase .....	10-39
10.6.8	Operational Phase .....	10-40
10.7	References .....	10-41
11.	Shadow Flicker.....	11-1
11.1	Introduction.....	11-1
11.1.1	Scope of Assessment.....	11-1
11.1.2	Competency of the Assessor .....	11-1
11.1.3	Statement on Limitations and Difficulties Encountered.....	11-2
11.2	Study Area and Methodology.....	11-2
11.2.1	Spatial Relationships .....	11-2
11.2.2	Wind Direction .....	11-3
11.2.3	Sunshine Hours.....	11-3
11.2.4	Theoretical Model Worst Case Assumptions .....	11-4
11.2.5	Realistic Scenario.....	11-5
11.2.6	Assessment Criteria.....	11-6
11.3	Baseline Environment .....	11-6
11.4	Assessment of Impacts and Effects .....	11-12
11.4.1	Construction Phase .....	11-12
11.4.2	Operational Phase .....	11-12
11.4.3	Do-Nothing .....	11-19
11.4.4	Cumulative Impacts and Effects .....	11-19
11.5	Mitigation and Monitoring Measures .....	11-19
11.5.1	Mitigation Measures .....	11-19
11.6	Residual Impacts .....	11-20
11.7	Conclusion .....	11-20
11.8	References .....	11-21
12.	Landscape and Visual.....	12-1
12.1	Introduction.....	12-1
12.1.1	Study Area .....	12-2
12.1.2	Competency of Assessor.....	12-3
12.2	Methodology .....	12-3
12.2.1	Definition of Landscape .....	12-3
12.2.2	Guidance.....	12-3
12.2.3	Key Guidance Documents.....	12-4
12.2.4	Policy Documents.....	12-4

12.2.5	Landscape and Visual Assessment Process .....	12-5
12.2.6	Limitations .....	12-14
12.3	Receiving Environment – Policy Context.....	12-14
12.3.1	Site Location and Description .....	12-14
12.3.2	Landscape Policy Context –Clare County Development Plan 2023-2029 .....	12-15
12.3.3	Limerick Development Plan 2022-2028 .....	12-26
12.3.4	Tipperary Development Plan 2022-2028 .....	12-35
12.3.5	National Policy – DoEHLG Guidelines.....	12-38
12.4	Receiving Environment- Landscape Character of Site and Surrounds .....	12-40
12.4.1	Site context and study area .....	12-40
12.4.2	Topography and Drainage .....	12-40
12.4.3	Landcover .....	12-43
12.4.4	Cultural Heritage and Built Form.....	12-45
12.4.5	Recreation and Amenity areas and Trails.....	12-48
12.4.6	Land Use .....	12-50
12.4.7	Settlement and Transport .....	12-50
12.4.8	Summary of Landscape Character.....	12-53
12.4.9	Potential Visual Receptors and Theoretical Visibility.....	12-54
12.4.10	Do-Nothing scenario .....	12-60
12.5	Construction Phase Effects .....	12-60
12.5.1	Landscape Effects .....	12-60
12.5.2	Visual Effects.....	12-62
12.6	Operational Phase Effects .....	12-63
12.6.1	Landscape Effects .....	12-63
12.6.2	Visual Effects.....	12-65
12.6.3	Cumulative Effects.....	12-91
12.7	Mitigation and Avoidance .....	12-98
12.7.1	Landscape Mitigation Measures – Construction Phase .....	12-98
12.7.2	Avoidance, Mitigation and Enhancement- Operational Phase .....	12-98
12.8	Decommissioning .....	12-99
12.9	Residual Effects.....	12-99
12.10	References .....	12-100
13.	Cultural Heritage .....	13-1
13.1	Introduction.....	13-1
13.1.1	Competency of Assessor.....	13-1
13.2	Methodology .....	13-1
13.2.1	Guidelines and Best Practice .....	13-3
13.2.2	Assessment Criteria.....	13-4

13.2.3	Statement on Limitations and Difficulties Encountered.....	13-6
13.3	Existing Receiving Environment of Proposed Development .....	13-6
13.3.1	Archaeology.....	13-6
13.3.2	Aerial Photography.....	13-24
13.3.3	Topographical Files.....	13-25
13.3.4	National Inventory of Architectural Heritage (NIAH).....	13-25
13.3.5	Archaeological Landscapes .....	13-27
13.3.6	Cultural Heritage Sites.....	13-27
13.3.7	Cartographic Research .....	13-30
13.3.8	Placename .....	13-33
13.3.9	Site Location and Description .....	13-33
13.4	Existing Receiving Environment of the Proposed Grid Cable Connection.....	13-46
13.4.1	General .....	13-46
13.4.2	Recorded Monuments along Proposed External Grid Connection.....	13-46
13.4.3	Excavations Ireland Database .....	13-47
13.4.4	Topographic Files.....	13-47
13.4.5	National Inventory of Architectural Heritage (NIAH).....	13-47
13.4.6	Cultural Heritage Sites.....	13-47
13.4.7	Cartographic Research .....	13-47
13.4.8	Placename .....	13-47
13.4.9	Sufficiency of Baseline Information .....	13-48
13.5	Likely Significant Effects .....	13-48
13.5.1	Proposed Turbines.....	13-48
13.5.2	Proposed Substation, Compound, Deposition Areas, Borrow Pit.....	13-56
13.5.3	Internal Grid Connection/Access Route .....	13-56
13.5.4	Proposed Grid Cable Connection .....	13-57
13.5.5	Construction Phase .....	13-58
13.5.6	Operation Phase.....	13-58
13.5.7	Demolition or Decommissioning Phase (If Relevant) .....	13-59
13.5.8	Likely Receiving Environment Should the Development not go Ahead (Do Nothing) .....	13-59
13.5.9	Cumulative Effects.....	13-59
13.6	Mitigation .....	13-60
13.6.1	Construction Phase .....	13-60
13.6.2	Operational Phase .....	13-62
13.6.3	Decommissioning Phase .....	13-62
13.6.4	Cumulative.....	13-62
13.7	Residual Effects.....	13-62
13.8	References .....	13-63

14.	Air and Climate .....	14-1
14.1	Introduction .....	14-1
14.1.1	Competency of Assessor .....	14-1
14.1.2	Guidelines and Legislation .....	14-1
14.2	Methodology .....	14-3
14.2.1	Scope of Assessment .....	14-3
14.2.2	Assessment Criteria .....	14-4
14.2.3	Statement on Limitations and Difficulties Encountered .....	14-5
14.3	Existing Environment .....	14-6
14.3.1	EPA Monitoring Data .....	14-7
14.3.2	Dust Sensitivity of the Receiving Environment .....	14-9
14.3.3	Global Climate .....	14-12
14.4	Likely Significant Effects of the Proposed Development .....	14-21
14.4.1	Do Nothing .....	14-21
14.4.2	Construction Phase .....	14-21
14.4.3	Operational Phase .....	14-26
14.4.4	Decommissioning Phase .....	14-28
14.4.5	Cumulative Effects .....	14-28
14.5	Mitigation Measures .....	14-30
14.5.1	Construction Phase .....	14-30
14.5.2	Decommissioning Phase .....	14-31
14.6	Risk of Major Accidents and Disasters .....	14-31
14.7	Residual Effects .....	14-31
14.8	Conclusions .....	14-32
14.9	References .....	14-33
15.	Material Assets .....	15-1
15.1	Introduction .....	15-1
15.1.1	Competency of Assessor .....	15-1
15.2	Methodology .....	15-2
15.2.1	Legislation, Policy and Guidance .....	15-2
15.2.2	Study Area .....	15-3
15.2.3	Scope of Assessment .....	15-4
15.2.4	Scoped out from Further Assessment .....	15-5
15.2.5	Statement on Limitations and Difficulties Encountered .....	15-5
15.3	Baseline Environment .....	15-5
15.3.1	Transport Infrastructure .....	15-5
15.3.2	Forest Resources .....	15-9
15.3.3	Grid Capacity and Electrical Infrastructure .....	15-10

15.3.4	Aviation .....	15-10
15.3.5	Television and Telecommunications .....	15-11
15.3.6	Gas .....	15-18
15.3.7	Water and Wastewater .....	15-19
15.3.8	Waste Management .....	15-19
15.4	Assessment of Impacts and Effects .....	15-20
15.4.1	Construction Phase .....	15-20
15.4.2	Operational Phase .....	15-27
15.4.3	Decommissioning Phase .....	15-30
15.4.4	Do-Nothing .....	15-30
15.4.5	Cumulative Impacts and Effects .....	15-30
15.5	Mitigation .....	15-31
15.5.1	Construction Phase .....	15-31
15.5.2	Operational Phase .....	15-34
15.6	Residual Impacts and Effects .....	15-36
15.7	References .....	15-38
16.	Interaction of the Foregoing .....	16-1
16.1	Introduction .....	16-1
16.1.1	Scope and Methodology of Assessment .....	16-1
16.2	Identification of Environmental Impacts .....	16-1
16.2.1	Population and Human Health .....	16-1
16.2.2	Shadow Flicker .....	16-2
16.2.3	Landscape and Visual .....	16-2
16.2.4	Material Assets .....	16-2
16.2.5	Biodiversity and Ornithology .....	16-3
16.2.6	Water .....	16-3
16.2.7	Land and Soil .....	16-4
16.2.8	Noise and Vibration .....	16-4
16.2.9	Air Quality and Climate .....	16-4
16.2.10	Cultural Heritage .....	16-5
16.2.11	Traffic and Transport .....	16-6
16.3	Summary .....	16-6
17.	Schedule of Mitigation Measures .....	17-1
17.1	Introduction .....	17-1
17.2	Methodology .....	17-1

## Figures

Figure 1-1: Development Area and Site Location .....	1-9
Figure 1-2: General EIA Project Area .....	1-10
Figure 2-1: Wind Energy Zoning within the main site boundary .....	2-4
Figure 2-2: Site location of the proposed Ballycar Wind Farm Development .....	2-5
Figure 2-3: EIA Project Area and Site Boundary .....	2-6
Figure 2-4: Site Boundary and Townlands .....	2-6
Figure 2-5: Wind Farm Project Development Site Boundary .....	2-8
Figure 2-6: Proposed Wind Farm Layout.....	2-8
Figure 2-7: Minimum extent of Study Area considered in the EIA for wind farm infrastructure .....	2-9
Figure 2-8: Meteorological mast on a wind farm .....	2-11
Figure 2-9: Site Access Points and Internal Access Track Layout .....	2-12
Figure 2-10: Permanent Access Finish .....	2-13
Figure 2-11: Proposed TDR Foynes to Ballycar Wind Farm .....	2-14
Figure 2-12: Location of Temporary Construction Compound .....	2-16
Figure 2-13: Borrow Pit/Material Storage Locations .....	2-17
Figure 2-14: Areas to be felled .....	2-19
Figure 2-15: Grid Connection Route and Substation .....	2-20
Figure 2-16: Wind Farm developments within 25km of proposed development.....	2-28
Figure 3-1: Site Entrance Points.....	3-2
Figure 3-2: Typical Wind Farm Entrance .....	3-3
Figure 3-3: Typical upgraded track on a wind farm .....	3-7
Figure 3-4: Typical new excavated access track on a wind farm.....	3-9
Figure 3-5: Typical floated track on a wind farm .....	3-11
Figure 3-6: Typical finished hardstand on a wind farm .....	3-13
Figure 3-7: Typical construction of a wind turbine base .....	3-15
Figure 3-8: Grid Connection Route.....	3-17
Figure 3-9: Typical joint bay construction .....	3-21
Figure 3-10: Typical substation building and compound .....	3-23
Figure 3-11: Typical meteorological mast on a wind farm .....	3-24
Figure 3-12: Typical temporary site construction compound on a wind farm .....	3-25
Figure 3-13: Separation of Clean and Dirty Water Drainage on A Wind Farm Site.....	3-30
Figure 3-14: Typical clear span pre-cast concrete arch units in place over an existing watercourse .....	3-33
Figure 3-15: Typical clear span pre-cast concrete box culvert over an existing watercourse .....	3-34
Figure 3-16: Typical concrete pipe channel crossing.....	3-35
Figure 3-17: Dirty water containment at watercourse crossings.....	3-36
Figure 3-18: Silt curtain containment along tracks near watercourses .....	3-36
Figure 3-19: Stone check dam with large aggregate on downstream side .....	3-38
Figure 3-20: Multi-tiered settlement pond with stone filter .....	3-40
Figure 3-21: Examples of check dams along access track drainage channels.....	3-48
Figure 3-22: Example of a silt fence used in conjunction with check dams along access track drainage channels.....	3-49
Figure 4-1: Potential Sites Identified as part of Initial Screening .....	4-3
Figure 4-2: Clare RES Wind Energy Designations Map .....	4-6
Figure 4-3: Proximity to Natura 2000 Sites .....	4-7
Figure 4-4: Watercourse and Archaeological Constraints .....	4-12
Figure 4-5: Habitats Identified (Sheet 1 of 2) .....	4-13
Figure 4-6: Habitats Identified (Sheet 2 of 2) .....	4-13
Figure 4-7: Initial 15no. 150m Tip Height Turbine Layout.....	4-16
Figure 4-8: Iteration 1 – 9no. 175m Tip Height Turbine Layout.....	4-16
Figure 4-9: Iteration 2 – 12no. 158m Tip Height Turbine Layout.....	4-17
Figure 4-10: Iteration 3 – Relocation of T1 – Increase distance from area of Upland Bog/Wet Heath .....	4-17



Figure 4-11: Iteration 4 – Relocation of T2- Increase distance from Archaeological Features .....	4-18
Figure 4-12: Iteration 5- Relocation of T12 to Avoid Felling of Woodland .....	4-18
Figure 4-13: Iteration 6 – Relocation of T10, Turbine Foundation outside watercourse buffer .....	4-19
Figure 4-14: Iteration 7 – Relocation of T6 due to landowner considerations .....	4-19
Figure 4-15: Connection Options Considered to Ardnacrusha 110kV Substation .....	4-21
Figure 4-16: Existing OHLs in the vicinity of the proposed development .....	4-22
Figure 5-1: Study Area Electoral Divisions (EDs) .....	5-4
Figure 5-2: Study Area Small Area Population Districts (SAPs) .....	5-5
Figure 5-3: Development Lands Townlands .....	5-10
Figure 5-4: Principal Towns/villages in the Area .....	5-11
Figure 5-5: Residential Dwellings within 1-2km of the wind turbines .....	5-12
Figure 6-1: EIA study area including planning application boundary and proposed grid route .....	6-4
Figure 6-2: Distribution of passive bat monitoring locations in summer 2023 .....	6-9
Figure 6-3: Distribution of passive bat monitoring locations in spring and autumn 2023 .....	6-9
Figure 6-4: Watercourses and survey sites examined as part of the aquatic ecology studies for the proposed Ballycar Wind Farm .....	6-11
Figure 6-5: Location of the proposed Ballycar planning application boundary, Co. Clare .....	6-18
Figure 6-6: Rivers within vicinity of Planning Application Boundary .....	6-20
Figure 6-7: Natura 2000 sites within a 15km potential ZOI .....	6-22
Figure 6-8: NHAs and pNHAs within 15km of the proposed development site .....	6-29
Figure 6-9: Habitats identified within the study area for the Proposed development (Sheet 1 of 2) .....	6-50
Figure 6-10: Habitats identified within the study area for the Proposed development (Sheet 2 of 2) .....	6-51
Figure 6-11: Badger setts and other non-volant mammal activity identified within the EIA study area .....	6-56
Figure 6-12: Bat roost locations identified via desktop review provided by BCI (taken from Appendix 6A) .....	6-60
Figure 6-13: Map of the marsh fritillary habitat condition assessment survey areas within the study area .....	6-69
Figure 7-1: Viewsheds from each VP (1-3). Locations of turbines and the 500m (approx.) buffer zone is also shown .....	7-8
Figure 7-2: Transect survey route, 2019-2022 .....	7-10
Figure 7-3: Transect survey route, 2022-2023 .....	7-11
Figure 7-4: Route driven during the hinterland surveys within approximately 5km of the proposed development site .....	7-14
Figure 7-5: Bird Sensitivity for Wind Energy Development .....	7-18
Figure 7-6: The distribution of relatively important breeding populations of Hen Harriers (i.e. designated and non-designated regional zones) .....	7-20
Figure 8-1: Source-pathway Target Model .....	8-4
Figure 9-1: Study Area .....	9-4
Figure 9-2: CORINE Landcover (source: EPA) .....	9-8
Figure 9-3: Topography (5m contour) .....	9-9
Figure 9-4: Bedrock Geology of County Clare (source: GSI) .....	9-10
Figure 9-5: Bedrock Geology (source: GSI) .....	9-12
Figure 9-6: Teagasc Soils (source: GSI) .....	9-14
Figure 9-7: Quaternary Sediments and Geomorphology (source: GSI) .....	9-14
Figure 9-8: Geological Heritage areas (source: GSI) .....	9-16
Figure 9-9: Geological Heritage – Ballycar South (source: GSI) .....	9-17
Figure 9-10: Economic geological sites in the southeast area of County Clare (source: GSI) .....	9-18
Figure 9-11: Economic geological sites located at or close to site (source: GSI) .....	9-19
Figure 9-12: Historic Landslide Events (source: GSI) .....	9-20
Figure 10-1: The Level of Typical Common Sounds on the dB(A) Scale .....	10-3
Figure 10-2: Noise Monitoring Locations, Noise Sensitive Receptors and Proximity to Project Infrastructure .....	10-10
Figure 10-3: Noise Sensitive Number and Identification (northwest) .....	10-10
Figure 10-4: Noise Sensitive Numbering and Identification (west/southwest) .....	10-11
Figure 10-5: Noise Sensitive Numbering and Identification (north) .....	10-11
Figure 10-6: Noise Sensitive Numbering and Identification (east) .....	10-12

Figure 10-7: Noise Sensitive Numbering and Identification (south).....	10-12
Figure 10-8: N1 Daytime Prevailing Background Noise Level .....	10-15
Figure 10-9: N1 Night Time Prevailing Background Noise Level.....	10-16
Figure 10-10: N2 Daytime Prevailing Background Noise Levels.....	10-16
Figure 10-11: N2 Night Time Prevailing Noise Levels.....	10-17
Figure 10-12: N3 Daytime Prevailing Noise Levels .....	10-17
Figure 10-13: N3 Night Time Prevailing Background Noise Levels .....	10-18
Figure 10-14: N4 Daytime Prevailing Background Noise Levels.....	10-18
Figure 10-15: N4 Night Time Prevailing Background Noise Levels .....	10-19
Figure 10-16: N5 Daytime Prevailing Background Noise Levels.....	10-19
Figure 10-17: N5 Night Time Prevailing Background Noise Levels .....	10-20
Figure 10-18: Predicted Noise Emissions from Wind Farm Development (Operational Phase) .....	10-32
Figure 11-1: Area prone to Shadow as a function of time of day. ....	11-3
Figure 11-2: Wind Turbine and House Locations (Overall Study Area – 10 RD) .....	11-7
Figure 11-3: Wind Turbine and House Locations (North West Section of Study Area – 10 RD) .....	11-8
Figure 11-4: Wind Turbine and House Locations (Southwest Section of Study Area – 10 RD) .....	11-9
Figure 11-5: Wind Turbine and House Locations (North Section of Study Area – 10 RD).....	11-10
Figure 11-6: Wind Turbine and House Locations (East Section of Study Area – 10 RD).....	11-11
Figure 11-7: Wind Turbine and House Locations (Southeast Section of Study Area – 10 RD).....	11-12
Figure 12-1: Landscape and Visual Study Area (20km radius) .....	12-2
Figure 12-2: Extract from County Development Plan with turbines indicated in pink – in working landscape. ....	12-16
Figure 12-3: Landscape Designations – Co. Clare, Co Limerick and Co. Tipperary .....	12-18
Figure 12-4: Landscape Character Areas in Co. Clare (with proposed Ballycar turbines in magenta).....	12-21
Figure 12-5: Strategic Areas in Co. Clare (Source: Clare County Council WES (2017)) .....	12-25
Figure 12-6: Landscape Character Areas in Co Limerick and Co. Tipperary.....	12-27
Figure 12-7: Views and Prospects in Limerick .....	12-30
Figure 12-8: Key Views and Landmarks Diagram.....	12-32
Figure 12-9: View D (Extract from Limerick Development Plan) .....	12-34
Figure 12-10: Key vantage points in Limerick City .....	12-35
Figure 12-11: Recreation Trails Map .....	12-50
Figure 12-12: Hub Height ZTV .....	12-55
Figure 12-13: Tip Height ZTV .....	12-56
Figure 12-14: Viewpoint Map with designations.....	12-67
Figure 12-15: Cumulative ZTV (Hub Height) .....	12-94
Figure 13-1: National Monuments in State Care in 10km study area. ....	13-8
Figure 13-2: Recorded monuments within 5km radius of the proposed development.....	13-9
Figure 13-3: Recorded monument within the planning (red line) boundary and close proximity to proposed development .....	13-19
Figure 13-4: Extract from 1 <sup>st</sup> Ed. OS 6” map with proposed internal access track /grid connection overlain. Note location of pre-famine structures circled in blue .....	13-28
Figure 13-5: Extract from 2 <sup>nd</sup> Ed. OS 25” 1893 map with proposed access track /grid connection overlain. Note location of vernacular structures circled in blue .....	13-29
Figure 13-6: Extract from Down Survey Map with three of the six townlands of the proposed development denoted .....	13-32
Figure 13-7: Extract from Down Survey Maps with parishes <i>Killalow &amp; St Muntions</i> marked.....	13-32
Figure 13-8: Proposed underground grid connection route .....	13-46
Figure 13-9: Extract from 1 <sup>st</sup> Edition OS 6” map of 1840-42 (to the left) and 2nd Ed. OS 25” 1893 map (to the right) showing relocated Parish boundary of St Munchins and Kilfinaghta .....	13-47
Figure 13-10: Location of the proposed development (red triangle) with National Monuments in 10km radius overlain on topographic map (ie.topographic.map.com) .....	13-49
Figure 13-11: Visual effect on recorded monuments in the study area.....	13-52
Figure 13-12: Possible direct effect on cultural heritage sites within the proposed development overlain on 1 <sup>st</sup> Ed. OS Map .....	13-57

Figure 13-13: Location of existing and permitted WF within 25km radius zone of the proposed development...	13-60
Figure 13-14: Test trenching strategy overlain on proposed development layout .....	13-61
Figure 14-1: Site Location .....	14-6
Figure 14-2: Existing Air Quality Index for Health (AQIH) ( <a href="http://www.epa.ie">www.epa.ie</a> ) .....	14-8
Figure 14-3: Wind Farm Infrastructure and Nearest Dwellings .....	14-10
Figure 15-1: Local Road Network and Turbine Delivery Route .....	15-6
Figure 15-2: Site Access Points .....	15-6
Figure 15-3: Overview of the road network in the vicinity of the proposed development .....	15-8
Figure 15-4: View of assessed junction looking directly north-west from R464 onto L3056.....	15-8
Figure 15-5: Aviation facilities in proximity to the development site .....	15-11
Figure 15-6: Telecom Operator Networks shown relative to the proposed development.....	15-12
Figure 15-7: Enet Radio Network – Plan View .....	15-13
Figure 15-8: Eir Radio Network – Plan View .....	15-14
Figure 15-9: Three Ireland Radio Network – Plan View .....	15-15
Figure 15-10: Virgin Media Radio Network – Plan View .....	15-16
Figure 15-11: Existing Telecom Duct Infrastructure (Source: Eir Maps).....	15-17
Figure 15-12: TV transmitters in proximity to the proposed wind farm site. Source: <a href="https://saorview.ie/en/check-coverage/">https://saorview.ie/en/check-coverage/</a> .....	15-18
Figure 15-13: Gas Infrastructure Map at Ballycar Wind Farm .....	15-19

## Tables

Table 1-1: Summary of Public Consultation .....	1-4
Table 1-2: EIAR Topics and Relevant Chapters within the EIAR.....	1-7
Table 1-3: Project Engineering Design Team.....	1-12
Table 1-4: EIAR Authors and Specialist Contributors .....	1-12
Table 1-5: EIAR Authors and Specialist Contributors Qualifications .....	1-13
Table 2-1: Proposed Turbine Dimensions and Co-ordinates .....	2-10
Table 2-2: Planning Applications in the Area .....	2-23
Table 2-3: Land Use Requirements.....	2-29
Table 2-4: Proposed Construction Techniques .....	2-30
Table 2-5: Preliminary Construction Programme .....	2-31
Table 2-6: Summary of Approximate Aggregate and Steel Quantities .....	2-35
Table 2-7: Sample of Authorised Waste Facilities.....	2-37
Table 2-8: Emissions and Nuisances.....	2-37
Table 3-1: Ground Parameters at Turbine Sites .....	3-12
Table 3-2: Spoil Excavation and Construction Material Volumes.....	3-27
Table 3-3: Calculated Drainage Storage Volumes .....	3-45
Table 3-4: Met Éireann point rainfall frequency table (rainfall depth in mm) .....	3-46
Table 3-5: Met Éireann point rainfall frequency table (rainfall intensity rate in mm per hour) .....	3-46
Table 4-1: Screening of Potential Sites Identified .....	4-4
Table 4-2: Summary of Site Suitability Criteria .....	4-5
Table 4-3: Physical and Environmental Sensitivities .....	4-8
Table 4-4: Design Evolution and Iterations .....	4-15
Table 4-5: Comparison of Environmental Effects.....	4-20
Table 4-6: Connection Options Considered to Ardnacrusha 110kV Substation.....	4-21
Table 4-7: Loop-in Substation Location Comparison .....	4-22
Table 4-8: Substation and Grid Connection Options Ranking .....	4-23
Table 4-9: Comparison of Environmental Effects of grid connection and proposed substation options.....	4-23
Table 4-10: Comparison of Environmental Effects of Access Track Construction Methods .....	4-26
Table 4-11: Comparison of Environmental Effects of Material Sourcing .....	4-27

Table 5-1: Study Area Electoral Divisions (EDs) List .....	5-4
Table 5-2: Study Area Small Areas and Electoral Divisions .....	5-5
Table 5-3: Issues relevant to the Human Environment .....	5-6
Table 5-4: Disturbance and Health and Safety issues and relevant assessment.....	5-7
Table 5-5: Assessment Criteria .....	5-8
Table 5-6: Small Area Population Statistics .....	5-13
Table 5-7: Population Trends .....	5-13
Table 5-8: Health Statistics 2022- % Population Bad or Very Bad – Health .....	5-14
Table 5-9: Workers by Industry.....	5-16
Table 5-10: Workers Commuting.....	5-17
Table 5-11: Potential Disturbance issues and relevant assessment .....	5-22
Table 6-1: FPM survey location on a river reach in the study area of the proposed Ballycar wind farm, Co. Clare.6-13	
Table 6-2: Summary of criteria for assessing impacts based on EPA (2022).....	6-16
Table 6-3: Natura 2000 sites within 15km of the Proposed development site.....	6-22
Table 6-4: NHA sites within 15km of the proposed development site.....	6-26
Table 6-5: pNHA sites within a 15km radius of the proposed development site.....	6-27
Table 6-6: Documented records of protected flora species within hectad R56.....	6-54
Table 6-7: Records of protected non-volant mammals from hectad R56 .....	6-55
Table 6-8: Designated sites (with bats listed as the conservation interest) within 10km of the proposed development .....	6-57
Table 6-9: Bat Habitat Suitability Index (BHSI) for the proposed development site and surrounds according to ‘Model of Bat Landscapes for Ireland’ (Lundy et al., 2011) .....	6-58
Table 6-10: Scheme for describing the potential suitability of PRFs in trees on a proposed development site for bats. ....	6-62
Table 6-11: Scheme for describing the potential suitability of PRFs in trees for bats. ....	6-62
Table 6-12: Distribution and range of aquatic Annex II listed habitats and species in the R56 hectad containing the Proposed development site .....	6-64
Table 6-13: Documented records of terrestrial macro-invertebrates within hectad R56 encompassing the study area. ....	6-68
Table 6-14: Selection of habitats within the development area as IEFs.....	6-71
Table 6-15: Evaluation of flora and fauna within the development area as IEFs .....	6-74
Table 6-16: Areas of habitat loss associated with the Proposed development .....	6-79
Table 6-17: Areas of linear habitat loss (length of loss of linear features) associated with the proposed development .....	6-80
Table 6-18: Construction stage potential effects on Important Ecological Feature (habitats) without mitigation ..6-81	
Table 6-19: Construction stage potential effects on Important Ecological Feature terrestrial species without mitigation.....	6-86
Table 6-20: Construction stage potential effects on Important Ecological Feature bat species without mitigation 6-89	
Table 6-21: Construction stage potential effects on Important Ecological Feature terrestrial macro-invertebrate species without mitigation.....	6-90
Table 6-22: Construction stage potential effects on Important Ecological Feature fish and invertebrate species without mitigation.....	6-92
Table 6-23: Construction stage potential effects on Important Ecological Feature amphibians (common frog) without mitigation.....	6-96
Table 6-24: Operational stage potential effects on Important Ecological Feature (Cloonlara House pNHA) without mitigation.....	6-98
Table 6-25: Estimation of Irish bat species' population vulnerability to wind energy development .....	6-100
Table 6-26: Overall collision risk assessment of relevant (high-risk) bat species.....	6-102
Table 6-27: Operational stage potential effects on Important Ecological Feature bat species without mitigation .6-102	

Table 6-28: Operational stage potential effects on Important Ecological Features (terrestrial macro-invertebrates) without mitigation.....	6-103
Table 6-29: Operational stage potential effects on Important Ecological Feature (freshwater fish and aquatic invertebrate species) without mitigation.....	6-103
Table 6-30: Operational stage potential effects on Important Ecological Feature (common frog) without mitigation.....	6-105
Table 6-31: Characterisation of Cumulative Effects for Proposed Ballycar Wind Farm.....	6-106
Table 6-32: Summary Table of Effects.....	6-128
Table 7-1: Personnel involved in Ornithological Surveys/Data Analysis for the Proposed development, 2019- 2023.....	7-4
Table 7-2: Vantage point locations at the proposed development site.....	7-7
Table 7-3: Hen Harrier 2022 and 2023 breeding season survey effort.....	7-12
Table 7-4: I-WeBS sites within 10km of the proposed development.....	7-17
Table 7-5: Records of Hen Harriers sightings and breeding sites within 0-10km of the study area (information from NPWS).....	7-19
Table 7-6: Target species identified for the proposed development study area.....	7-21
Table 7-7: Species recorded during the waterbird surveys and also recorded within the study area.....	7-26
Table 7-8: Conservation status of ornithological receptors in the Study Area.....	7-28
Table 7-9: Summary of estimated number of collisions for key ornithological receptors over the lifetime of the proposed development.....	7-43
Table 8-1: Receptor Sensitivities (Adapted from: <a href="http://www.sepra.org.uk">www.sepra.org.uk</a> ).....	8-3
Table 8-2: Summary of Impact Assessment Process.....	8-4
Table 8-3: Summary of Impact Assessment Process (Source: GSI).....	8-8
Table 8-4: Assessment of Magnitude of Hydrological Impact (Adapted from NRA, 2005).....	8-9
Table 8-5: Significance of Criteria.....	8-9
Table 8-6: River Water Quality at relevant EPA Stations in proximity to the proposed development site.....	8-14
Table 8-7: Biological Water Quality at Aquatic Sites within and downstream of the Proposed Development....	8-16
Table 8-8: Physico-chemical water quality results from on-site measurements taken on 24 <sup>th</sup> June 2021.....	8-18
Table 8-9: Physico-chemical water quality results from laboratory analysis (samples taken on 24th June 2021). ..	8-18
Table 8-10: Physico-chemical water quality results from laboratory analysis (samples taken on 26th June 2023). ..	8-19
Table 8-11: Groundwater Wells Properties & Description.....	8-23
Table 8-12: Residual Hydrological and Hydrogeological Effect Significance on Sensitive Receptors.....	8-42
Table 9-1: Summary of Site Visits.....	9-3
Table 9-2: Description of Effects.....	9-5
Table 9-3: Geological Heritage Sites in Proximity to Site (GSI online database).....	9-15
Table 9-4: Residual Effects.....	9-38
Table 10-1: Construction Stage Noise Level Thresholds.....	10-5
Table 10-2: Noise Monitoring Locations.....	10-8
Table 10-3: Prevailing Background Noise Levels – Amenity Hours.....	10-20
Table 10-4: Prevailing Background Noise Levels- Night Hours.....	10-21
Table 10-5: Plant and Machinery and associated noise levels to be used in Wind Farm Track Construction....	10-22
Table 10-6: Borrow Pit Plant Noise Emissions.....	10-23
Table 10-7: Typical Construction Plant and Machinery which will be used during the Substation Construction ..	10-24
Table 10-8: Forestry Felling.....	10-25
Table 10-9: Assessment of Construction Effects as per EPA Guidelines.....	10-26
Table 10-10: Model Input Data.....	10-28
Table 10-11: V136 (Serrated Edge) – Total Sound Power Levels- dB.....	10-29
Table 10-12: V136 (Serrated Edge) – Total Sound Power Levels – Octave Band.....	10-29
Table 10-13: Noise Limits- Amenity and Night-time Hours.....	10-29
Table 10-14: Ballycar Wind Farm predicted noise levels and noise limit comparison.....	10-30

Table 10-15: Operational Phase Assessment of Noise Effects (Pre-Mitigation) .....	10-35
Table 10-16: Operational Phase Assessment of Vibration Effects (Pre-Mitigation) .....	10-35
Table 10-17: Cumulative Noise Emissions Calculations.....	10-36
Table 10-18: Construction Phase Noise Residual Effects.....	10-39
Table 10-19: Construction Phase Vibration Residual Effects.....	10-40
Table 10-20: Operational Phase Noise Residual Effects .....	10-40
Table 10-21: Operational Phase Vibration Residual Effects .....	10-40
Table 11-1: Average Hours of Sunshine and Average Hours of Day for County Clare 1991-2020 (Shannon Airport Meteorological Station) .....	11-4
Table 11-2: Shadow Flicker Modelling Results.....	11-13
Table 11-3: Residual Effects .....	11-20
Table 13-1: Assessment criteria.....	13-4
Table 13-2: National Monuments in State Care / Guardianship within 10km study zone .....	13-7
Table 13-3: Recorded enclosures in the 5km radius study area .....	13-13
Table 13-4: Recorded monuments within proposed development and close proximity (www.archaeology.ie). ...	13-18
Table 13-5: Recorded Protected Structures in 5km study zone.....	13-25
Table 13-6: Cultural heritage sites within the 100m wide corridor of proposed tracks/internal grid connection	13-29
Table 13-7: Townlands of the proposed development study boundary in Down Survey Map as per original spelling.....	13-31
Table 13-8: Townland names and meaning .....	13-33
Table 13-9: Monuments within a 3km radius from the proposed development – visual effect.....	13-52
Table 14-1: EPA Annual Monitoring Data .....	14-9
Table 14-2: Sensitivity of the Area to Dust Soil Effects on People and Property.....	14-10
Table 14-3: Sensitivity of the Area to Human Health Impacts .....	14-11
Table 14-4: Sensitivity of the Area to Ecological Impacts.....	14-12
Table 14-5: Shannon Airport 1991-2020 Averages.....	14-20
Table 14-6: Do Nothing Assessment of Air Quality and Climate Effects.....	14-21
Table 14-7: Risk of Dust Impacts – Earthworks.....	14-22
Table 14-8: Risk of Dust Impacts – Construction .....	14-23
Table 14-9: Risk of Dust Impacts – Trackout .....	14-24
Table 14-10: Risk of Dust Impacts – Demolition .....	14-25
Table 14-11: Proposed Development Dust Risk Summary Table .....	14-25
Table 14-12: CO2 Losses due to the Proposed Development.....	14-27
Table 14-13: Operational Phase Carbon Savings .....	14-28
Table 14-14: Operational Phase Assessment of Air Quality and Climate Effects .....	14-31
Table 15-1: Material Assets and Topics to be included .....	15-4
Table 15-2: Baseline 2023 Traffic Volumes .....	15-9
Table 15-3: Commencement Year 2026 Traffic Volumes .....	15-9
Table 15-4: Enet Radio Links .....	15-12
Table 15-5: Eir Radio Links .....	15-13
Table 15-6: Three Ireland Radio Links .....	15-14
Table 15-7: Virgin Media Radio Link.....	15-15
Table 15-8: Predicted 2026 R464 TII Rural Road AADT Volume/Capacity Ratio with TII High Growth and Peak Construction Traffic .....	15-22
Table 15-9: Traffic Impact on Assessed Junction .....	15-23
Table 15-10: Spoil Excavation and Material Volumes.....	15-26
Table 15-11: Telecommunications Mitigation Measures Summary.....	15-34
Table 15-12: Material Assets Residual Effects.....	15-36
Table 16-1: Matrix of Interactions .....	16-7

## Plates

Plate 6-1: Spoil and Bare Ground (ED2) habitat located within the study area	6-31
Plate 6-2: Derelict building, an example of Buildings and Artificial Surfaces (BL3) on site	6-32
Plate 6-3: Access track, corresponding to Buildings and Artificial Surfaces (BL3).	6-33
Plate 6-4: Improved agricultural grassland habitat (GA1) at site	6-34
Plate 6-5: Dry-humid Acid Grassland (GS3) located in the northwest of the site	6-35
Plate 6-6: Example of Wet Grassland habitat (GS4) at site	6-37
Plate 6-7: Conifer plantation habitat (WD4) occurs at much of the site	6-38
Plate 6-8: Hedgerow (WL1) habitats delineate field boundaries throughout the study area	6-40
Plate 6-9: Treeline habitat (WL2) delineating field boundaries, often occurring in combination with Hedgerows (WL1)	6-40
Plate 6-10: Example of Mixed Broadleaf Woodland habitat (WN1), along the banks of the East Ballyannan stream within the study area.	6-42
Plate 6-11: Recently felled woodland (WS5) in the northern area of the proposed development site.	6-43
Plate 6-12: Upland blanket bog (PB2)/Wet heath (HH3) mosaic in the background	6-45
Plate 6-13: Eroding/upland river habitat (FW1) – Cappateemore East Stream, an EPA registered channel.	6-47
Plate 6-14: Eroding/upland river habitat (FW1) in the north of the proposed development site after prolonged heavy rainfall – not an EPA registered channel.	6-48
Plate 6-15: Drainage ditch on relatively flat ground to the north of turbine T1 at the northwest of the site.	6-49
Plate 6-16: Japanese knotweed, not yet established, located adjacent to a farm track	6-53
Plate 6-17: Japanese knotweed located in hedgerow adjacent to a farm track	6-53
Plate 12-1: Sloping land on the site with Limerick City in the distance	12-40
Plate 12-2: Woodcock Hill seen to the west of the site.	12-41
Plate 12-3: The high ground at Ballycar, visible from flatter topography along Limerick’s riverfront	12-42
Plate 12-4: Views towards Shannon estuary from ridge of higher ground near Woodcock Hill	12-43
Plate 12-5: Agricultural grassland and coniferous forestry on the site	12-44
Plate 12-6: Mosaic of forestry, wet heath, and grassland on the northern part of the site	12-44
Plate 12-7: Barrow and standing stones in agricultural land at Glennagross, in the northwest of the site	12-46
Plate 12-8: Views of Wellesley Pier, Strand Barracks, St Mary’s Cathedral and King John’s castle from the riverwalk	12-47
Plate 12-9: View from Thomond Bridge towards site	12-47
Plate 12-10: Bunratty Castle and Durty Nelly’s to the right, screening the views of the hills	12-48
Plate 12-11: Glimpse of site through trees along Lough Derg Way between Limerick city and University of Limerick	12-49
Plate 12-12: More remote character north of site	
Plate 12-13: More settled areas south-west of site	12-51
Plate 12-14: Views over Shannon Estuary from scenic route west of Woodcock Hill (left) and Plate 12-15: Views to the higher ground looking east from Woodcock Hill (right)	12-52
Plate 13-1: Cluster of three recorded monuments located c.90m – 120m to the N of proposed Turbine 2	13-20
Plate 13-2: Standing stone CL052-064002 (from W)	13-21
Plate 13-3: Ring barrow CL052-064003 (from S)	13-22
Plate 13-4: Oblique view of enclosure CL053-040 (from W)	13-23
Plate 13-5: Location of earthwork CL053-049 (from S)	13-24
Plate 13-6: Location of proposed Turbine 1 (from N)	13-34
Plate 13-7: Barrow CL052-064003 situated c. 110m to the N of proposed Turbine 2 (from N)	13-35
Plate 13-8: Location of proposed Turbine 3 (from S)	13-36
Plate 13-9: Location of proposed Turbine 4 (from E)	13-37
Plate 13-10: Location of proposed Turbines 5 and 6 within existing forestry (view from SE)	13-38
Plate 13-11: Location of proposed Turbine 7 (from E)	13-39
Plate 13-12: Location of proposed Turbine 8 (from E)	13-40
Plate 13-13: Location of proposed Turbine 9 (from NE)	13-41
Plate 13-14: Location of proposed Turbine 10 and temporary compound (from NW)	13-42

Plate 13-15: Location of proposed Turbine 11 (from SE)	13-43
Plate 13-16: Location of proposed Turbine 12 (from N)	13-44
Plate 13-17: Ballycannon West and Ballycannon East townland boundary at the location of proposed borrow pit/deposition area	13-45
Plate 13-18: View from the centre of the proposed development towards Bunratty Castle (from E)	13-50
Plate 13-19: King John's Castle, Limerick. Note the uphill location of the proposed development (online drone image from S, <a href="http://www.youtube.com">www.youtube.com</a> .)	13-51